EXPERIMENTAL TAXONOMY, PROPAGATION AND MODELS OF INHERITANCE FOR FLOWER COLOUR AND EXTRA PETALS IN *Potentilla fruticosa* L.

by

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FORWARD

A paper style format has been followed for this thesis. Manuscript one, Experimental Taxonomy of Shrubby Cinquefoil; *Potentilla fruticosa* L. will be submitted to the Canadian Journal of Botany. Preliminary reports have previously been presented at the 1984 meeting of the Western Canadian Society for Horticulture and at the 1985 meeting of the North Central Region of the American Society for Horticulture Science. (Graduate Student Award for best paper).

Manuscript two; The Propagation of *Potentilla fruticosa* L. by Sexual and Asexual Means, will be presented at the International Plant Propagators Society meeting at the next available opportunity.

Manuscript three; Models of Inheritance of Flower Colour and Extra Petals in *Potentilla fruticosa* L., will be submitted to the Journal of the American Society of Horticultural Sciences. A paper covering the same topic has been accepted for presentation at the forthcoming 22nd International Horticultural Congress in California (August 1986).

ABSTRACT

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Experimental taxonomy, propagation and models of inheritance for flower colour and extra petals in Potentilla fruticosa L.
Major advisor: Louis M. Lenz

This study was conducted to obtain a broader comprehension of the taxonomy, to determine practices of sexual and asexual propagation and to develop models of inheritance for flower colour and extra petals for Potentilla fruticosa.

Numerical and experimental approaches were utilized in the taxonomic study. Seasonal variation of quantitative taxonomic characters was significant and resulted in use of ratios of variables in the calculation of similarity coefficients. The Gower general coefficient was calculated for 127 representatives including North American, European and Asian representatives as well as cultivars. Interpretation of cluster and non-metric multidimensional scaling multivariate statistical analysis suggest that all taxa are variants of a common central theme. 'Mongrelization' may have clouded any distinct phenetic differences.

Most taxa were self-incompatible. One tetraploid representative was self-compatible but resulting seedlings lacked vigour.

Eight geographic representatives were selected to study breeding relationships. All were successfully crossed with the exception of a tetraploid taxa. Heteroploid matings were noted by a reduced success rate. Backcrosses to existing putative F_1 hybrids were successful. On the basis of this study Potentilla fruticosa should be used as the species name for the shrubby cinquefoil complex.

Softwood cuttings are easy-to-root. Success was highest during the early part of the growing season. Reduced rooting corresponded to a period of high temperature. Hardwood cuttings were difficult-to-root.

After-ripening of seed generally increases both emergence rates and maximums. A period of 30 to 45 days is sufficient to promote rapid emergence. Two taxa originally obtained from the Rocky Mountains were noted by very low emergence maximums.

Preliminary models of inheritance of flower colour and extra petals were derived. Two whitening genes W_1 and W_2 and two yellowing genes Y_1 and Y_2 are proposed to explain the observed segregation of white and yellow flower colours. The action of a bleaching gene is also suspected. The cyanic flower colour model developed involves background petal colour, cyanic pigments and distribution and temperature sensitivity genes.

The extra petal model proposed involves a two gene switch, D_1 and D_2 to turn on the production of up to five extra petals and a modifier gene, Dm that accounts for an additional one to five extra petals.

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INTRODUCTION

The shrubby cinquefoil is a dwarf shrub that is widely used in the landscape industry. Plant size, hardiness, ease of maintenance and long flowering period have contributed to the popularity of this shrub.

The University of Manitoba has been involved in a *Potentilla fruticosa* breeding program since 1968. Recent objectives have centered on two floral characteristics, flower colour and extra petals.

This study was undertaken to assist in the continued development of this breeding program by determining;

1) a broader comprehension of the taxonomy of the species.
2) practices for sexual and asexual propagation.
3) inheritance of flower colour and extra petals.

LITERATURE REVIEW

2.1 Plant Taxonomy

2.1.1 Introduction

Man has always been intrigued with the classification of the animate and inanimate objects around him. This is accomplished by recognition of discontinuous structure in an environment which is sometimes discrete but more often continuous (Legendre and Legendre 1983). Common folk classifications were the earliest of plant groupings (Raven 1976). These "use" classifications function admirably well, particularly under local conditions. With advances in knowledge of biology many intricate systems of classification were soon developed. Until the time of Linnaeus there was little agreement in handling identification and naming of plants. Linneaus in his Classes Plantarum (1738) and Species Plantarum (1753) laid the framework for a more natural classification system and binomial nomenclature. From then until the present there have been many researchers who have contributed to a greater understanding of plant taxonomy (Vickery 1984).

2.1.2 Biosystematics

According to Baker (1970) there are fewer "classical" taxonomists now than in the previous 50 years. These taxonomists judge the taxonomic disposition of a plant simply on the basis of external morphology. There is now almost universal agreement that whenever possible physiology, ecology, distribution, cytogenetics and breeding behavior information should be considered with morphology (Vickery 1984). The treatment of a particular taxa or individual requires the succinct compilation of as much information as possible.

Biosystematics, a word coined after pioneering work by Camp and Gilly (1943) has become synonymous with this approach to taxonomy (Stace 1980). These studies are concerned with populations of individuals and the processes that occur within. Many components are involved and generally encompass field as well as experimental garden studies (Stace 1980). An early concern of biosystematists has been the definition of a species. Mayr (1942) defined the biological species as

> "groups of actually or potentially interbreeding populations which are reproductively isolated from any other such groups".

As has been discussed by other reviewers (Stace 1980, Briggs & Walters 1984, and Wagner 1984) this definition functions well for animal species, however, difficulties are encountered when dealing with plants. These difficulties generally relate to the diversity of reproductive and isolation mechanisms. The ability to intermate should not be used as the sole criterion for species definition (Stace 1980).

Many rather intricate nomenclatural systems have been developed to assist taxonomists. These include the coenspecies, ecospecies and ecotype of Clausen, Keck and Heisey (1940), the homogenon, phenon, dysploideon, etc. of Camp and Gilly (1943), the "deme" terminology of Gilmour (1960) and the more recently defined species terminology of Grant (1981) namely taxonomic species, biological species, microspecies and successional species. However in applied fields the biological species concept has found considerable support allowing the ability to test a hypothesis.

Breeding relationships and gene exchange are of considerable interest to plant breeders (Allard 1960). However even this component may be less important in the future due to considerable studies in the fields of genetic engineering. In the future concern may not be whether plants will intermate but if genes can be transferred by some other means.

Wagner (1984) has proposed a definition of a species which really outlines how most researchers use the term. He considers a species as

> "a convenient taxonomic category that defines a unit of organismic diversity in a given time frame and composed of individual organisms that resemble one another in all or most structural and functional characters, that reproduce true by any means, sexual or asexual and constitute a distinct phylogenetic line that differs consistently and persistently from populations of other species in gaps in character state combinations, including geographical, ecological, physiological, morphological, anatomical, cytological, chemical and genetics, the character states of number and kind ordinarily used for species definition in the same or related genera and if partially or wholly sympatic and coexistent with related species in the same habitat, unable to cross or if so, able to maintain special distinctions".

The author agrees that this definition is cumbersome but is removed from the simplistic approach that relies on only one or a few criteria. Significant freedom is provided for the taxonomist to work (Wagner 1984).

2.1.3 Numerical Taxonomy

The fields of biosystematics and numerical taxonomy begin to merge at this point (McNiel 1984). According to Heywood (1976) numerical taxonomy can be defined as

> "the numerical evaluation of similarities or dissimilarities between groups of organisms and the ordering of these groups into higher ranking taxa on this basis".

From the onset proponents of numerical procedures have suggested the use of as many variables as possible to discriminate groups of individuals (Sokal and Sneath 1963, Sneath and Sokal 1973, Dunn and Everitt 1982). The larger the information matrix, the more reliable or predictive the model will be. These techniques are exploratory rather than confirmatory tools (Tukey 1980). Much controversy has ensued, however numerical techniques have developed a role in modern taxonomy (Stace 1980, Briggs & Walters 1984). The proponents of these techniques have outlined seven advantages as follows:

1) The greater the information content available for a taxa and the more characters on which it is based, the better or more predictive a given classification will be.

2) A priori, every character is of equal weight in creating natural taxa.

3) Overall, similarities between any two entities is a function of individual similarities in each of the many characters being compared.

4) Distinct taxa can be recognized because correlations of characters differ among the groups of organisms under study.

5) Phylogenic inferences can be made.

6) Taxonomy is viewed and practiced as an empirical science as opposed to an interpretive or deductive one.

7) Classifications are based on phenetic similarity (Sneath and Sokal 1973).

Since the early work of Sneath and Sokal (1973) computer technologies have progressed rapidly. Numerical techniques have rapidly developed to the point where Legendre and Legendre (1983) referred to a

> "panoply of techniques".

These authors were referring principally to cluster analysis, listing no less than five major approaches and 14 different mathematical methods.

The same comment could be stated for measures of resemblance. They list 23 different distance coefficients and 15 different similarity coefficients. According to Orloci and Kenkel (1985) major problems include the proper choices or combinations of the coefficients and the algorithms. The relative availability of many of these techniques as packaged programs has resulted in a great deal of misuse.

Cormack (1971) stated;

> "The availability of computer classification technique packages has led to the waste of more valuable scientific time than any other "statistical" innovation with the possible exception of multiple-regression techniques!"

These comments not being disregarded however, it may also be stated that if properly handled numerical techniques do provide a very useful tool for the taxonomist.

Of the techniques reviewed by Cormack (1971) and Legendre and Legendre (1983) the polythetic agglomerative hierarchical types are most widely used in taxonomy. These begin with discontinuous partitions of operational taxonomic units (OTU's) and successively group them into larger and larger clusters. This continues until only one cluster remains. The taxonomist decides at which point in the iterative process, that biological meaningful groups have been attained. The polythetic approaches enables a large body of data representing many attributes or association matrices to be utilized. This is judged superior to monothetic models which are based on consideration of single descriptors at a time since there is less chance of error (Orloci and Kenkel 1985). Single linkage clustering (Sneath 1957) is often used as a basic model to discuss clustering procedures (Legendre and Legendre 1983).

The first step involves the manipulation of the similarity (or dismilarity = distance) matrix so that the most/least similar pair of OTU's are followed by the next most/least similar OTU, etc. This proceeds until all OTU's have been ordered. In the second phase, clusters are formed hierarchically starting with the two most similar OTU's and letting the objects clump into clusters and the groups clump to one another as the similarity criteria is relaxed. The rule used to assign an object to a single linkage cluster requires that an OTU has a similarity, at least equal to the considered level of the portion, with at least one OTU already a member in the cluster. Many of the other major techniques follow similar procedures, however the entrance of an OTU to a cluster is treated differently. Average linkage or unweighted pair grouping based on arithmetic average clustering (or UMPGMA) (Sneath and Sokal 1973) for example bases entrance not on simple singular similarities but on arithmetic averages of similarities or distances to each of the members.

Centroid clustering bases entrance on average distances to the centroid of a cluster. A centroid of a cluster of OTU's can be imagined as the center of a hyperspace surrounding all OTU's. This procedure requires recalculation of similarities or distances on the basis of the new or adjusted centroid coordinates after an OTU has been added. Several of the technqiues, weighted average linkage and weighted centroid clustering have intricate procedures for allowing for cluster size compensation (Sneath & Sokal 1973). The last of the commonest group of algorithums is complete linkage. Complete linkage is almost opposite to single linkage and has also been called furthest neighbour sorting (Legendre and Legendre 1983). The fusion of OTU's depends on the most distant pair of OTU's. An object joins a group when linked to all the OTU's which are already a member of the cluster. Two clusters can fuse only when all OTU's of the first are linked to all objects of the second and vice versa. The difficulty of including new OTU's increases as the process progresses (Legendre and Legendre 1983).

As mentioned previously wrong procedures can be chosen. However, the choice of correct ones is difficult (Orloci and Kenkel 1985). The correct choices are primarily based on the structure of the data set and the ultimate purpose of the study. In many instances researchers utilize a variety of approaches in order to obtain a broad picture of the data. In a study of Daucus carota, Small (1978) presented dendrograms for nine different clustering procedures. Comparisons were made between these in order to develop an overall synthesis of the complex under study. This is, however, somewhat of an extreme example. Most researchers use two procedures to ensure that either technique is not distorting the data representation. Single linkage clustering has been recommended (Legendre and Legendre 1983) as a good position to start. The procedure is well suited for the identification of intermediates between groups. Chaining or the sequential addition of OTU's to the cluster may be the result if the groups are not sharply defined (Orloci and Kenkell 1985).

Other equally informative mathematical techniques which are not related to cluster analysis directly can also be applied to multidimensional data sets. These procedures are variously referred to as ordination (Legendre and Legendre 1983). Whereas cluster analysis seeks to determine relatively homogenous subsets of the OTU's and thereby produce a classification, ordination attempts to represent OTU's as points in some hopefully low dimensional space with distances between points reflecting relationships (Dunn & Everett 1982). No classification is implied with these procedures. They are more of an ordering on a reduced scale which can assist in interpretation of the data. Ordination techniques that are commonly used in data exploration include principal component analysis, cannonical analysis, reciprocal averaging and non-metric multi-dimensional scaling (NMDS) (Orloci and Kenkell 1985). With the exception of NMDS all the techniques attempt to determine linear relationships in the data set (Fasham 1977). It is possible to determine linear trends in many data sets, however if the real trends are non-linear, interpretation of results may be at best tenuous or even erroneous. NMDS on the other hand makes fewer assumptions (Orloci and Kenkell 1985, Kruskal 1964a, b, Shepard 1974). NMDS as described by Kruskal (1964a, b) allows greater choices of the input resemblance structure which widens the choice of similarity/dissimilarity coefficients that can be utilized. The number of dimensions is specified a priori hence no information is lost or discarded by higher axes. Two dimensions are the easiest to interpret and most commonly utilized. In the other techniques, such as principal component analysis information may be lost to higher dimensions (Fasham 1977). In a typical principal component analysis the first two axes may explain 60 to 80 percent of the variation present while the remaining 20 to 40 percent is not considered. In NMDS 100 percent of the variation is represented. NMDS conceptually finds an arrangement of individuals in a reduced metric space such that the pair wise distances in this space are as closely monotonic as possible with the original data matrix (Kruskal 1964 a, b). Monotonic relationships imply that the rank order of the variables in the two matrices are the same. NMDS is not a modeling tool. It is a data exploration technique that allows visualization of data in reduced dimensions while maintaining as far as possible the distance relationships between the objects. It hopefully achieves a concise and assimilable representation of the essential pattern of structure that is more or less hidden in a given array of numerical data.

2.1.4 Phenotypic plasticity

The genotype of a particular plant is the sum total of the genetic determinants but any particular genotype can give rise to a range of phenotypes, depending on environmental variables (Grant 1975). The role of phenotypic plasticity has been recognized as important but has been largely neglected by taxonomists and biosystematists (Moriset and Boutin 1984). Bradshaw (1965) has shown that plasticity or response of a particular character or genotype with respect to a given environmental factor varies between individuals, between populations and between species. Moriset and Boutin (1984) make the distinction between developmental and environmental plasticity. As the name implies, developmental plasticity relates to the ontogenetic development of an organism. Alternation of the phenotype occurs during different parts of the life cycle. This is also known as fixed phenotypic variation (Bradshaw 1965). Environmental plasticity results when the phenotype is modified by environmental stimuli (Moriset and Boutin 1984). Environmental plasticity enables the plant to tolerate or compensate when growing under non-optimal conditions. This is generally referred to as an adaptive strategy which permits the plant to respond to environmental variations that are too small to permit adaptation through genetic differentiation (Bradshaw 1965). These are most evident in pioneering species which may develop different forms depending on habitat condition (Moriset & Boutin 1985). One of the problems that has troubled researchers is the difficulty of studying this phenomenon. The response of a plant to environmental stimuli is often complex. Factors such as nutrients, temperature and moisture are often interrelated leading to results which are difficult to interpret. Experiments, particularly in the field, are difficult to conduct (Hurlbert 1984). However for an indepth study of a particular taxa phenotypic plasticity should be included. Moriset and Boutin (1984) suggest dividing the phenotype into two essential components, the genotype and the environment. Only with detailed programs will a better model result. Such studies are valuable (essential) for characters which are being utilized as taxonomic descriptions of an organism (Briggs & Walters 1984).

2.2 Plant Propagation

2.2.1 Introduction

A knowledge of plant propagation is essential in Agriculture. This is very evident in ornamental horticulture where aspects of both sexual and asexual propagation are important. Seed propagation information is necessary for breeding programs while asexual techniques such as cuttage and graftage are often required to maintain a particular genotype (Allard 1960, Hartman and Kester 1983).

2.2.2 Seed Dormancy

One of the more important obstacles that may influence seed germination is seed dormancy (Khan 1977). Viable seeds that fail to germinate in favourable conditions are considered to be dormant (Villers 1972) with dormancy being a state of growth and reduced metabolism (Salisbury and Ross 1978). Seed dormancy is very common in woody plants (Schopmeyer 1974). Factors which have been influential in controlling seed dormancy patterns have been reviewed by Nikolaeva (1977) who utilized the basic concepts as outlined by Crocker (1916). Two main groupings were recognized. These are exogenous and endogenous dormancy. Exogenous dormancy relates to physical, chemical or mechanical impediments to seed germination generally caused by seed coverings. Endogenous dormancy relates to internal constraints such as morphology and physiology that can influence seed germination. Morphological considerations such as immature embryos and physiological considerations such as growth inhibitors or light requirements often are important in dormancy regulation.

Various techniques of seed coat modification or scarification are useful in overcoming exogenous dormancy while stratification in moist media under specific temperature conditions to after-ripen the seeds can be utilized to overcome endogenous dormancies (Hartman and Kester 1983). Combinations of both endogenous and exogenous dormancies are also known (Nikolaeva 1977). In these situations scarification and stratification are both required. Such a situation is evident in Cornus stolonifera (Davidson 1979).

References to germination of Potentilla fruticosa seed are few. According to Currah et al. (1983), Grewal and Ellis (1972), Elkington and Woodel (1963) and Rhodes (1954) seeds germinate readily without any pretreatment. The germination percentages range from 20-95 percent. Meshinev (1973) determined that light during the germination period increased the rate of emergence but had no effect on germination maximums. He suggested that a very light covering of media be used. This was to prevent rapid drying of the seeds or newly emerged seedlings. Greater variability was obtained when the seeds remained uncovered.

2.2.3 Cuttage

The rooting of cuttings of various plant parts is a widely practiced method of plant propagation (Hartman and Kester 1983). Parts such as stems, leaves and roots have been used for many species, however between and within species the success rates are highly dependent on the parts selected and procedures utilized (Janick 1979). Trials with each species and often cultivars are required to determine suitable conditions for rooting.

Hartman and Kester (1983) have reviewed factors which may influence success rates. These are divided into three general areas:

1) Selection of the cutting material which includes the condition and age of the stock plant, type of wood selected, presence of viruses and the time of year that the cuttings are taken.

2) Treatment of cuttings including growth regulators, mineral nutrition, fungicides and wounding.

3) Environmental factors during rooting including water relations, temperature, light and rooting medium.

Potentilla fruticosa cultivars have been classified as "easy-to-root" (van de Laar 1982, Freeland 1977, Bowden 1957). The extent of knowledge of factors influencing success rates are meager (Freeland 1977). She suggested that cuttings can be taken from early summer through fall and both bottom heat and rooting hormones are helpful.

Predictions of the ability of a cutting to root during the growing season is difficult. Several approaches have been tried to help define a "rooting window". A rooting window is a period of time when rooting is most successful. Cram and Lindquist (1961) proposed the use of moisture content. Rooting of *Caragana arborescens* Lam. declined when moisture content of the cutting dropped below 70 percent. Kender (1965) found that the time of shoot tip abortion of *Vaccinium angustifolium* Ait. was a good indicator of when rooting success would decline. Cuttings taken after this period rooted poorly.

Adams and Roberts (1967) tried to use terminal flower bud size of *Rhododendron* sp. to define the best rooting window. Measurements of flower bud size were taken and correlated with rooting success. Interpretation of the results suggested that a firm relationship was not evident. Differential growth rates of shoots and buds limited the utility of this procedure. Propagators still largely rely on experience to determine when the best period to take cuttings of a particular species or cultivar (Hartman and Kester 1983).

2.3 Flower Colour

The genetics of flower colour have been well studied in many species (Grant 1971). This has resulted in development of a generalized model for gene action (Paris et al. 1967). This model is based on accumulated evidence from seventy-five different species of flowering plants. Paris et al. (1967) have proposed that five major genes are responsible for colour and one to several genes may be involved in intensification, bleaching or dilution. The major genes are:

W = colour   ww = white   P = purple, magenta
Iv = non ivory   iv iv = ivory   pp = pinks, roses or reds
Y = non yellow   yy = yellow
B = purple, magenta   bb = blues

There have been no direct studies on inheritance of flower colour in *P. fruticosa*. Clausen and Heisey (1958) in an extensive analysis of *Potentilla glandulosa* Lindl. developed a genetic model that dealt with flower colour. Due to the relative uniformity of flower colour inheritance in general (Paris et al. 1967) it is not unrealistic that colour inheritance in *P. fruticosa* would be similar.

P. glandulosa is a long-lived herbaceous perennial that is easily hybridized. Clausen and Heisey (1958) initiated their comprehensive study of this species in 1932. Crosses were made between different subspecies and progeny were grown and evaluated over many years at different locations on an elevational gradient. *P. grandulosa typica* is a white-creamy white plant; subspecies *reflexa* is deep yellow; subspecies *hansenii* is cream; and subspecies *nevadensis* is cream-white. F_2 progeny from the original crosses were used to develop inheritance models. They determined that there were at least two pairs of multiple whitening genes W_1 and W_2 and two pairs for yellow: deep yellow Y_1 and lemon yellow Y_2. The action of a bleaching gene B_1 was also suspected. The action of the W genes tends to cover the effects of the Y genes and in turn deep yellow Y_1 tends to cover the pale lemon yellow Y_2 although there is not complete epistasis. This system establishes a delicate balance in the intermediate colours which was also modified to varying extent by the environment. Their observed frequencies were not always in close agreement with the calculated but they felt that these were due to the inherent difficulties of classification. Calculated ratios also do not take into consideration genetic linkage and crossovers which would shift the ratios. They did not rule out the possibility of more genes operating but lacked data from additional generations required to test the hypothesis.

The environmental variability of flower colour noted by Clausen and Heisey (1958) is also apparent in P. fruticosa (Robertson 1984). This variability is most evident in cyanic taxa but is also present in acyanic plants. Cyanic taxa of P. fruticosa derive their "redness" from the production of anthocyanins. Yellow colours are due to carotenoids and flavonoids other than anthocyanins are responsible for white (Robertson 1984). Flower pigments production is affected by high temperature. Anthocyanin synthesis was the most variable with almost a complete cessation at 30°C. Changes in carotenoids were also observed but these did not result in drastic petal colour changes. The rates of loss of anthocyanin production varied among the taxa studied. UM 7904 and UM 7911 were among the more stable types identified.

2.4 Double Flowers

Plants bearing flowers with extra petals or double flowered have long held interest for the horticulturist. According to Reynolds and Tampion (1983) Theophastus (372-387 BC) was the first horticulturist to record observations about plants bearing extra petals. Reynolds and Tampion (1983) recently reviewed double flowering plants in relation to history, occurrences, developmental and physiological considerations as well as genetics. Several species have been well studied eg. Rosa, Aquilegia vulgaris L., Petunia hybrida Hort., Narcissus and Calendula but for most plants there is relatively little information. Double flowers were reported for two herbaceous Potentilla species; P. reptans L. and P. tomentilla L. (Reynolds and Tampion 1983). Several cultivated types are also known to bear extra petals. The most recent introduction has been *P. hybrida* 'Double French Hybrids' from Royal Sluis Co. in Holland. The next most common double flowered cultivar is 'Glory of Nancy'. Extra petals are also known in *P. fruticosa* (Bowden 1957, Lenz 1970). The triploid cultivar 'Hersi' occasionally produces extra petals and cv. 'Sundance', an introduction from the University of Manitoba (Lenz 1977) has between one and six extra petals above the basic compliment of five. This was one of the main selection criteria used in the development of the cultivar.

Studies on the genetics of double flowers although not rare, are not very common. Such studies are often complicated by sterility of double flowers (Saunders 1928). Stamens and/or carpels may be lacking due to the presence of extra petals.

The number of genes affecting petal number varies considerably with the plant studied. A summary of reports from a wide variety of plants was made by Beatty (1937). In 17 out of 49 studies examined a dominant gene was responsible for doubleness. The remaining 32 were due to recessive factors. 36 out of 49 had only one factor pair involved while seven had two genes and two were undetermined. Eight different studies suggested that from one to three modifiers were involved in determination of actual petal numbers. More recent studies (Lambert 1945, Johnson 1953, and Nugent and Synder 1967) follow similar trends. Crane and Lawrence (1938) were unable to determine the number of genes involved in *Dahlia variabilis*, however, there were more than four. The double flowered *Dahlia* used had 160 to 170 petals while the single had eight. Altered segregation ratios are also known in several species. In *Aquilegia* doubleness is inherited maternally and probably cytoplasmically (Rousi 1968). Pollen from all forms of the double crossed on to a wide range of single flowers produced only single flowered plants yet pollen from singles or doubles on doubles produced only double flowered plants. Genetic linkage of the double flowering gene to a pollen lethal is known to have caused altered segregation ratios in *Mathiola incana* (Johnson 1953).

Environmental factors affecting the expression of doubleness of a particular genotype have been reported. Low temperatures (5° to 12°C) increased petal numbers in rose and carnation (Moe 1971, Garrod and Harris 1974) while in *Freesia* and *Kerria japonica* L. (Baer and Kho 1971, Reynolds and Tampion 1983) high temperatures resulted in complete reversion to single flowered plants that were genetically double. Robertson (1984) found that petal number was affected by temperature at bud initiation in *P. fruticosa*. Petal number increased with increasing temperature but the extent of variation depended on the taxa examined. Moisture relations were also implicated in variation of the expression of doubleness. Under dry conditions, numbers of extra petals were generally lower.

3.0 MANUSCRIPT I: EXPERIMENTAL TAXONOMY OF SHRUBBY CINQUEFOIL; *Potentilla fruticosa* L.

3.1 *Introduction*

The shrubby cinquefoil is widely distributed throughout the northern hemisphere of the world. It is also a common ornamental shrub with more than 80 named cultivars (van den Laar 1982). It has long been a source of taxonomic confusion and controversy. This in part may relate to the use of the plant as a landscape ornamental (van den Laar 1982) and partially to an incomplete taxonomic understanding of naturally occurring taxa (Hulten 1971). *P. fruticosa* was initially described by Linnaeus in 1753 (pl. 495) from material collected in Oeland, England and Siberia. From that point to the work of Handel-Mazzetti (1939) and Juzcepchuk (1941) numerous new species, varieties or forms were described (Crantz 1766, Willdenows 1813, Pursh 1814, Loddiges 1824, Hamilton 1825, Don 1825, Lehmann 1831, Rafinesque 1840, Maximowicz 1873, Watts, 1873, Rydeberg 1898, 1908, Farrer 1916, Rheder 1922, 1924, 1929, 1960, Besant 1927 and Fernald 1935).

Handel-Mazzetti (1939) dealing with Asian taxa, recognized four species; *Potentilla arbuscula* D. Don, *P. parvifolia* Fisch, *P. glabra* Lodd, and *P. davurica* Nestl. These were in addition to *P. fruticosa* which was not discussed. The principle differences of the four described species involved leaf size, leaf vesture, leaf venation, flower colour and plant habit. Handel-Mazzetti (1939) also recognized four hybrid taxa; *P.* x *vilmoriana* (Komar) Komken (*P. arbuscula* var.

albicans x *P*. *glabra* var. *mandshurica*), *P*. x *Rhederiana* Hand-Mzt (*P*. *parvifolia* x *P*. *fruticosa*), *P*. x *Sulphurescens* Hand-Mzt (*P*. *arbuscula* x *P*. *glabra* and *P*. x *Fredrichsenii* Spath (*P*. *fruticosa* x *P*. *glabra*).

Juzcepchuk (1941) adopted the generic name *Dasiphora*, after work by Rydeberg (1898, 1908). Six species and one hybrid grouping were described and are summarized in table 1. According to Stace (1980) Juzcepchuk usually recognized species rather than varieties or forms.

Rheder (1960) presented a more conservative viewpoint. He suggested all taxa belong to the same species *P*. *fruticosa* with the understanding that it was a morphological variable grouping. He listed fourteen forms and one variety. Hara (1952) while studying Asian taxa came to the similar conclusion stating;

> "the differences between those species and *P*. *fruticosa* are not so clear and regard them all as geographical varieties of *P*. *fruticosa*".

Löve (1954) considered there was sufficient divergence between the North American taxa and Eurasian representatives for the former to be treated as a separate species and also suggested the resurection of *Pentaphyloides* as the generic name.

Bowden (1957) examined and counted chromosomes for a wide range of members. The majority of taxa were diploid ($2n = 14$) but triploids, tetraploids, hexaploids and octoploids were reported. Bowden (1957) followed the nomenclature established by Handel-Mazzetti (1939).

Elkington (1968) proposed recognition of two varieties; *P*. *fruticosa fruticosa* from northern Europe and *P*. *fruticosa floribunda* from North America and southern Europe. Recognition of these was based on ploidy determinations and sexuality. Taxa from northern Europe are

TABLE 1. Comparison of morphological differences used by Juzepchuk to differentiate shrubby cinquefoils - *Dasiphora* spp.

Taxon	Flower colour	Flower size	Sepals bracts	Leaf size	Number of leaflets	Leaf vesture	Stipule shape	Plant height	Distribution
D. fruticosa	Yellow	large (15-30 mm)	bracts> sepals	large	5	more or less hairy	acute	20-150 cm	N. Am., Europe, Asia
D. parvifolia	Yellow	small (5-10 mm)	bracts= sepals	± small	7(9)	densely hairy	obtuse	15-80 cm	W. Siberia
D. phyllocalyx	Yellow	large (20-30 mm)	bracts> sepals	small	5	sparse - dense hairs	ovate/ acute	5-20 cm	Central Asia Alpine regions
D. dryanthoides	Yellow	small (10-15 mm)	bracts≤ sepals	small	(5) 7(9)	tomentose	ovate	3-12 cm	Cental Asia Alpine regions
D. davurica	White	large (20-25 mm)	bracts< sepals	large	5	glabrous	ovate	± 100 cm	E. Siberia
D. mandshruica	White	small (10-15 mm)	bracts< sepals	large	5	silky villous	ovate	?	Manchuria

often tetraploid and dioecous while North American and southern Europe plants are diploid with perfect flowers. Recognition of the varieties on the basis of morphological features alone was not possible. Further separation of the North American and southern European group was not possible due to considerable similarity. The only certain method of identification of P. fruticosa fruticosa was to count the chromosomes. Even the dioecous nature of the tetraploids is not consistant. Interpretation of observations by Tornblom (1911) and experiments by Richards (1975) indicate significant variability in the degree of sex expression exists in wild populations.

In Hulten's review of circumpolar plants he states that the morphology of the shrubby cinquefoil is extremely variable and often changes dramatically even within a short distance (Hulten 1971). The often used characters such as leaf size and pubescence show remarkable variability thus suggesting that previous taxonomic treatments based on these are inadequate. Hulten states that at best the identified types are races of a variable complex.

Hulten (1971) also argued for the retention of the generic name Potentilla. This was based on studies of hybridization between various herbaceous and woody Potentilla (Asker 1970, 1971, 1977, Ellis 1962). Several of these and subsequent studies also involved Fragaria sp. (Jelenkovic 1984, Niemirowicz-Szczytt 1982, Macfarlane-Smith and Jones 1985 a & b). Although there has been several proposals to change the generic name of Fragaria to Potentilla none have been followed through. The principal taxonomic difference between the two species is the nature of the fruit. Fragaria have a fleshy fruit while Potentilla are dry and dehiscent (Macfarlane-Smith and Jones 1985a). Kalkman (1968) suggested that the only reasons for the retention of separate genera were nomenclatural stability and practical useage.

Viability and fertility of hybrids between woody and herbaceous Potentilla and Fragaria has been very low. Until the work by Macfarland-Smith and Jones (1985) no fertile F_1 hybrids had been obtained. This study involved Fragaria moschata L. and P. fruticosa cultivars. Four male sterile seedings were obtained. All seedlings resembled the herbaceous parent. Attempts to backcross these by conventional methods were not successful (Macfarlane-Smith and Jones 1985b). Embryo rescue techniques were employed to obtain seedlings from backcrosses between an aneuploid hybrid (2n=23) and the parents. Seven vigorous progeny were obtained. Chromosome numbers were 2n=44, 49, 63, 63, 65, 67, 67. The origin of these exceptional chromosome numbers could be through unreduced and double unreduced gametes (Macfarlane-Smith and Jones 1985b). The occurrence of double unreduced gametes have been proposed in earlier interspecific hybridization work in Potentilla (Muntzing and Muntzing 1944). Parental chromosome numbers were 2n=42 (Fragaria moschata) and 2n=14 (P. fruticosa).

The shrubby cinquefoil has been used as an ornamental since early 1700 (Mussel 1971). Van de Laar (1982) lists over 80 cultivars. The taxonomic picture becomes even more clouded if cultivars used in the landscape industry are included. The correct treatment of cultivated taxa is often complicated due to extensive hybridization and selection (Hawkes 1970, Brandenburg 1984).

The primary purpose of this study is to obtain a greater biological understanding of this group of plants. Data will be examined from a phenetic and experimental viewpoint to determine if the resulting groups correspond to previous taxonomic investigators or to suggest a more practical treatment. In addition the extent and potential importance of phenotypic plasticity of often used taxonomic characters will be investigated. Finally to identify potential areas where further hybridization could be used to extend the range of characteristics that may be valuable in the development of new cultivars will be identified. This requires the determination of relationships of existing cultivars to native types and possible zones of hybridization.

3.2 Materials and Methods

3.2.1 Phenotypic plasticity of quantitative vegetative and reproductive characters

It has been well established that the taxonomic value of a character varies enormously from group to group and it is difficult to predict which are the most useful (Stace 1980, Benson 1959). To determine the extent of phenotypic plasticity, seventeen vegetative and reproductive characters were selected for measurement during the growing season. The characters were 1) flower diameter (mm), petal length (mm), petal width (mm), sepal diameter (mm), sepal length (mm), sepal width (mm), epicalyx diameter (mm), length of epicalyx bract (mm), width of epicalyx bract (mm), leaf length (mm), leaf width (mm), petiole length (mm), terminal leaflet length (mm), terminal leaflet width (mm), stipule length (mm), stipule width (mm), and the number of leaflets. Measurements were obtained for eight taxa; *P. fruticosa* - North American, *P. fruticosa* - European (2n = 2x), *P. fruticosa* - European (2n = 4x), *P. fruticosa* - Scandinavia, *P. arbuscula*, *P. parvifolia*, *P. glabra* and *P. davurica* 'Hersi' (2n = 3x). Five samples were obtained from each of two established plants growing in the University of Manitoba test garden. Vegetative characters were sampled every two weeks from mid-June to September 1984 while reproductive structures were sampled from late June to September 1984. The second fully expanded leaf was used for vegetative measurements while the primary flowers of an inflorescence were sampled for reproductive characters. The data were analyzed by analysis of variance procedures.

3.2.2 Numerical Taxonomy

To assess the morphological variation 127 operational taxonomic units (OTU) were sampled during August/September 1984. OTU's included 66 cultivars, 51 North American representatives and 10 Eurasian taxa. The North American taxa were collected as indicated in figure 1. A complete list of all taxa is presented in Appendix I.

Forty-seven characters were assessed or measured (Table 2). The means of quantitative characters were calculated on five samples. Leaf measurements and assessments were conducted on the second fully expanded leaf on a stem. Reproductive character measurements and assessments utilized the primary flower of an inflorescense. Colour assessments were made with the assistance of the Royal Horticultural Society colour charts (1938, 1941).

The nonmetric general similarity coefficient of Gower (1971) was calculated for each pair of taxa. The Gower coefficient permits combination of both qualitative and quantitative descriptors. Details of the calculation and the fortran program used are presented in Appendix 2. After conversion of the similarity measurements to distances the coefficients were sorted by the agglomerative hierarchical procedures of single linkage clustering and weighted pair group

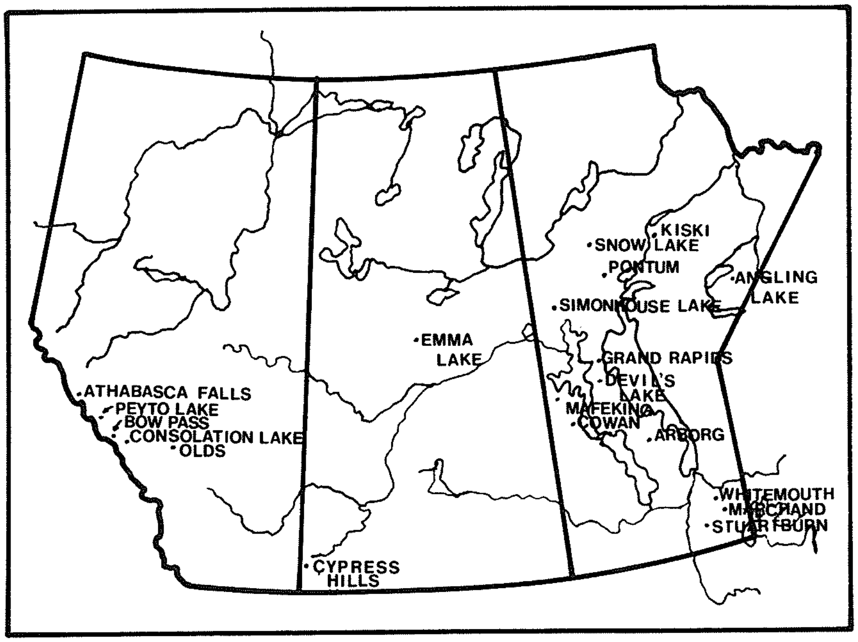

FIGURE 1 COLLECTION SITES FOR NORTH AMERICAN TAXA

TABLE 2. List and mode of assessment for characters* recorded in study of taxonomy of the shrubby cinquefoil

Character	Code **	Assessment Mode
A. Reproductive		
Abundance of fruit	ABSED	none ... very abundant
Calyx diameter	SEPD	mm
Duration of flowering	DUR	long (60 days), medium (30-60 days), short (30 days)
Edge of epicalyx	EBCT	smooth, toothed, notched
Edge of sepal	ESEP	smooth, toothed, notched
Epicalyx bract length	BRLEN	mm
Epicalyx bract width	BRWID	mm
Epicalyx diameter	BRD	mm
Floriferous rating	FLORR	low ... high
Flower colour	FCOL	Royal Hort. Soc. Colour Charts
Flower diameter	FLD	mm
Mature fruit colour	SDCOL	dark brown, brown, light brown
Number of petals	NEPT	count
Peduncle length	PEDL	mm
Peduncle vesture	PEDPUB	glabrous ... tomentose
Petal length	PETL	mm
Petal width	PETW	mm
Prominance of fruit	PROSED	hidden, visible, prominent
Sepal length	SLEN	mm
Sepal width	SWID	mm
Stamen colour	STCOL	yellow - yellow orange
Timing of flowering	TIM	continuous, sporatic, cyclic
B. Vegetative		
Depth of stipule notch	DNOT	mm
Form	FOM	round, oval, spreading, irregular
Inner stipule vesture	ISTPUB	glabrous ... tomentose
Leaf colour	LCOL	light green, green, dark green, silver green, blue green
Leaf length	LLEN	mm
Leaf texture	LTEX	fine ... coarse
Leaf venation	LVEIN	smooth ... rugose
Leaf width	LWID	mm

Lower leaf vesture	LLPUB	glabrous ... tomentose
Mid-rib vesture	MRPUB	glabrous ... tomentose
Number of leaflets	NLL	count
Outer stipule vesture	OSTPUB	glabrous ... tomentose
Petiole length	PETOLEN	mm
Petiole vesture	PETPUB	glabrous ... tomentose
Plant height (average)	HGHT	cm
Plant width (average)	WID	cm
Secondary leaflet length	SLLLEN	mm
Secondary leaflet width	SLLWID	mm
Stipule length	STLEN	mm
Stipule membranous	STMEN	yes no
Stipule notch	STNOT	present, absent
Stipule width	STWID	mm
Terminal leaflet length	TLLEN	mm
Terminal leaflet width	TLLWID	mm
Upper leaf vesture	ULPUB	glabrous ... tomentose

* See text for explanation of sampling procedures.
** CODE = symbols used in appendix summary (Appendix III).

clustering based on arithmetic averages or average linkage (Sneath & Sokal 1973). Finally an ordination technique, non-metric multidimensional scaling (Kruskal 1964a, b) was performed to provide an additional visualization of the data in a reduced number of dimensions.

3.2.3 Cytogenetics

Chromosome counts were conducted for all taxa under study. Techniques used were as described by Bowden (1957) except that a two to three hour cold treatment prior to fixation was incorporated to condense the chromosomes which enabled easier counting.

3.2.4 Gene Exchange Trials

3.2.4.1 *Woody plant hybridization*. To assess breeding relationships a total of eleven taxa were selected as parental material (Table 3). With the exception of *P. davurica* all plants were well established in the University of Manitoba test garden. *P. davurica* was obtained at the initiation of the study and subsequently transplanted and grown in the same area. Parents one to eight were cross pollinated in all combinations including selfing (diallel crosses) while only selected backcrosses were performed with parents nine to 11. A minimum of ten pollinations were attempted except with *P. davurica*. Insufficient flowers reduced crossing levels in some cases. Additional crosses were made if seed set was low or variable. Pollinations were completed in the field or in a growth room with potted plants during June 1983 to August 1984. The flowers were emasculated prior to anthesis. The pollinations were completed within 24 hours either by rubbing mature anthers repeatedly over the stigmas or with the use of a camel hair brush inoculated with freshly collected pollen. After pollinations, flowers were immediately enclosed in glycine bags. All

TABLE 3. Parental taxa used in the breeding relationship study of *Potentilla fruticosa*

	Taxa	Region of Occurrence	Source	Chromosome number
1	P. fruticosa	North America	UMC *	14
2	P. fruticosa	Europe	RSM **	14
3	P. fruticosa	Europe	RSM	28
4	P. fruticosa	Scandinavia	RSM	14
5	P. davurica	E. Siberia & China	SKI ***	14
6	P. glabra	E. Siberia & China	RSM	14
7	P. parvifolia	Mid Asia	RSM	14
8	P. arbuscula	SE Tibet, Western & Northern China	RSM	14
9	P. x Rhederiana	P. parvifolia x P. fruticosa	RSM	14
10	P. x Sulphurescens	P. fruticosa x P. arbuscula	RSM	14
11	P. x Friedrichsenii	P. fruticosa x P. glabra	RSM	14

* University of Manitoba collection, Winnipeg, Manitoba.
** RSM = Agriculture Canada, Research Station, Morden, Manitoba.
*** SKI = Skinner's Nursery Ltd., Roblin, Manitoba.

equipment was sterilized with 95% ethanol to prevent contamination.

Self-pollinations were conducted utilizing two methods. Flowers were either enclosed in glycine bag prior to anthesis (autogamous) or were emasculated as previously described and fertilized with pollen from same plant (geitonogamous). As apomixis is known in Potentilla pollinations were also made with foreign pollen (Nygren 1967, Asker 1977, Goswami and Matfield 1974). Rosa pollen was used in the majority of these pollinations.

If possible all crosses were conducted with the primary flower of the inflorescence. All other flowers or buds were removed at the time of emasculation. The mature fruit was collected 30 to 40 days after pollination. Ripeness was visually determined. Seeds were manually extracted, counted and placed in paper envelopes in cool, dry storage until planting. Due to small seed size and difficulty of distinguishing between filled and shrunken or shriveled seed, random samples of all material extracted from the fruit were retained.

Seeds were sown in a peat:vermiculite media (1:1 vol.). Emergence was monitored for 40 days and then seedlings were transplanted to small plastic cell pak containers (6 cm x 3.5 cm x 5.5 cm) containing heat sterilized soil:sand:peat media (2:1:1 vol.). Seedlings were field planted the following spring. Samples of shriveled or misshapened seed were also planted, however, no emergence was noted.

Due to variation in flower size of the parental taxa and of possible subsequent effect on seed set, open-pollinated seed set and mean numbers of ovules were determined. Ovule counts were obtained by dissection of 10 flowers. Open pollinated seed was collected in August 1983, and 1984. Seed counts for a minimum of 25 mature fruit were conducted.

3.2.4.2 *Woody and Herbaceous Plant Hybridizations*. Pollinations were conducted with herbaceous *Potentilla* representatives to assist in relationship determinations and to investigate the ease of mating and transfer of desirable traits. Asker (1970, 1971), Ellis (1962), Jelenkovic et al. (1984) and Macfarlane-Smith and Jones (1985 a & b) have utilized *P. fruticosa* in crossing with herbaceous *Potentilla* and *Fragaria* sp. These studies related to intergeneric hybridization haploid production or studies of apomixis. In the present study the herbaceous plants were all used as the pollen parents since the degree or extent of apomixis in the herbaceous plants is unknown. Apomixis is not known in *P. fruticosa* (Elkington 1968). The herbaceous taxa used in the crossing program are presented in Table 4. Many of these plants have very desirable characteristics which if transferred to the woody plant would significantly increase horticultural value. These characters include:

1) increased range and improved flower colours
2) increases in flower diameter (> 40 mm)
3) increases in numbers of petals (± 25)
4) resistance to spider mites
5) increased range of foliage characters

3.3 Results and Discussion

3.3.1 Seasonal Variation

The results of the analyses of variance for reproductive and vegetative characters are presented in Tables 5 and 6. Interpretation of these indicates that there were significant differences among taxa, sampling periods as well as the interaction terms for most characters measured. This suggests that each taxa was responding differently to

TABLE 4. Herbaceous Potentilla used in crossing with P. fruticosa

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P. atrosanguinea Lodd ex D. Don
P. arguta Pursh.
P. alpina Dallatane
P. arenaria
p. arsenina L.
P. aurea plena L.
P. bipinnatus
P. crantzi G. Beck ex. Fritsh.
P. crantzi baldensis G. Bech ex. Fritch.
P. cuneata Wallich ex Lehm
P. nepalensis Hook.
P. nepalensis 'Miss Willmott'
P. nitida L.
P. palustris (L.) Scop.
P. recta L. 'Warreni'
P. reptans L.
P. rupestris pygmaea Duby
P. subacaulis
P. villosa Pall ex. Pursh
P. thurberi A. Gray
p. tridentata Ait.
P. x 'Glory of Nancy'
P. x 'Gibson Scarlet'
P. x 'Mons Rouillard'
P. x 'Double French Hybrids'
P. x 'Yellow Queen'
P. salesoviana Steph. (suffruticose)
Fragaria vesca L.
F. x ananassa Dush. 'Red Coat'

TABLE 5. Analysis of seasonal variation of individual and ratios of quantitative reproductive characters in shrubby Potentilla complex

			Significance of Interaction Term		
Taxonomic Character	Taxa*	Sampling Time**	All Dates	June 29 Sample Deleted	June 29, July 13 Samples Deleted
Flower diameter (mm)	0.001***	0.001	0.011	0.029	0.026
Petal length (mm)	0.001	0.001	0.078	0.184	0.128
Petal width (mm)	0.001	0.001	0.001	0.132	0.097
Sepal diameter (mm)	0.001	0.001	0.001	0.006	0.008
Sepal length (mm)	0.001	0.001	0.001	0.001	0.001
Sepal width (mm)	0.034	0.005	0.075	0.075	0.124
Epicalyx diameter (mm)	0.001	0.001	0.001	0.001	0.001
Bract length (mm)	0.001	0.001	0.001	0.001	0.001
Bract width (mm)	0.001	0.001	0.001	0.001	0.014
Ratios					
Flower diameter/ Sepal diameter	0.001	0.376	0.091	0.100	0.100
Petal length/ Sepal length	0.001	0.044	0.070	0.051	0.176
Epicalyx diameter/ Bract length	0.022	0.002	0.233	0.246	0.431

* Taxa *P. fruticosa* - North American, *P. fruticosa* - European (2n=2x), *P. fruticosa* - European (2n=4x), *P. fruticosa* - Scandinavia, *P. fruticosa* 'Hersi' (3n), *P. glabra*, *P. parvifolia*, *P. arbuscula*

** Sampling times, June 29, July 13, July 29, August 10, August 24, September 7

*** Values are probabilities of a greater F value

TABLE 6. Analysis of seasonal variation of individual and ratios of quantitative vegetative characters in shrubby Potentilla complex

			Significance of Interaction Term			
Taxonomic Character	Taxa*	Sampling Time**	All Dates	June 14 Sample Deleted	June 14 & June 29 Samples Deleted	June 14, 29 & July 13 Samples Deleted
Number of leaflets	0.001***	0.001	0.040	0.215	0.202	0.176
Leaf length (mm)	0.001	0.001	0.001	0.001	0.040	0.033
Leaf width (mm)	0.001	0.001	0.002	0.02	0.382	0.511
Petal length (mm)	0.001	0.001	0.001	0.001	0.001	0.001
Terminal leaflet length (mm)	0.001	0.001	0.001	0.001	0.010	0.006
Terminal leaflet width (mm)	0.001	0.007	0.120	0.108	0.156	0.215
Stipule length (mm)	0.001	0.001	0.001	0.001	0.001	0.001
Stipule width (mm)	0.001	0.001	0.006	0.001	0.001	0.008
Ratios						
Leaf length/terminal leaflet length	0.001	0.001	0.920	0.175	0.222	0.160
Stipule length/stipule width	0.001	0.001	0.026	0.054	0.093	0.129

* P. fruticosa - European (2n=2x), P. fruticosa 'Hersi' (3n), P. fruticosa - European (2n=4x), P. fruticosa - North American, P. arbuscula, P. fruticosa - Scandinavia, P. glabra, P. parvifolia

** Sampling times, June 14, June 29, July 13, July 29, August 10, September 7, 1984

*** Values are probabilities of a greater F value the varying environmental conditions during the growing season. Petal width and leaf length were selected to illustrate these responses (Fig. 2 and 3).

The significance of the interaction term raises the question whether or not these are "good" characters to use in a taxonomic study. The variable response could be due to developmental or environmental plasticity (Bradshaw 1965). Early season growth may be different than growth later in the growing season. Similar changes for vegetative characters have been documented for other species including Acer (Critchfield 1971, Powell et al. 1982) and Populus (Critchfield 1960).

Subsequently the early sampling periods (June 14, June 29 and July 13) were sequentially removed and the remaining data analyzed. The remaining periods would still correspond to the general time period for the major taxonomic study. The significance of the interaction term was lost in approximately 40% of the cases.

Ratios of various characters were calculated to determine if the significant interaction term would be lost. Ratios have been previously used (Juzcepchuk 1941). Ratios of components were calculated and treated in a similar manner (Tables 5 and 6). These were superior due to both the loss of the significant interaction term and potentially conveying greater taxonomic information by enabling more descriptors to be used. As a consequence of this discovery the only quantitive measurements used in the subsequent analysis were the ratios presented in tables 5 and 6.

The significant interaction term raises some interesting questions concerning the use of quantitative characters in taxonomic studies. Are the interactions significant in taxonomic terms or do they represent relatively small changes which have statistical significance but limited

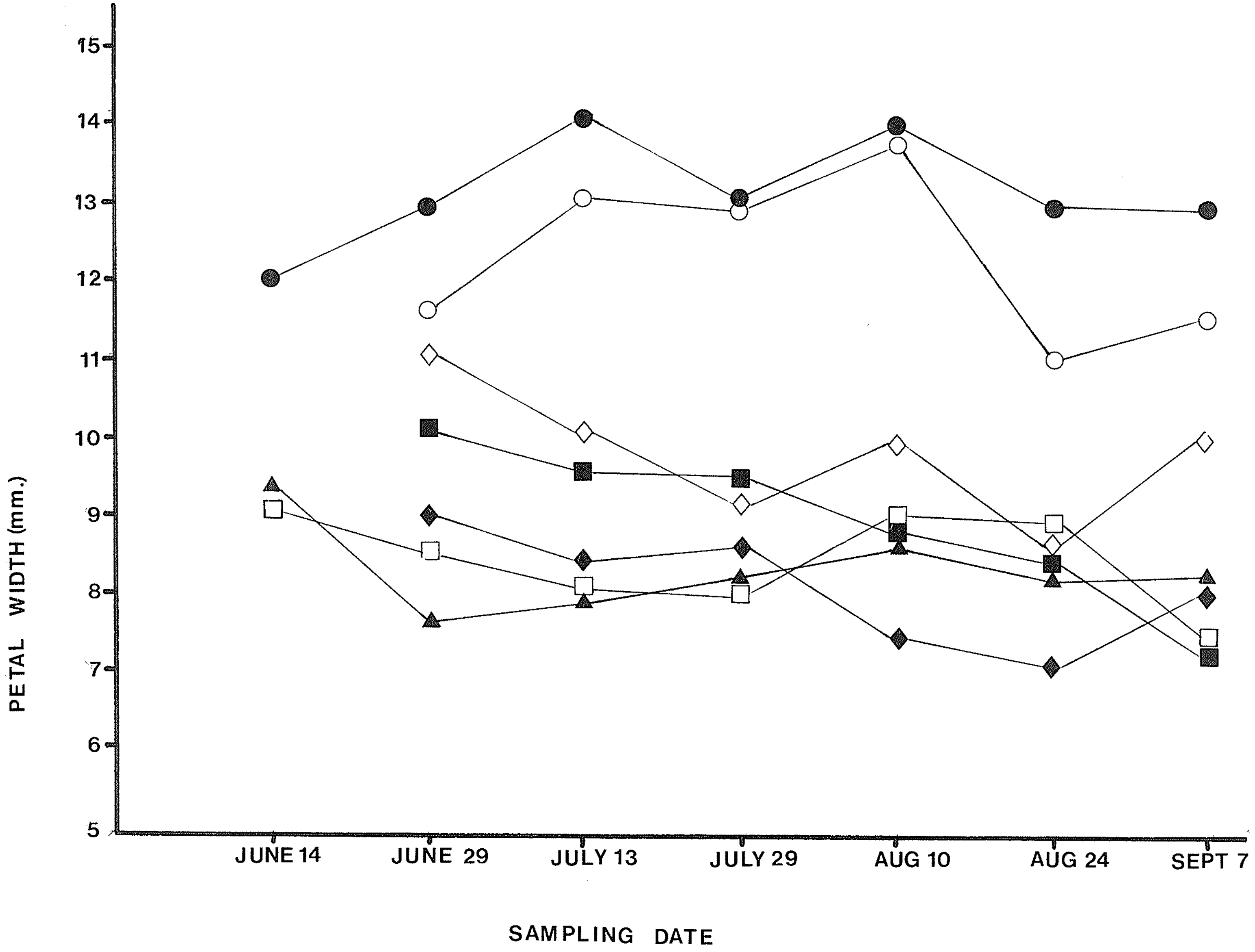

Figure 2. Seasonal variation of petal width for P. *fruticosa* - North American (◇), European (2n=2x) (○), European (2n=4x) (◆), Scandinavian (□), P. **arbuscula** (●), P. *parvifolia* (▲), 'Hersi' (■).

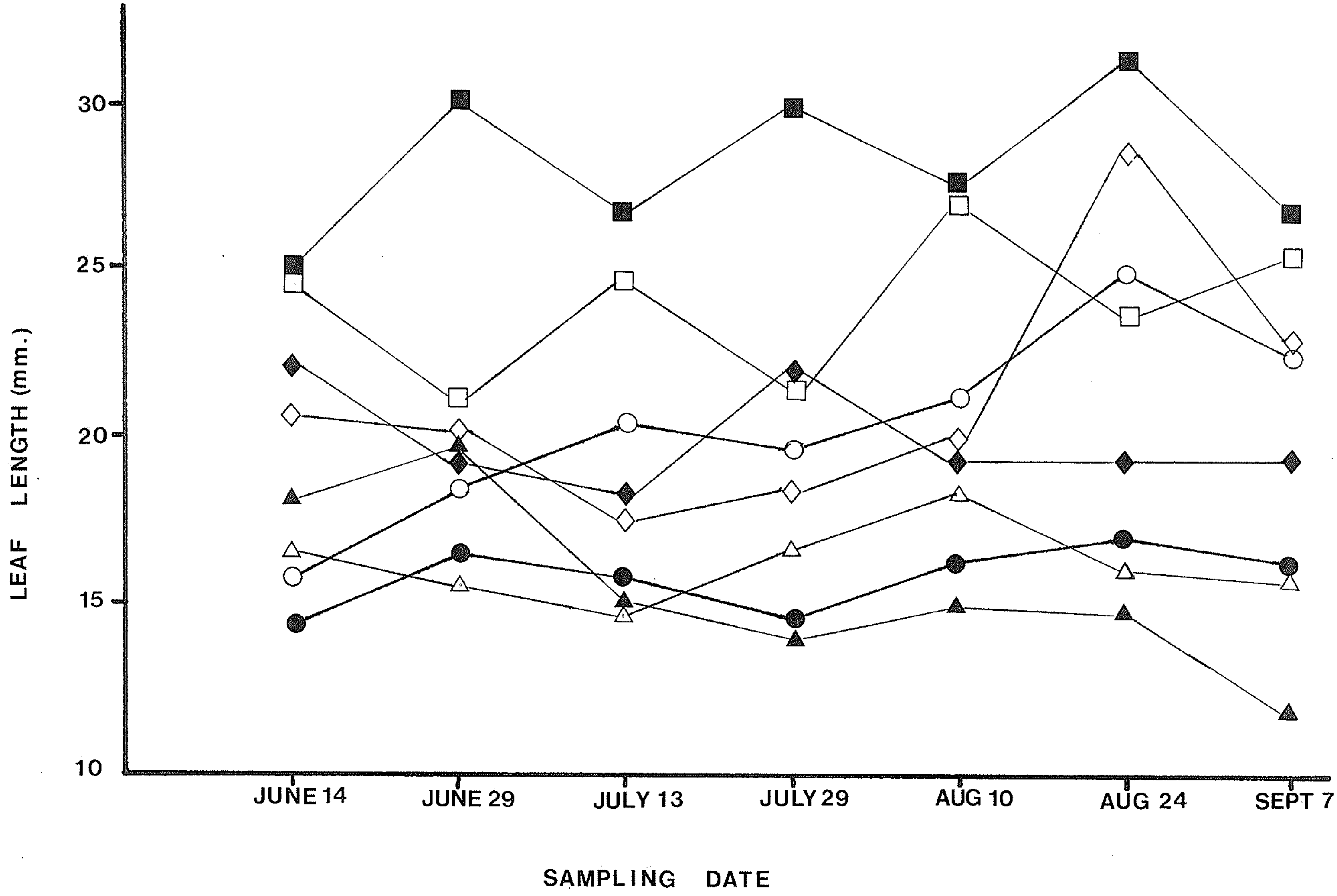

Figure 3. Seasonal variation of leaf length for *P. fruticosa* - North American (◇), European (2n=2x) (○), European (2n=4x) (◆), Scandinavian (□), *P. glabra* (△), *P. parvifolia* (▲), 'Hersi' (■), *P. arbuscula* (●).

or less biological meaning. Are ranked data subject to similar problems or are the categories generally broad enough to avoid this difficulty?

Does variation in times of sampling in previous studies make comparisons between different studies meaningful? Sexual maturity is frequently used as a biological indicator for sampling (Benson 1959). However in a plant such as Potentilla sexual maturity occurs through the major part of the growing season. Flowering on field grown plants in this study occurred from early June through to late October.

Are sample sizes significantly large? In the present study two replicates of five samples each were obtained. How may more intensive sampling be handled efficiently and economically?

In species that are known to be phenotypically plastic, character expression varies from location to location and year to year (Bradshaw 1965). Only through study and evaluation over a number of environments and years can response patterns of different genotypes be determined (Clausen and Heisey 1958). From these studies salient features can be extracted and used in further taxonomic studies. The use of controlled environment facilities and experimental gardens is considered important (Moriset and Boutin 1984).

Phenotypic plasticity is well known in plants with such examples as Ranunculus and Polygonum often cited (Briggs and Walters 1984). However plasticity may be much more subtle and require years of study to investigate. Biosystematic studies that include phenotypic plasticity assessments are not common (Moriset and Boutin 1984).

3.3.2 Numerical Analysis

The mean values for the measurements of each OTU are presented in Appendix 3. The similarity coefficients determined by Gowers general coefficient between each pair of OTU's are presented in Appendix 4. These values are difficult to compare due to the large number of individuals involved in the study. Cluster analysis enables significant data reduction and hence easier interpretation.

A typical phenogram obtained by single linkage clustering is presented in Figure 4. Single linkage clustering generally gives an accurate picture of relationships between pairs but has a tendency to chain particularly if intermediates are present (Legendre and Legendre 1983). Chaining is the sequential addition of taxa in a stepwise fashion. The distance between individuals is generally small. Chaining is evident in figure 4 and as a consequence formation of strong, distinct groups is not apparent. North American representatives show a general affinity, however, several taxa are scattered throughout the entire phenogram. Trends relating to the collection sites are not apparent. Plants collected in Manitoba had equal affinity to those collected in Alberta. No elevational or latitudinal associations are visible either. Eurasian taxa are also scattered as are the cultivars. Very little development of clusters is apparent. The principal reason for this likely relates to the general similarity of the taxa. This is substantiated by the minimum distances between group or individuals. The majority of taxa have less than 20% difference (80% similarity) (Appendix 4).

The results of the unweighted pair grouping analysis are presented in figure 5. General trends are similar but chaining is less evident. There is greater internal organization of the OTU's. North American OTU's again group fairly well but outliers are evident. No associations based on collection site, elevation or latitude are present. Many of

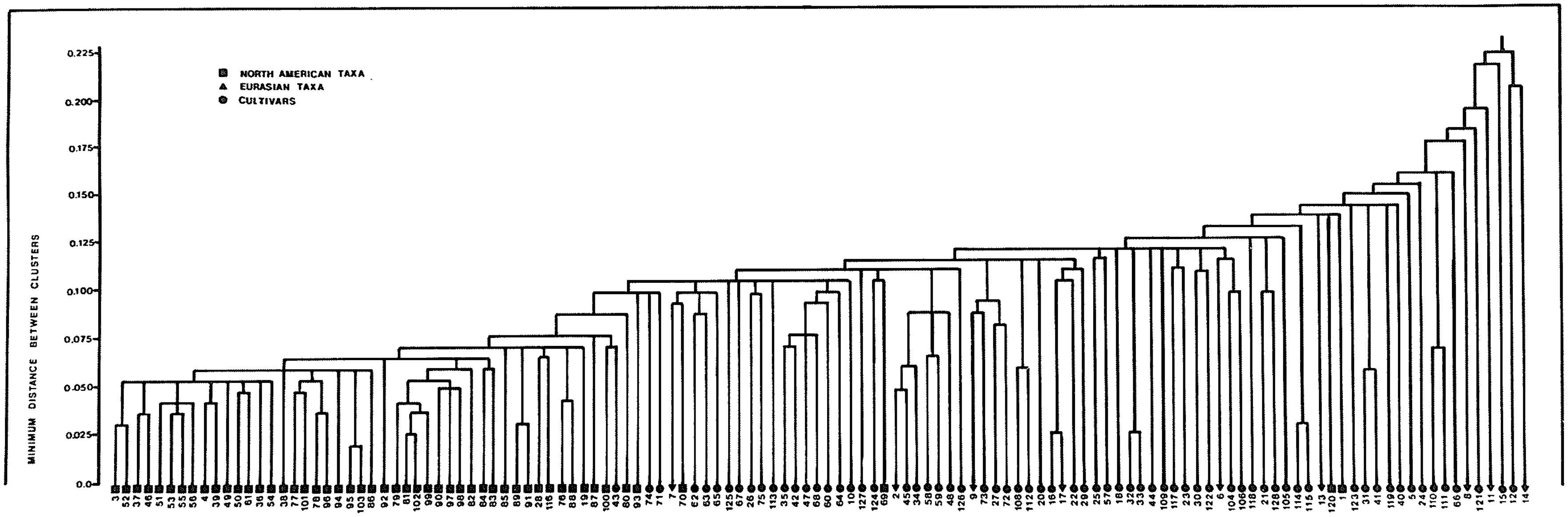

FIGURE 4. DENDROGRAM DEPICTING RELATIONSHIPS AMONG 127 SHRUBBY CINQUEFOIL TAXA DETERMINED BY SINGLE LINKAGE CLUSTERING

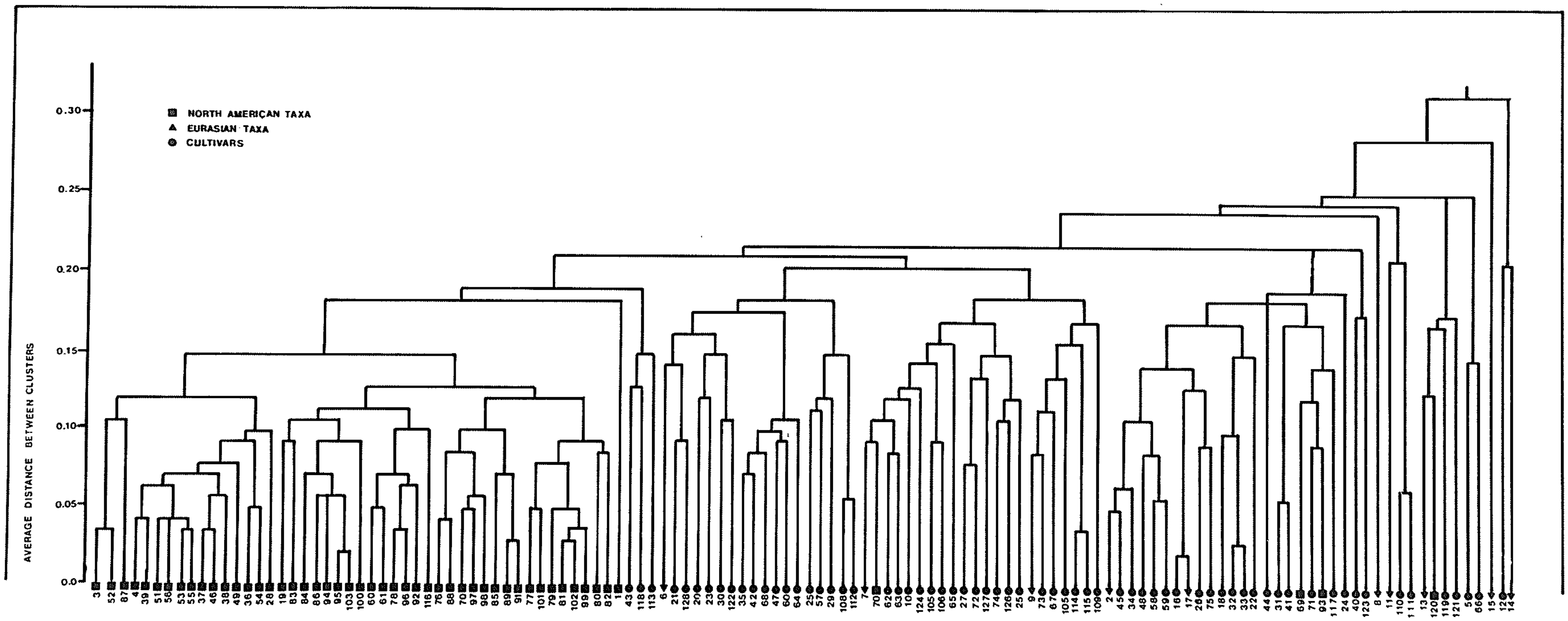

FIGURE 5. DENDROGRAM DEPICTING RELATIONSHIPS AMONG 127 SHRUBBY CINQUEFOIL DETERMINED BY AVERAGE LINKAGE CLUSTERING

the Eurasian taxa and known hybrids have cultivated types closely associated. For example P. arbuscula and the cultivars 'Fran Lady Daresbury', 'Sutters Gold', 'Longacre', '700' and 'White Gold' form a fairly compact grouping. It is apparent that this clustering procedure is more successful in this respect than single linkage. However, the distances between individuals and groups still remains quite small. The majority of taxa retain an overall similarity of near 80%. Thus the groupings that are evident can not be considered definitive.

The ordination results are presented in figure 6. The actual stimulus co-ordinates are presented in appendix 5. Once again, the native North American representatives are fairly tightly grouped but several representatives are scattered throughout the figure. Several of the associations visible in the cluster analysis are also apparent with this analysis. For example, similar taxa are grouped around P. arbuscula as was observed in the cluster analysis. There is a greater tendency for cultivars to be spread generally. More cultivars are situated close to the native grouping indicating a closer association than observed in the clustering phenograms.

The greatest differences between the cluster analysis and the ordination are observed in the treatment of two taxa, P. fruticosa - European (2n = 4x) and P. glabra. These plants are the first to split off from the pack in the cluster analysis and appear quite similar to each other. This distinctiveness is evident in the NMDS ordination, however there is little similarity between the two taxa. They appear in distinct positions in this analysis. P. glabra is a low mound forming plant, densely pubescent and bears few creamy yellow to light yellow flowers. The tetraploid representative from Europe is noted by

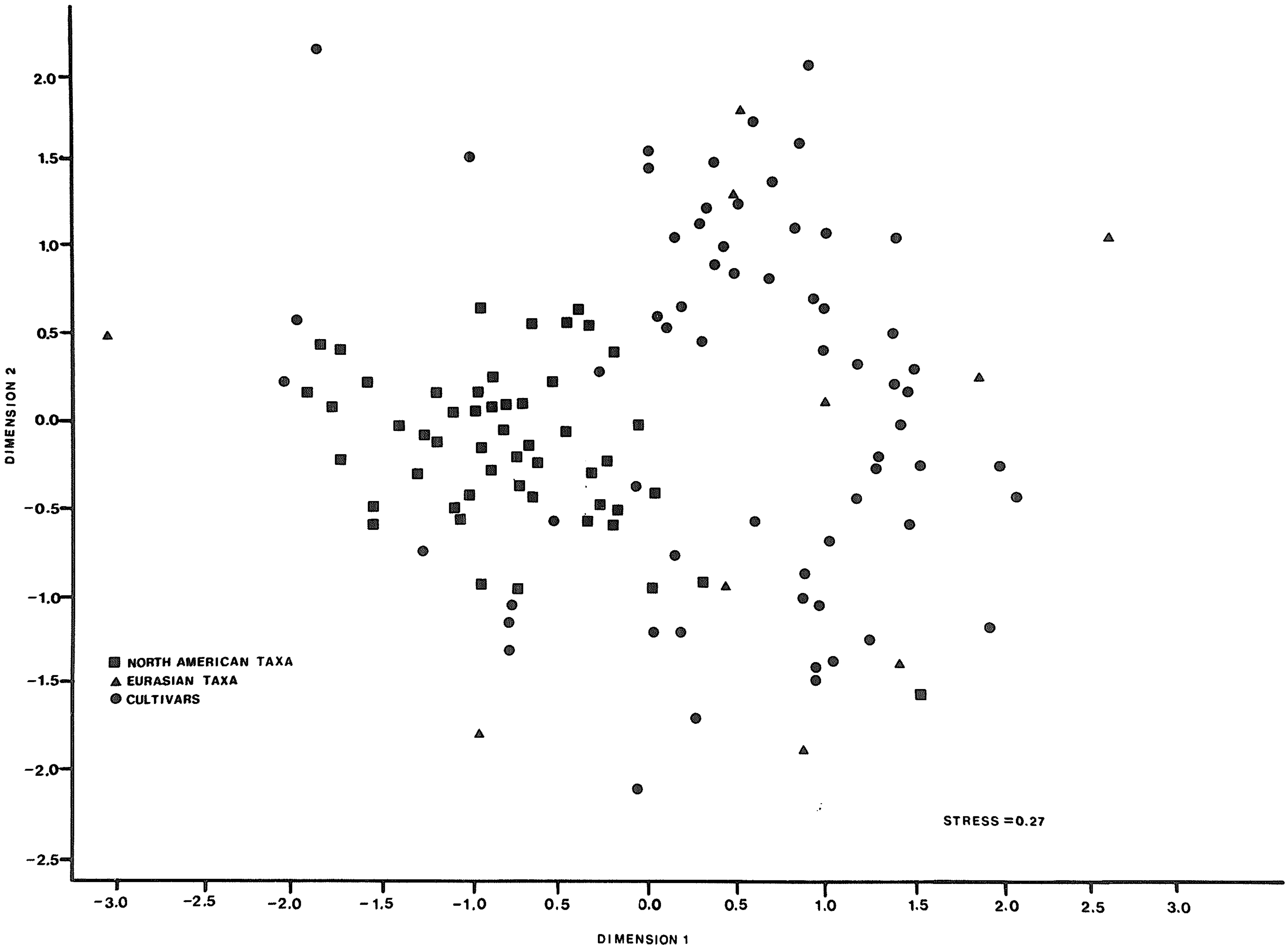

FIGURE 6. RELATIONSHIP OF 127 SHRUBBY CINQUEFOIL DETERMINED BY NON-METRIC MULTIDIMENSIONAL SCALING (SEE APPENDIX 5)

relatively small, nearly glabrous leaves, a profusion of bright yellow flowers and an oval shape. It is unlikely that the tetraploid nature of the plants is responsible for unique characteristics since tetraploids are very difficult to distinguish except by chromosome counts (Elkington 1968). In addition two other tetraploids split off much later than this representative.

The clustering procedures may have resulted in the close positioning of these two taxa. These are more dissimilar than any other representative and this through the process of elimination are the first two plants to be positioned. Hence their close proximity to each other. In the ordination a better positioning results since all taxa are treated equally in the space condensation process. Differences between clustering and ordination are not uncommon (Orloci and Kenkel 1985). These discrepancies may be useful indication of where further research is required.

In previous taxonomic treatments flower colour was used to assist in species delineation. There is little evidence that this character is responsible for any groups postulated. White, light creamy yellow, creamy yellow and bright yellow taxa occur throughout the groups. The observations of Farrer (1916), an early plant explorer are important to recall (page 90, 91)

> "... the pure white forms are abundant all over the foothills of the Siku Alps and only towards the highest limits in the turf at 12,000 feet does it seem to pass into a yellow form ... in the Tibetan Alps, opposite Jô-ni the valley bottoms are filled with masses of deep and brilliant gold, while higher up the white forms comes into fuller possession. The golden types passes to pure white by innumerable graduations of cream, amber, citron, butter yellow, saffron, sulfur and cream ..."

We suggest that flower colour is not a good character for species delineation in P. fruticosa.

In a general overview the grouping of North American, Eurasian and associated cultivars appears fairly homogeneous. The overall similarity supersedes any general development of groupings. The variation observed appears to represent a continuum rather than concrete organization. In a study of Daucus sp. and cultivars Small (1978) coined the term "mongrelization" to explain the obscuring of racial lines. Artificial selection and hybridization both natural and induced may have clouded any firm natural grouping. This is often the case in cultivated plants (Hawkes 1970). There is also additional evidence to suggest that racial separation was not strong initially (Hulten 1971, Elkington 1968, Elkington and Woodel 1963, Bowden 1957 and Hara 1952).

3.3.3 Gene Exchange Trials

3.3.3.1 Self pollinations. A summary of the results of self-pollinations is presented in Table 7. Self-incompatibility indices similar to that described by Gornall and Bolm (1984) were calculated for both seed set and seedlings per pollination (seedling yield) by expressing the means as a percentage of outcrossed seed set or seedling yield. Interpretation of this table indicates that most taxa are self-incompatible (SI). P. arbuscula and P. x Friedrichsenii have been classified as SI based on the very low index rating for seedling yield. P. fruticosa - European 2n = 4x could be classified as self-compatible. Since this was the only tetraploid in the study it is difficult to generalize, however, it is recognized that tetraploidation often disrupts SI systems (de Nattencourt 1977). Tetraploid relatives or artifically induced tetraploids of diploid plants with gametophytic

TABLE 7. Mean seed set and numbers of seedlings obtained from outcrossed and selfed flowers of shrubby cinquefoils

Species	Number of pollinations	Mean seed set per fruit	Percent emergence	Mean seedlings per fruit	Compatibility Index	
					Seed percent	Seedling percent
P. fruticosa (North American)						
outcrossed	25	9.8±1.13	7.8	0.7		
self	30	0		0	0	0
P. fruticosa (Scandinavian)						
outcrossed	45	10.7±0.77	63.5	6.8		
self	29	0		0	0	0
P. fruticosa (European 2n = 2x)						
outcrossed	20	3.3±0.76	58.9	1.9		
self	27	0		0	0	0
P. fruticosa (European 2n = 4x)						
outcrossed	50	1.8±0.28	32.4	0.6		
self	40	0.9±0.04	22.2	0.2	48.9	33.3
P. davurica						
outcrossed	44	11.4±2.51	30.4	3.5		
self	10	1.7±0.56	29.4	0.5	14.9	14.5
P. glabra						
outcrossed	20	4.3±0.86	60.5	2.60		
self	23	0		0	0	0
P. parvifolia						
outcrossed	60	2.6±0.34	33.1	0.9		
self	27	0		0	0	0
P. arbuscula						
outcrossed	60	6.1±0.72	46.0	2.8		
self	33	0.3±0.18	18.2	0.10	5.4	2.1
P. x Rhederiana						
outcrossed	45	1.8±0.31	47.8	0.90		
self	27	0		0	0	0
P. x Sulphurescens						
outcrossed	25	2.8±0.61	40.1	1.1		
self	10	0		0	0	0
P. Friedrichsenii						
outcrossed	10	13.1±3.86	40.7	5.3		
self	10	0.1±0.1	100.0	0.1	0.8	1.9

monofactorial SI often are self-compatible. Pollen changes have been proposed in Prunus (Crane and Lawrence 1929), Petunia (Scott and Chandler 1942) and Pyrus (Crane and Lawrence 1942). These results were based on reciprocal crossing programs with either naturally or artificially obtained tetraploids.

An alternative to this hypothesis proposed by Stebbins (1971) relies on selection pressure theories for an explanation. In tetraploids, selection for self-compatibility is often strong due to reproductive isolation. Heteroploid matings are often unsuccessful or result in the production of sterile triploids thus plants that can self-fertilize and produce viable offspring are more successful.

P. davurica could be classified as partially self-compatible. Seeds were set only after geitonogamous pollinations. Both geitonogamous and autogamous pollinations on the European tetraploid were successful. The shrubby cinquefoils have "sticky pollen" and generally rely on insects for pollinations (Elkington and Woodel 1963) thus both plants could conceivably be self-pollinated in nature.

The compatibility index based on seed set is generally higher than the seedling yield index. This is due to lack of germination and emergence uniformity. Emergence rates varied from 7.8% to 63.5%. Indices based on seedling yield are more conservative than those based on seed set alone and are likely more representative of natural occurrences since emergence is rarely 100%.

Variation in mean ovule numbers per flower are presented in table 8. Values range from 35.0 to 71.75. These changes are indicative of changes in flower size. Variation in the fertilization success rate are also apparent (Table 8). The fertilization success rate was determined

TABLE 8. Mean ovule number and fertilization success rate based on outcrossed seed set

Taxa	Sample size	Mean number of ovules (± SE)	Fertilization success rate (percent)
P. fruticosa (North American)	7	55.3 ± 1.34	17.7
P. fruticosa (Scandinavian)	10	35.0 ± 0.97	30.7
P. fruticosa (European 2n = 2x)	10	65.3 ± 2.54	5.0
P. fruticosa (European 2n = 4x)	9	71.6 ± 2.71	2.6
P. davurica	8	71.8 ± 1.56	15.9
P. glabra	3	48.7 ± 1.86	8.8
P. parvifolia	9	39.7 ± 1.24	6.5
P. arbuscula	7	56.4 ± 2.45	10.8
P. x Rhederiana	9	39.4 ± 1.67	4.6
P. x Sulphurescens	10	59.7 ± 3.28	4.8
P. x Friedrichsenii	10	62.1 ± 5.53	21.1

by dividing the mean open-pollinated seed set value by the mean numbers of ovules. The lowest fertilization success rate was with the tetraploid plant while the highest was recorded on the Scandinavian representative. The low success in the former is possible due to the ploidy level, however, the reasons for the variability in success rates for the remaining plants is unclear. Further research is required to clarify this situation.

Of the successful self-pollinations loss of vigour in the resulting seedlings was only noted for the tetraploid. Twenty-five percent of the seedlings died during the first growing season and the remainder only had a mean vigour rating for the remainder was of 2.7 (0 = dead ... 9 = very vigorous).

No other reports of SI in the shrubby cinquefoil are known to the author. SI is common in Rosaceae where homomorphic gametophytic system generally operates (North 1971). Further research is required to determine the type of incompatibility.

3.3.3.2 Cross pollinations. The results of the controlled crosses between the eight major parents are presented in table 9 while results of backcrosses to putative F_1 hybrids are presented in table 10. In total 789 pollinations were made in 62 different combinations. Compatibility indices were calculated by dividing the mean seed set or seedling yield by the appropriate mean value for the outcrossed seed parent. This correction factor is required due to considerable variation in the mean number of ovules and subsequent average fertilization success rate for the parental taxa (Table 8).

In general three situations arose. Firstly, the cross was successful and plump sound seed were easily extracted and counted.

TABLE 9. Mean seed set, seedling yield and compatibility indices among eight shrubby cinquefoils. The compatibility indices are the mean seed set or seedling yield divided by the similar value for the outcrossed parent

Pollination (♀ x ♂)	N*	Mean seed set per pollination ± standard error of mean	Mean seedlings per pollination	Compatibility index (%) seed	Compatibility index (%) seedlings
P. fruticosa (N. America) x					
P. fruticosa (Scandinavia)	16	0.3±0.10	0	2.6	0
P. fruticosa (European 2n = 2x)	19	0.6±0.20	0	6.4	0
P. fruticosa (European 2n = 4x)	17	0.4±0.16	0.1	4.2	8.7
P. davurica	2	11.0±1.00	3.0	112.2	434.8
P. glabra	9	3.7±2.30	0.1	37.5	15.9
P. parvifolia	19	0.5±0.30	0.1	4.8	7.3
P. arbuscula	20	0.9±0.38	0.1	8.7	7.3
TOTAL	102				
P. fruticosa (Scandinavia) x					
P. fruticosa (N. America)	19	0.2±0.15	0.1	2.0	1.6
P. fruticosa (European 2n = 2x)	10	3.8±0.74	3.2	35.4	47.0
P. fruticosa (European 2n = 4x)	11	1.6±0.53	0.1	15.3	1.3
P. davurica	5	8.0±3.00	0	74.6	0
P. glabra	6	3.2±1.42	2.3	29.5	34.2
P. parvifolia	9	3.6±1.23	2.7	33.2	40.7
P. arbuscula	12	1.3±0.56	0.8	11.7	12.2
TOTAL	72				
P. fruticosa (European 2n = 2x) x					
P. fruticosa (N. America)	10	5.3±1.73	1.8	163.1	94.2
P. fruticosa (Scandinavia)	20	1.1±0.31	0.6	32.3	31.4
P. fruticosa (European 2n = 4x)	10	12.6±4.12	0.1	387.7	5.2
P. davurica	6	26.5±4.68	14.0	815.4	733.0
P. glabra	20	6.4±2.18	1.6	195.4	81.2
P. parvifolia	26	1.6±0.90	0.2	48.6	12.0
P. arbuscula	16	2.4±1.41	0.4	75.1	19.9
TOTAL	108				
P. fruticosa (European 2n = 4x) x					
P. fruticosa (N. America)	18	2.3±0.1	0	125.0	0
P. fruticosa (Scandinavia)	17	0.0	0	0	0
P. fruticosa (European 2n = 2x)	19	0.0	0	0	0
P. davurica	5	0.0	0	0	0
P. glabra	14	0.2±0.15	0	11.4	0
P. parvifolia	10	0.7±0.19	0	38.0	0
P. arbuscula	16	0.0	0	0	0
TOTAL	99				

TABLE 9. Continued

P. davurica x					
P. fruticosa (N. American)	4	0.0 -	0	0	0
P. fruticosa (Scandinavia)	7	15.9 ± 6.97	4.6	139.1	132.1
P. fruticosa (European 2n = 2x)	5	13.2 ± 6.54	5.8	115.8	167.6
P. fruticosa (European 2n = 4x)	4	8.8 ± 1.11	0	76.8	0
P. glabra	8	14.1 ± 5.36	5.9	130.0	169.9
P. parvifolia	5	11.8 ± 2.80	5.4	103.5	156.1
P. arbuscula	5	13.8 ± 3.20	0.8	121.1	23.1
TOTAL	38				
P. glabra x					
P. fruticosa (N. American)	12	0.0 -	0	0	0
P. fruticosa (Scandinavia)	9	6.1 ± 1.50	2.3	142.1	89.6
P. fruticosa (European 2n = 2x)	5	15.6 ± 6.56	4.2	362.8	161.5
P. fruticosa (European 2n = 4x)	6	8.7 ± 1.78	0.7	201.6	25.7
P. davurica	26	4.4 ± 1.88	1.1	101.9	41.5
P. parvifolia	4	7.0 ± 0.71	2.0	162.8	76.9
P. arbuscula	5	28.6 ± 6.20	10.4	665.1	400.0
TOTAL	67				
P. parvifolia x					
P. fruticosa (N. American)	25	0.2 ± 0.08	0.1	6.2	14.0
P. fruticosa (Scandinavia)	16	1.8 ± 0.73	0.1	69.9	15.1
P. fruticosa (European 2n = 2x)	23	0.2 ± 0.11	0.1	8.5	10.5
P. fruticosa (European 2n = 4x)	11	1.4 ± 0.33	0	52.5	0
P. davurica	5	0.0	0	0	0
P. glabra	17	0.6 ± 0.27	0.1	22.8	14.0
P. arbuscula	21	1.3 ± 0.40	0.3	49.8	33.7
TOTAL	118				
P. arbuscula x					
P. fruticosa (N. American)	21	0.4 ± 0.13	0.1	6.2	5.0
P. fruticosa (Scandinavia)	13	10.1 ± 5.43	4.2	165.3	147.7
P. fruticosa (European 2n = 2x)	9	5.9 ± 2.20	2.7	96.6	95.0
P. fruticosa (European 2n = 4x)	10	3.4 ± 0.58	0	55.7	0
P. davurica	15	27.3 ± 4.66	8.3	447.7	295.4
P. glabra	10	4.2 ± 0.18	0.7	68.9	24.9
P. parvifolia	19	2.4 ± 0.77	1.2	39.7	43.1
TOTAL	97				

* Number of cross pollinations

TABLE 10. Mean seed set, seedling yield and compatibility indices for backcross to putative F_1 hybrids. The compatibility indices are the mean seed set or seedling yield divided by the similar value for the outcrossed seed parent

				Compatibility index (%)	
Pollination (♀x♂)	Number of crosses	Mean seed set per pollination	Mean seedlings per pollination	seed	seedlings
P. x Rhederiana x					
P. parvifolia	22	0.6±0.27	0.1	33.0	11.5
P. fruticosa (European 2n = 2x)	26	8.3±3.55	3.5	456.0	402.0
TOTAL	48				
P. x Sulphurescens x					
P. arbuscula	9	0.0	0	0	0
P. glabra	8	20.1±7.36	6.0	707.8	526.3
TOTAL	17				
P. Friedrichensii x					
P. fruticosa (European 2n = 2x)	13	8.2±2.43	2.4	62.6	45.0
P. glabra	10	22.0±4.08	6.0	167.9	112.6
TOTAL	23				

Secondly, sound seed were present but many small shriveled ones were also obtained. These were not recorded in seed yield information. All attempts to germinate shriveled seed failed. Thirdly, all pollinations were unsuccessful. Floral structures whithered and dried. Few small shriveled "seed" were observed in this situation. In any particular cross combination all three situations could arise. This variability of success is expressed as the standard error of the mean in tables 9 and 10.

In the diallel crosses most matings were successful. As suspected according to Rhodes (1954) all taxa are generally interfertile. Of the 56 combinations 12.5% failed to produce seed and 28.6% failed to yield seedlings. The majority of these failures involved the tetraploid parent. As a maternal parent only 42.9% of the crosses produced seed and no seedlings emerged. Success was higher when this plant was used as a pollen parent. Seed was set in all combinations and seedlings were obtained in 42.9% of the cases. Heteroploid crosses are often unsuccessful (Stebbins 1971). Further cytogenetic studies are required to explain the variability observed. By averaging the compatibility indices for reciprocal crosses it is evident that gene exchange is possible in all combinations except with some of the heteroploid matings (Fig. 7 and 8). Cumulative differences in success rates are evident. *P. fruticosa* - North American generally performs poorly whereas *P. davurica* and *P. glabra* are very successful. This may relate to centers of origin for this complex. According to Hulten (1971) and Elkington (1968) the center of origin is in Asia. As greater and greater spacial isolation occurs there is a larger potential for genetic isolation. This could eventually lead to the development of reproductive barriers.

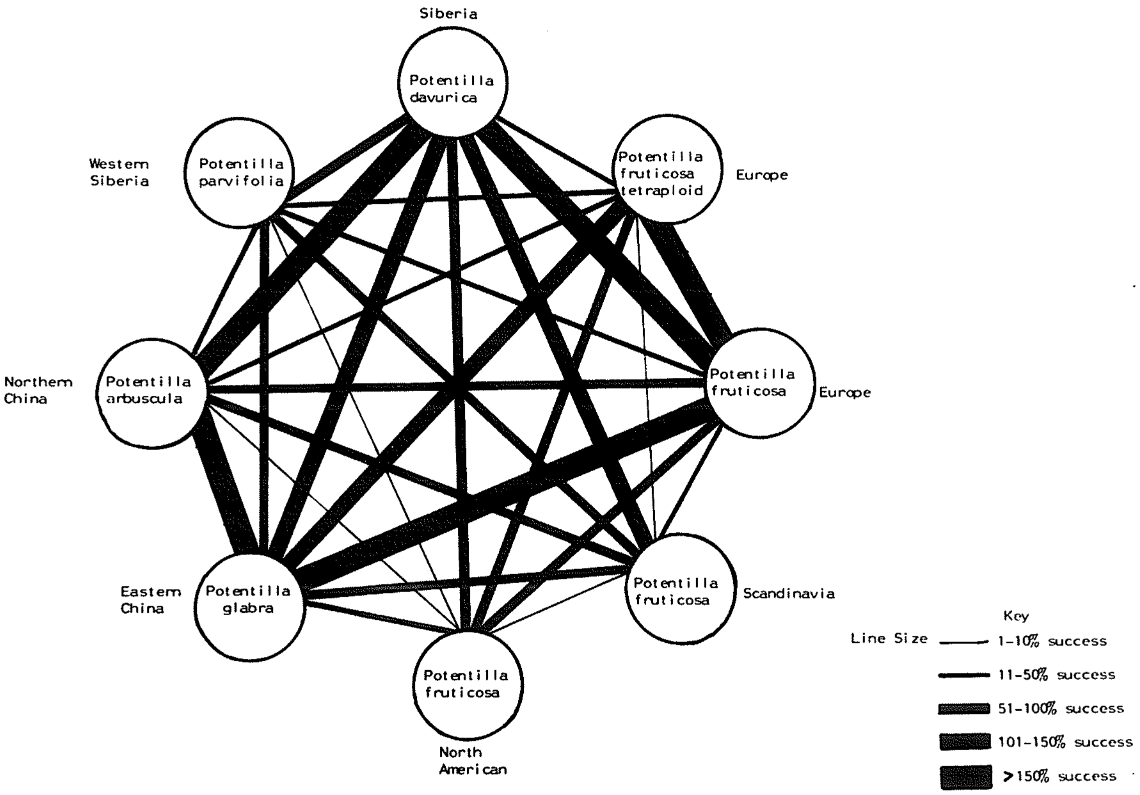

Figure 7 - Breeding relationships based on success of seed production. Success was based on the average seed yield for the cross and reciprocal divided by the appropriate outcrossed maternal parent value.

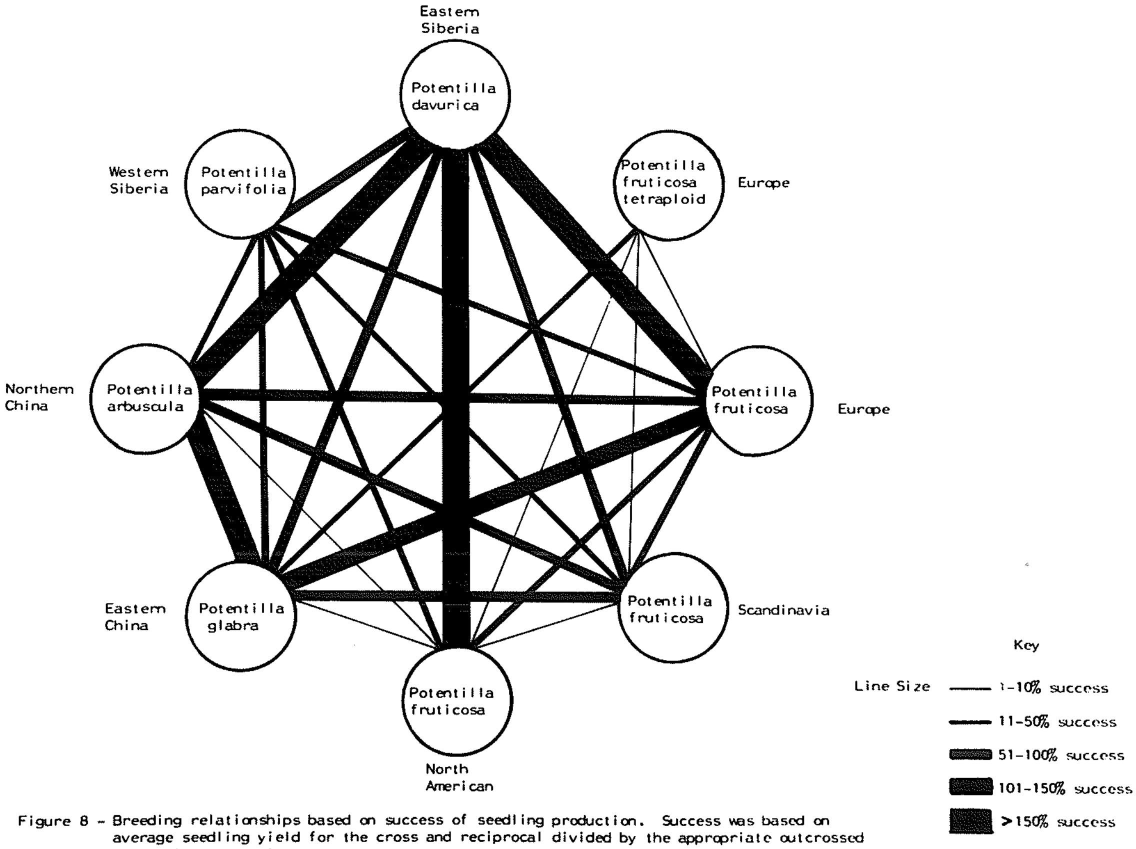

Figure 8 - Breeding relationships based on success of seedling production. Success was based on average seedling yield for the cross and reciprocal divided by the appropriate outcrossed maternal parent value.

The ability to intermate and produce viable progeny is interpreted as a measure of relationship, however the converse is not necessarily true (Stace 1981). This information must be correlated with other data to obtain a holistic outlook.

Relationships based on seed set alone (Gornall and Bohm 1984) are likely to be overestimates. In nearly every case in this study a reduction in the compatibility index occurred when seedling yields were considered. A compatibility index that combines both seed and seedling information is also known (Van der Kloet 1980), however this may result in some loss of information as well. Use of both indices provide the broadest picture with the greatest information content. Future research may develop better techniques for seed germination which may positively influence the ultimate seedling yield. Thus, performance of the plants in relation to both seed and seedling yield should be reported.

The interpretation of results for backcrosses to existing F_1 hybrids (Table 10) indicate that all are fertile. Seed and seedlings were obtained in all but one cross, P. x sulphurescens x P. arbuscula. it is possible that failure of this cross is due to common incompatibility alleles.

To further support the hypothesis of fertility seed yields were determined on a sample of progeny from the diallele mating as well as plants from the backcrossing program (Table 11). In all cases significant seed set was obtained.

3.3.3.3 Woody x herbaceous crosses. A total of approximately 1000 pollinations were made over a two year period with 28 different species or cultivars of herbaceous Potentilla (Table 4). From all of these only six seeds were set of which 3 seedlings emerged and grew. All were from

TABLE 11. Open pollinated seed yield of F_1 and BC_1 progeny

Parental Combination	Number of plants	Mature fruit counted	Seed yield (± SE of mean)
P. davurica x P. glabra	5	25	18.8±2.0
P. davurica x P. fruticosa (Scandinavian)	5	25	24.5±1.5
P. davurica x P. fruticosa (European 2n = 2x)	5	25	20.4±1.2
P. davurica x P. arbuscula	2	10	10.6±1.5
P. fruticosa (N. American) x P. davurica	2	16	10.4±1.8
P. fruticosa (European 2n=2x) x P. fruticosa (Scandinavian)	8	40	20.0±0.8
P. fruticosa (European 2n=2x) x P. davurica	5	25	18.9±2.2
P. arbuscula x P. fruticosa (Scandinavian)	5	25	20.5±2.8
P. arbuscula x P. davurica	5	25	20.4±1.7
P. x Rhederiana x P. davurica	5	25	9.4±1.3
P. Friedrichsenii x P. fruticosa (Scandinavian)	5	25	22.2±1.7

a cross between UM8102 x P. x hybrida 'Gibson Scarlet'. UM8102 is a University of Manitoba selection that produces double white flowers while 'Gibson Scarlet' is a dark red flowered herbaceous plant.

Two of the seedlings are matroclinous while the third is patroclinous. The matroclinous plants are slow growing, reaching only 15 cm and 30 cm after 18 months. The smaller plants appear very chlorotic and weak. No flowers have been observed. Sporadic flowering has occurred on the taller seedling. Petals are pale pink in colour. Pistil development appeared normal, however, anthers were generally small and misshapen. Attempts to cross pollinate flowers have been unsuccessful. Chromosome number for both plants is 14, the same as the maternal plant.

The patroclinous plant is quite vigorous with growth equivalent to the pollen parent. Flowers are orange-red in colour and petal counts frequently exceed the basic number of five. Supernumerary petals have not been observed on the pollen parent, however, are common on the maternal parent. Petal counts average fifteen in UM8102 (Robertson 1984). Floral abortion has taken place on numerous occasions under both greenhouse and field growing conditions. The chromosome number for the plant is 84. The pollen parent has 56 chromosomes. All attempts to cross pollinate these seedlings have failed. No seeds have been observed on open-pollinated flowers.

It is possible that the two matroclinous plants resulted from accidental selfing. After many repeated attempts UM8102 was successfully self-pollinated, however, only healthy, vigorous and white flowered plants were obtained. This is in contrast to the performance of the hybrid seedlings. All seedlings have been field planted and performance will be monitored over several years.

As previously noted crosses between herbaceous and woody *Potentilla* as well as *Fragaria* are known (Asker, 1970, 1971, 1977, Ellis 1962, Niemirowicz-Szczytt 1982, Jelenkovic et al. 1984, Macfarlane-Smith and Jones 1985). In these studies *P. fruticosa* was always used as the pollen parent. Jelenkovic et al. (1984) noted that the possibility of fertility restoration was remote in *Fragaria* x P. *fruticosa*. Increasing *Fragaria* genomic ratios from 1:1 to 8:1 resulted in greater numbers of surviving seedlings, however fertility restoration was not achieved. Ellis (1962) did not obtain fertility in pentaploid and hexaploid intergeneric hybrids. However, Macfarlane-Smith and Jones (1985 a & b) have obtained putative hybrids between *Fragaria moschata* and *P. fruticosa*. Embryo rescue techniques were employed to obtain 7 vigourous seedlings from a cross between a F_1 aneuploid (2n=23) and the two parents (2n=42 and 2n=14). Both unreduced and double unreduced gametes were suspected as being important in the production of the seedlings. Double unreduced gametes could be involved in the production of the matroclinous plant (2n=84) in the present study. Muntzing and Muntzing (1944) suggested that double unreduced gametes were involved in the production of an interspecific pentaploid hybrid herbaceous *Potentilla*.

Love (1954) suggested that the woody species of *Potentilla* be placed in a separate genus (*Pentaphyloides*) on the basis of morphological and mating behaviour differences. On the basis of our research and that of others there is some residual cross compatibility supporting the view of Hulten (1971) that *Potentilla* be retained as the generic name.

Verification of hybridity of the matroclinous and patroclinous seedlings is required. Use of electrophoresis, chromatography and enzyme analysis should be evaluated (Macfarlane-Smith and Jones 1985 a & b). Chromosome studies of pairing relationships could also be undertaken, however, sterility may prevent such an investigation.

If hybridity is confirmed this would be the first time known to the author that crosses using the woody plant as a female have been successful. In addition, this is the only known occurrence of a woody plant habit from woody x herbaceous crosses. Such plants have significant potential in future breeding programs.

In view of the potential for gene exchange further studies should be undertaken. It is apparent that success rates in the present program were very low but it may be possible to increase successes through embryo rescue techniques. Unfortunately, Macfarlane-Smith and Jones (1985 a & b) have not published their methods. This may result in more plants either for direct release or for future breeding programs. Several herbaceous Potentillas have very valuable floral characteristics. These include bright red, orange and pink flowers; extra petals (± 25) and large flower size ($>$ 40 mm). If these characters could be incorporated into the woody habit very significant improvements in ornamental value could be the result.

3.3.4 Chromosomal Information

All North American collections were diploid (2n = 14). These data are consistent with those of Love (1954, 1982) and Bowden (1957). Of the remaining 65 taxa examined all but three were diploid. Two individuals _P. fruticosa_ - European 2n = 4x and _P. fruticosa_ - Oeland were tetraploid while the third _P.f._ 'Snowflake' or 'Hersi' was triploid. No hexaploid or octoploids were observed. These data are also in general agreement with Bowden (1957). Distinguishing between diploid and tetraploid taxa is not simple (Elkington 1968, Bowden 1957). European tetraploids are generally considered to be dioecious (Tornblom 1911, Elkington 1968, Grewel and Ellis 1972). On this basis Elkington (1968) proposed the recognition of P. fruticosa fruticosa (2n = 4x = 28, dioecious) and P. fruticosa floribunda (2n = 2x = 14, hermaphodite).

Without further information on flower morphology of other tetraploids, hexaploids or octaploids it is difficult to be definitive but the description of two new varieties (Elkington 1968) may have been somewhat premature, particularly in light of the perfect flowered nature of the tetraploid used in our study.

3.4 General Discussion

The results of the multivariate statistical analysis and gene exchange trials are consistent with observations of several earlier investigators. Hara (1952), Rhodes (1954), Hulten (1971), Rheder (1960) and van den Laar (1982) suggested that the Potentilla complex is a very polymorphous continuous grouping of plants. The discontinuities reported by Juzepchuk (1941) and Handel-Mazzetti (1939) are not as firm as originally expected. It is possible that the seasonal variation of often used characters has contributed or resulted in confusion. Differences in month, year and location of collections may have confounded earlier work.

It is apparent that the potential for exchange of genetic information is present. This is particularly evident when the fertility of the F_1 hybrids is considered. Continuity of plant types in outcrossing species with limited barriers to gene flow is not unexpected (Briggs and Walters 1984).

The relative positioning in the numerical analysis of several of the Eurasian types and hybrids (eg. P. fruticosa - European 2n = 4x, P. glabra) may be due to small sample size. Whereas North American taxa were well represented, samples of Eurasian taxa were not as completely surveyed. Continuity may increase if native taxa from these regions could be sampled. Recent botanical expeditions to China may be able to shed more light in this regard (D. Boufford - per com).

The biological species concepts of Mayr (1942) is most useful for the study of cultivated plants and plant breeding (Hawkes 1970, Baker 1970, Hawkes 1981 and Brandenburg 1984). The potential for gene exchange, and inheritance of desired characteristics are of prime interest in plant breeding programs.

During domestication of crop plants intermating of types leads to taxonomic problems. As mentioned previously the "mongrelization" effect (Small 1978) can significantly cloud the overall taxonomic picture. However, this domestication through breeding and selection may make these plants dependent on man (Brandenburg 1984). In relation to Potentilla, the stage of domestication is likely low. Interest in the plant as an ornamental dates to the 1700's (Mussel 1971) however concerted efforts were not apparent until the late 1800's (van den Laar 1982). Significant overall similarities of near 80% still remain between cultivated and naturally occurring types (fig. 4 and 5).

Based on the data examined all taxa studied belong to the biological species Potentilla fruticosa L. This hypothesis is based on the examination of phenetic and reproductive observations and experiments. Uniformity of treatment of the taxa should lead to less confusion, particularly in the related commercial industries. Further biosystematic research of the Asian representatives is required and hopefully will be completed.

4.0 Manuscript II. The propagation of Potentilla fruticosa L. by sexual and asexual means

4.1 Introduction

A knowledge of plant propagation is required in cultivar development programs. Asexual techniques are important for maintenance and/or increase of selected plant material. Germination and emergence studies are important for effective handling of valuable seeds. Germination as used in this study is defined as the emergence and development from the seed embryo of those essential structures which are indicative of the ability to produce a normal plant (Schopmeyer 1974). When the radicle was equal to or greater than the seed length a seed was considered germinated. All germination studies were completed in small petri dishes. Emergence refers to the development of young seedlings to such an extent that they were visible above level of the medium. Only green healthy seedlings were considered in emergence counts. Emergence values are often lower than germination since small seeds that germinate but lack vigour may not emerge above the medium level.

Potentilla fruticosa L. has not been studied extensively. Interpretation of research on seed germination and seedling production suggested that pretreatments are not necessary (Currah et al. 1983, Meshinev 1973, Grewal and Ellis 1972 and Elkington and Woodel 1963). Emergence percentages have ranged from 20% to 90%. Meshinev (1973) suggested that covering the seed with medium should be limited. Light increased the rate of germination but had no effect on maximum percentages observed.

Stem cuttings of *P. fruticosa* have been classified as easy-to-root

(Hartman and Kester 1983). General recommendations suggest that softwood cuttings root easily under intermittent mist (Elkington and Woodel 1963, Van de Laar 1982). Freeland (1977) found that cuttings could be taken from early summer to late summer and the use of bottom heat and rooting hormones increased success rates. Rhodes (1954) suggested that hardwood cuttings would also root.

The object of this study is to develop better guidelines for the propagation of *P. fruticosa* which will enable increased operational efficiency of a breeding and cultivar development program.

4.2 Materials and Methods

4.2.1 Rooting of Cuttings

4.2.1.1 *Cutting collection.* All cuttings were harvested from the terminal 10 to 15 cm of growth on established field grown plants in the University of Manitoba test garden. Cuttings were collected and placed in plastic bags with a moist paper towel to maintain a high relative humidity. All treatments were initiated within two hours of harvest. Each cutting had four to six buds present on the stem. The lower third of the cutting was defoliated manually and dipped in Stim root No. 1 rooting hormone (0.1% IBA - Plant Products) immediately prior to treatment initiation (Freeland 1977).

A series of exploratory experiments dealing with factors potentially influencing rooting were conducted. An outline of these and the results thereof are presented in Appendix 6.

4.2.1.2 *Cultivar rooting survey.* An experiment initiated in mid-June 1983 involved a survey of rooting of 64 *P. fruticosa* taxa (Appendix 7). Cuttings were placed in a peat:vermiculite media (50:50 vol.) in plastic cell packs (6 cm x 3.5 cm x 5.5 cm) in an intermittent mist chamber in the greenhouse. The mist was supplied by humidifiers which operated for ten seconds every two minutes for 16 hours day length. A completely randomized design with three replicates and six cuttings per replicate was used. Assessments were conducted after 45 days for main and lateral root development. Main roots are considered to be roots originating from the stem, while lateral roots originate from main roots. Rooted cuttings were then potted in soil:peat:sand media (2:1:1 vol.) and survival was assessed approximately 1 week later. A relative assessment of growth and vigour was also made.

4.2.1.3 Harvest date survey. The influence of harvest date of cuttings was investigated for three taxa; *P. fruticosa* 'Abbotswood', 'Coronation Triumph' and 'Moonlight'. Cuttings were collected every two weeks from June 1 to October 5 and on November 2 and December 3. The sequential harvesting of cuttings could not be accommodated for October-December due to shortage of suitable materials on field plants. Cuttings were treated as previously described. Assessments completed 42 days after treatment included main and lateral root development ratings, counts of bud breaks, height changes and survival. From May 8 to October 9 maximum and minimum temperatures were recorded near the test garden site. Growing degree days were calculated according to the method of Dunlop and Shaykewich (1982).

4.2.2 Seed Studies

4.2.2.1 Seed collection. All seed was harvested from established plants. Seed ripeness was visually determined by observing colour changes. Collections were made when fruit was brown. Seed was manually extracted and counted with the aid of a dissecting microscope. Only full plump seed was used in the study. Unless otherwise specified seeds were sown in a peat:vermiculite (50:50 vol.) medium. A very small amount of medium was used to cover the seed (Meshinev 1973). Growth room temperatures were 20°C/15°C (day/night). Light was supplied for 16 hours daily. All data were analyzed by analysis of variance.

4.2.2.2 Germination temperature. To determine temperature sensitivity of seeds during germination open-pollinated seed from *P. fruticosa arbuscula* and *P. fruticosa* 'Hurstborne' were placed on a thermal gradient in small sealed plastic containers (Zastre 1985). Filter paper moistened with distilled water was placed beneath the seeds. Temperature treatments were 7°C, 13°C, 17°C and 20°C. Each treatment consisted of three replicates with 10 seed per replicate. Germination was monitored for 30 days with counts made twice a week. Seed which had formed a radicle equivalent to the length of the seed was considered germinated.

4.2.2.3 After-ripening study. Experiments were conducted to determine the effects of after-ripening treatments on the rate and percentage of seedling emergence. Open-pollinated seed collected from established field grown plants were sown in a completely randomized and replicated design. Four replicates of 25 seed were used for each treatment. Seed were collected from *P. fruticosa arbuscula*, *P. fruticosa parvifolia*, *P. fruticosa* - European source, *P. fruticosa* - Scandinavian source and three North American plants, NA-1, NA-2 and NA-3. Two of the plants, NA-1 and NA-2 were collected near Bow Pass in the Rocky Mountains, Alberta and the other from near Marchand, Manitoba. The seed was stratified in peat:vermiculite media (50:50

vol.) in small sealed plastic containers which were also enclosed in plastic bags to reduce moisture loss. The treatments were:

1) 15 days at 4° ± 1°C and dry (no moisture added)
2) 15 days at 4° ± 1°C and moist (pre moistened medium)
3) 30 days at 4° ± 1°C and moist (pre moistened medium)
4) 45 days at 4° ± 1°C and moist (pre moistened medium)

The media was moistened with distilled water prior to treatment. Treatments were initiated sequentially to allow uniform placement of the containers in a controlled environment growth room (20°/15° day/night temperature). Emergence was monitored twice a week for a period of five weeks. Containers were re-randomized each time. Data were analyzed by analysis of variance.

4.3 Results and Discussion

4.3.1 Rooting of Cuttings

4.3.1.1 Cultivar survey. The results of the survey of rooting of 64 taxa are presented in Appendix 7. Interpretation of these suggests that the majority of plants rooted and survived very well. The mean survival percentage was 88.0% ± 3.2 with most plants growing quite vigorously. The mean main root rating was 3.27 ± 0.15 out of a possible maximum of 5.0 while the mean lateral root rating was 2.68 ± 0.09 out of a possible maximum of 3.0. The only taxa that consistently failed to root well were plants collected from native North American sources. According to Tornbloom (1911) and Elkington and Woodel (1963) seed reproduction is more important than any vegetative means in wild populations. However, ease of asexual propagation is an important criterion in commercial production and breeding programs (Hartman and Kester 1968). Considerable selection pressure may have been exercised for ease of rooting prior to the release of new cultivars.

It is also evident from this survey that if root development did occur subsequent survival and growth were generally high. If root development was poor, the cuttings usually died.

4.3.1.2 Harvest date survey. The percentage of cuttings rooted at each harvest date for the three cultivars is presented in table 12. Cuttings were classified as rooted if the number of main roots was greater than three. This was based on the survival information gained in earlier experiments.

'Cornation Triumph' rooted most uniformly during the growing season. Success rates were low only during the last two sampling dates. Rooting of 'Moonlight' and 'Abbotswood' were most successful during the earlier part of the growing season. After mid-summer rooting was much more variable.

The results of ratings for main and lateral root development are presented in table 13. A highly significant interaction term between cultivars and sampling dates indicates that each cultivar responded differently to the treatment conditions. Several overall trends are visible however. Root development on cuttings collected in November and December was the poorest. Rooting did take place but only to a limited extent. Secondly, root development was lower on the August 10 sampling than either immediately proceeding or subsequent dates. This general reduction may be related to environmental conditions immediately prior to the sampling date. From July 27 to August 10 the warmest period of the summer occurred (Table 14 and Appendix 8). Cuttings collected

TABLE 12. Mean* rooting percentage for three cultivars of *Potentilla fruticosa* sampled every two weeks from June 1 to October 5 and November 2 and December 3, 1984.

Sampling Date	Cultivar		
	Coronation Triumph	Moonlight	Abbotswood
June 1	100.0 a**	94.4 a	94.4 a
June 15	100.0 a	94.4 a	83.3 a
June 29	100.0 a	94.4 a	83.3 a
July 13	88.9 a	77.8 abc	88.9 a
July 27	94.4 a	88.9 a	94.4 a
August 10	88.9 a	50.0 c	41.2 d
August 24	100.0 a	66.7 abc	50.0 cd
September 7	88.9 a	22.2 d	61.1 bcd
September 21	83.3 a	72.2 abc	77.7 abc
October 5	88.9 a	22.2 d	88.2 a
November 2	55.6 b	61.1 bc	77.8 abc
December 3	61.1 b	61.1 bc	38.8 d
Mean	87.5	75.6	73.4

* Means of three replicates with six cuttings per replicate.

** Means followed by a similar letter are not significantly different at $\alpha = 0.05$, Duncans Multiple Range Test.

TABLE 13. Root development of cuttings of three P. *fruticosa* cultivars, collected during the period June 3 to December 3, 1984 rated after 42 days in an intermittant mist chamber

Sampling Date	Main Root Rating*			Lateral Root Rating**		
	Coronation Triumph	Moonlight	Abbotswood	Coronation Triumph	Moonlight	Abbotswood
June 1	2.50b***	1.50abcd	1.67 cde	1.50 bc	2.44 a	1.83 a
June 15	2.83 ab	1.78 ab	1.67 cde	1.94 ab	1.83 bc	1.56 ab
June 29	2.50b	1.94 a	1.44 cde	1.50 bc	1.89 b	1.17 abc
July 13	2.83 ab	2.17 a	2.67 abc	1.17 bc	1.56 bcd	1.33 abc
July 27	3.28 ab	2.22 a	3.39 a	1.39 bc	1.11 de	1.50 ab
Aug. 10	2.72 b	0.89 bcde	0.69 e	0.89 cd	0.72 ef	0.52 cde
Aug. 24	3.56 ab	1.61 abc	1.22 de	1.78 ab	1.28 cde	0.94 bcd
Sept. 7	2.33 b	0.33 e	1.56 cde	1.61 bc	0.11 g	0.83 bcde
Sept. 21	3.11 ab	1.78 ab	2.17 bcd	1.78 ab	0.72 ef	1.00 abcd
Oct. 5	4.22 a	0.50e	2.91 ab	2.50 a	0.28 fg	1.49 ab
Nov. 2	1.00 c	0.61 de	1.22 de	0.33 d	0.00g	0.17 de
Dec. 3	0.83 c	0.78 cde	0.44 e	0.17 d	0.00g	0.06 e
Mean	2.64	1.34	1.75	1.38	1.00	1.03

* Main root ratings; 0 = 0 roots, 1 = 1-3 roots, 2 = 4-6 roots, 3 = 7-9 roots, 4 = 10-12 roots, 5 = 12 roots

** Lateral root ratings - 0 = 0 roots, 1 = few, 2 = moderate, 3 = heavy

*** Values followed by a similar letter are not statistically different at α = 0.05 (Duncan's Multiple Range Test).

during or shortly after periods of high temperature generally have a reduced ability to root. This reduction could also relate to internal moisture stress (Cram and Lindquist 1961). It should also be noted that the growing degree day values provide a simple method of summarizing temperature data and thus can be very useful to assist in data interpretation (Edey 1977).

Environmental conditions did not affect the three cultivars in the same manner. Development of main roots from the August 10 sampling in 'Coronation Triumph' was reduced by 17%, 'Abbotswood' by 60% and 'Moonlight' by 80% (Table 13). Similar trends are present in lateral root ratings. These results may relate to the place of origination for each cultivar. 'Coronation Triumph' was selected at Indian Head, Saskatchewan while the other two were developed in Europe. The Saskatchewan introduction may be better adapted to prairie growing conditions having been selected under the harsher prairie environment. The other cultivars originated from Europe and may not have been exposed to as hot and droughty conditions during the selection process.

The average height increase for all cuttings was generally higher when rooted earlier in the growing season (Table 15). Cuttings exhibited more vigorous growth during this period. The mean number of bud breaks is difficult to interpret. These data were not analyzed by analysis of variance procedures due to non-normality and heterogeneity of error variances (Steel and Torrie 1980). Transformations were of no assistance hence only means and standard errors are presented (Gomez and Gomez 1984). Counts of bud breaks includes both lateral and terminal types, however, terminal buds were not important until after September 7 to September 24. Prior to this shoots were actively growing. Lateral

TABLE 14. Summary* of growing degree day values calculated** for 14 day intervals from May 18 to October 5, 1984.

Date	Growing Degree Days
May 18 - June 1	219.7
June 1 - June 15	269.8
June 15 - June 29	362.5
June 29 - July 13	346.7
July 13 - July 27	375.5
July 27 - August 10	393.9
August 10 - August 24	336.8
August 24 - September 7	285.8
September 7 - September 21	208.9
September 21 - October 5	103.1

* For complete data, see appendix 8.

** Dunlop and Shaykewich 1982 (minimum base temperature 4.4°C).

TABLE 15. Mean* growth parameters for cuttings of three cultivars of *Potentilla fruticosa* rooted in intermittent mist for 42 days.

	Mean Number of Bud Breaks ±SE**			Mean Length Change (mm)		
Sampling Date	Coronation Triumph	Moonlight	Abbotswood	Coronation Triumph	Moonlight	Abbotswood
June 1	0.33±0.18	0.00	0.00	13.0 b***	16.9 a	13.9 a
June 15	0.50±0.30	0.67±0.33	0.2±0.15	23.0 b	18.7 a	13.1 a
June 29	1.18±0.20	1.43±0.30	0.82±0.26	13.2 b	11.2 ab	14.2 a
July 13	1.00±0.71	1.50±0.5	1.33±0.67	8.4 bc	9.2 ab	13.3 a
july 27	1.09±0.21	1.00±0.25	1.0 ±0.40	5.0 c	1.6 cd	14.3 a
Aug. 10	0.92±0.31	0.00	0.71±0.18	4.4 c	3.7 c	4.1 b
Aug. 24	0.00	1.00±0.30	0.42±0.19	1.6 d	4.3 bc	6.1 b
Sept. 7	0.86±0.2	0.61±0.25	0.70±0.16	3.9 cd	3.3 c	3.6 b
Sept. 21	0.95±0.5	0.80±0.50	0.43±0.18	11.0 b	3.6 c	3.4 b
Oct. 5	2.40±0.59	0.33±0.14	2.13±1.20	22.5 a	9.0 ab	0.6 c
Nov. 2	0.78±0.28	0.43±0.20	1.13±0.38	7.7 bc	3.8 c	4.3 b
Dec. 3	1.72±0.24	1.0 ±0.21	1.20±0.21	3.9 cd	0.5 a	0.7 c
Mean	0.96	0.73	0.84	9.82	7.15	7.63

* Mean of 18 cuttings (three replicates x six cuttings)

** SE = standard error of mean

*** Values followed by a similar letter are not statistically different at α = 0.05 Duncan's Multiple Range Test.

bud breaks were of two types. Firstly buds below the medium initiated growth which developed into new shoots. In many instances rooting was observed on these. Secondly buds initiated growth above the medium line. These developed into branches.

Neither the number of bud breaks or the height changes should be viewed singularly since both are estimates of growth. Growth may have resulted from either component singly or together. Further studies should include biomass estimates. This may be a better overall estimator of cutting performance (Collicutt 1981).

4.3.1.3 General discussion of rooting of cuttings. In view of the results obtained *P. fruticosa* cultivars could be classified as "easy to root" substantiating the work of Freeland (1977) and reports by Hartman and Kester (1983). There is a relatively broad "window" during which cuttings can be successfully rooted. A "rooting window" is a period of time when rooting is successful. There were differences between the cultivars. In the detailed study the window was broadest for 'Coronation Triumph' but was more restricted for 'Abbotswood' and 'Moonlight'. All attempts to correlate growing degree days to apparent rooting success failed. The principal reason being the relatively high success during the major part of the growing season. Environmental information was useful however in proposing an explanation for the decline in root development on the August 10 sampling date. Perhaps the concept of a 'rooting window' would be more fruitfully persued with species that are more difficult-to-root. Other parameters such as tissue moisture content could be evaluated. Cram and Lindquist (1961) found that tissue moisture content of *Caragana arborescens* Lam. was a good indicator of rooting capacity of softwood cuttings. Success rates declined when the moisture content dropped below 70%. Correlations between tissue moisture content and growing degree days were not attempted in this study, but may be present. These investigators noted differences in environmental conditions. Temperature and precipitation appeared to be related to tissue moisture content at the time of sampling.

Another point for discussion relates to the minimum number of roots required for successful establishment. In the survey of cultivars it was noted that relatively few roots were required for establishment. Plants with greater than three roots per cutting were successful. Does a greater number of roots translate into greater success? Success meaning increased survival and vigour of the new plants. Studies should be initiated to determine the influence of the number of roots has on these parameters. Cuttings with varying degree of root development should be outplanted and subsequent growth and performance monitored, providing greater insight into this question.

Cuttings from _Potentilla fruticosa_ should be harvested early in the growing season. During this period rooting and growth were greatest and most consistent. Periods of environment stress to the mother plants may reduce rooting levels. Management programs should be implemented to ensure the mother plants are maintained healthy and vigorous.

4.3.2 Seed Studies

4.3.2.1 _Germination temperature_. Interpretation of the analysis of variance for the study of temperature effects on seed germination indicated that the major effect was the slower germination rate as a result of reduced temperatures (Probability F = 0.008). The 7°C treatment was the slowest followed by the 13°C and then 17°C and 20°C. The rate of germination was not statistically different for 17°C and 20°C. No differences were obtained for germination maximums. All treatments reached similar maximums regardless of temperature (Probability of F = 0.46). No statistical differences were observed between the seed from the two parents. (Probability F = 0.07). Maximum germination percentages were in the range of 40.0 to 57.8%. Temperature effects on seed of many woody plants have been documented for many species (Schopmeyer 1974). Germination and emergence are routinely evaluated at 15°C to 25°C. Most species germinate and emerge rapidly at these temperatures.

4.3.2.2 After ripening study. The results of the after-ripening study are presented in tables 16 and 17. Due to a highly significant interaction between taxa and treatment each taxa was analyzed separately. The interaction indicates that the taxa were responding differently to the treatments and thus required separation to determine true treatment effects. No seedling emergence was observed at the termination of the cold treatment.

There was a general decrease in the days to emergence maximum, days to 50% of emergence maximum and an increase in overall emergence percentages with increasing treatment duration. At 30 days of after-ripening emergence was at or near the maximum. The days to 50% of emergence maximum also reflect this. This value was recorded since germination is often non-linear (Milthorpe and Moorby 1979), particularly for woody plants (Schopmeyer 1974). Little selection pressure has likely been applied for germination and emergence

TABLE 16. Mean* percentage emergence after four different after-ripening treatments for seven taxa of <u>Potentilla fruticosa</u>.

	Taxa						
Treatment	P. fruticosa NA-1	P. fruticosa NA-2	P. fruticosa NA-3	P. fruticosa parvifolia	P. fruticosa arbuscula	P. fruticosa European	P. fruticosa Scandinavian
45 days moist cold***	7.0 a**	15.0 a	59.00 a	34.0 ab	37.0 b	70.0 a	80.0 a
30 days moist cold	2.0 a	5.0 a	75.0 ab	47.3 a	61.3 a	64.0 a	56.0 b
15 days moist cold	2.0 a	0.0 a	44.0 b	34.0 ab	58.0 a	41.0 b	81.0 a
45 days dry cold	0.0 a	13.0 a	22.0 c	21.0 b	42.0 ab	51.0 ab	80.0 ab
Overall Mean	2.8	8.25	50.0	34.1	49.6	56.5	74.3

* Mean of four replicates of 25 seeds each.

** Values followed by a similar letter are not statistically different; α = 0.05, Duncan's Multiple Range Test.

*** Cold treatment at 4.0 ± 0.5°C.

TABLE 17. Mean* number of days to emergence maximum and 50% of emergence maximum after four after-ripening treatments for seven taxa of <u>Potentilla fruticosa</u>

	Taxa													
	P.fruiticosa NA-1		P.fruticosa NA-2		P.fruticosa NA-3		P.fruticosa parvifolia		P.fruticosa arbuscula		P.fruticosa European		P.fruticosa Scandinavian	
Treatment	Emerge Max.	50% Max.	Emerge Max.	50% Max.	Emerge Max.	50% Max.	Emerge Max.	50% Max.	Emerge Max.	50% Max.	Emerge Max.	50% Max.	Emerge Max.	50% Max.
45 days moist cold ***	4.3a**	2.3a	5.8b	3.3b	10.0c	4.3c	11.0a	5.3b	9.3b	4.0c	8.5c	4.3c	7.3b	3.0c
30 days moist cold	4.0a	2.5a	2.5c	1.8bc	12.0bc	4.0c	11.0a	5.0b	10.0b	5.5bc	11.5bc	5.5bc	9.5b	3.3c
15 days moist cold	2.0a	1.3a	0.0c	0.0c	16.0bc	6.5b	14.0a	7.8b	11.0b	7.0b	14.0b	7.5b	10.0b	6.3b
45 days dry cold	0.0a	0.0a	16.0a	14.0a	20.8a	15.3c	18.0a	13.8a	21.5a	13.8a	20.0a	13.8a	18.0a	12.3a
Overall mean	2.6	1.5	6.1	4.8	14.7	7.5	13.5	8.0	13.0	7.6	13.5	7.8	11.2	6.2

* Mean of four replicates of 25 seeds each.

** Values followed by a similar letter are not significantly different as determined by Duncan's Multiple Range Test (X = 0.05).

*** Cold treatment at 4.0 ± 0.5°C.

uniformity especially when compared to domesticated crops species.

There are two significant exceptions to this generalization. P. fruticosa NA-1 and NA-2 did not follow similar trends. Emergence maximums are generally very low. Both of these plants were originally obtained near the Bow Pass in the Rocky Mountains of Alberta. It is possible that they are ecotypes adapted to particularly short growing seasons and a long cold period and thus require a longer after-ripening period to stimulate emergence. This is in contrast to the third native plant originally collected near Marchand, Manitoba. The response pattern of this taxa does follow the general trends as outlined. Further experimentation is required to test this hypothesis.

Earlier researchers (Currah et al. 1983, Grewel and Ellis 1972, Elkington and Woodel 1963, Rhodes 1954) suggested that pretreatments of seeds is not required. In the present study emergence rates for most taxa after the dry cold treatment was substantial. This was particularly true for the representative from Scandinavia where the after-ripening treatment did not affect the emergence maximums. However the number of days to this maximum were reduced by treatments. Earlier workers may not have been concerned with minimization of the germination period and consequently led to the development of these recommendations. The objective of our study was to determine methods to maximize percentages and rates due to value of seed propagation in a breeding program. Seed of Potentilla fruticosa should be after-ripened for a period of 30-45 days to obtain more rapid and uniform emergence. It is evident from this study that preliminary experiments with seed germination and emergence can be beneficial particularly when only general recommendations are available.

5.0 Manuscript III. Models of Inheritance of Flower Colour and Extra Petals in *Potentilla fruticosa* L.

5.1 Introduction

P. fruticosa is a valuable dwarf ornamental shrub that is widely planted in the landscape. In excess of eighty cultivars have been selected although only a small number are routinely propagated and used by the landscape industry (van den Laar 1980). Some of the important plant characteristics which have influenced the popularity of the plant include plant size and form, flower colour, size and abundance, long season of flowering, foliage colours, and ease of maintenance in the landscape.

Flower colours range from bright yellow to white with numerous shades in between, herein referred to as acyanic. Flowers with shades of red and orange are also known. These colours are due to the presence of anthocyanins and flavonoids, herein referred to as cyanic. These colours are greatly influenced by environmental conditions, particularly temperature (Robertson 1984). Pigment synthesis is reduced as temperature increases. In a controlled environment study (temperatures of 30°/20° C day/night), there was a significant reduction in synthesis of cyanic pigments.

No previous studies on the inheritance of flower colour in *P. fruticosa* have been found although, Clausen and Heisey (1958) have studied flower colour inheritance of *Potentilla glandulosa* Lindl. They proposed a series of four epistatic genes to explain the observed segregations in F_2 populations. A bleaching gene was also implicated.

Double flowering potentillas are known but are rare. Doubleness is used in the sense as described by Reynolds and Tampion (1983); that is the presence to varying degrees of extra petals. Cv. 'Hersi' or 'Snowflake' often has six to seven petals or one to two extra petals above the basic compliment of five (Robertson 1984). 'Sundance', a cultivar released by the University of Manitoba in 1970, has eight to 10 petals during much of the growing season (Lenz 1977). Studies on advanced selections in the University of Manitoba breeding program suggest the number of extra petals is influenced by both temperature and plant moisture status (Robertson 1984). The latter was most important in field studies.

Double flowers have been reported for other _Potentilla_ species: _Potentilla reptans_ L. and _Potentilla tomentilla_ L. (_P. erecta_ L.) (Reynolds and Tampion 1983). In _P. reptans_ double flowers resulted from petalody of both stamens and carpels while doubleness in _P. tomentilla_ resulted from petaloid stamens. No genetic information was available.

The objective of this study is to develop inheritance models of flower colour and extra petals. This information should be useful in designing future breeding programs. The majority of plants used in this study are advanced selections from the University of Manitoba breeding program. Two plants, UM 8102 and UM 7901 will be released in the near future.

5.2 Materials and Methods

To study the inheritance of flower colour and petal number, taxa were selected from existing cultivars as well as advanced selections from the University of Manitoba breeding program. A summary of parental taxa and their associated characteristics are presented in Table 18 and illustrated in Fig. 9.

All crossing, harvesting and seed handling procedures were as

TABLE 18. Descriptions of flower colour and petal number of parental taxa used in the inheritance study

	Flower Colour		Number of Petals	
Taxa	Description*	Phenotypic class designation	Range	Phenotypic class designation
UM 8102	white	white	10-15	15
P. fruticosa davurica	white	white	5	5
UM 7901	sulphur yellow 1/0	bright yellow	5-10	10
UM 7911	primrose yellow 601/3 with pink	pink	5-8 (extra petals rare)	6
UM 7904	sulphur yellow 1/2 with orange	orange	5	5
'Goldfinger'	sulphur yellow 1/0	bright yellow	5	5
P. fruticosa grandiflora	sulphur yellow 1/0	bright yellow	5	5

* According to Royal Horticulture Colour Charts 1938, 1941, assessed under daylight conditions.

Figure 9. Illustration of some of the parental taxa used in the crossing program.

A = UM 8102
B = UM 7901
C = UM 7911
D = UM 7904
E = *P. fruticosa grandiflora*


A


B


C


D


E

previously described under the experimental taxonomy. In most cases a minimum of 40 pollinations were attempted per cross and the reciprocal to produce an adequate population to observe segregation. An outline of the crosses is presented in Table 19. All crossing was completed during the 1984 field season. Seeds were planted as soon as possible after harvest. Seedlings were transplanted into small plastic containers (6 cm x 3.5 cm x 5.5 cm) with a soil, peat and sand (2:1:1 vol.) medium and placed in a controlled environment growth room (20°C/15°C day/night temperature). When the seedlings flowered, data were obtained on flower colour, diameter and numbers of petals, foliage colour, numbers of leaflets per leaf and plant vigour. All colour assessments were conducted under natural lighting. Seedlings were then transferred to a small fiberglass greenhouse and held at 0 to 5°C until spring. Field planting was initiated in early May 1985 at the University of Manitoba test garden. A randomized complete block design with four blocks was used. Five plant were planted per replicate but the number of replicates varied with the family size. Parental taxa were included in the planting plan, but, due to larger plant size, only three plants per replicate were used. All plant material was irrigated at planting and as required during the growing season. From the initiation of flowering until mid-September, data were recorded for both floral and vegetative characteristics (Table 20). Similar data were also recorded for open-pollinated seedlings and progeny from the experimental taxonomy work. A listing of these is presented in Appendix 11.

The distribution of the cyanic pigments was often not uniform (Fig. 10). Red, pink and orange pigments were observed as central blotches, as a faint feather in the center of the petal or as a band

TABLE 19. Outline of crossing* program for the study of inheritance of flower colour and petal number

Parents ♀ x ♂	Number of crosses
UM 8101 x UM 7901	83
UM 8102 x UM 7911	20
UM 8102 x UM 7904	52
UM 7901 x *P. fruticosa davurica*	13
UM 7901 x UM 8102	75
UM 7901 x UM 7911	29
UM 7901 x UM 7904	37
P. fruticosa x UM 8102 'Goldfinger'	28
UM 7911 x UM 8102	38
UM 7911 x UM 7901	38
UM 7911 x UM 7904	49
UM 7904 x UM 8102	45
UM 7904 x UM 7901	70
UM 7904 x UM 7911	62
P. fruticosa 'Goldfinger' x *P. fruticosa davurica*	25
P. fruticosa davurica x *P. fruticosa grandiflora*	15
TOTAL	679

* Female parent listed first

TABLE 20. List and mode of assessment of characters utilized in progeny evaluations

Character	Assessment Mode
A. Reproductive characters	
1) flower colour	Royal Horticultural Society Colour Chart*
2) flower diameter	1 = 10 mm, 2 = 10-15 mm ... 8 = >40 mm
3) petal insularity	1 = gapped, 2 = touching, 3 = overlapped
4) number of petals	count
5) size of petals	rate 1 = 100-75% of basic size ... 3 = 25% of basic size
B. Vegetative characters	
1) plant height	average height in cm
2) plant width	average width in cm
3) leaf size **	1 = very large, 2 = large ... 6 = very small
4) leaf colour	1 = dark green, 2 = medium green ... 7 = light green, 8 = chlorotic
5) leaf vesture	1 = glabrous ... 6 = tomentose
6) number of leaflets/leaf	average count
7) plant vigour	0 = dead ... 9 = extremely high
8) winter injury	0 = dead, 1 = dead to soil line ... 6 = no damage (assessed only on open-pollinated families)

* A detailed listing of flower colour classes is presented in Appendix 9.

** Illustrations of leaf size classes is presented in Appendix 10.

Figure 10. Typical examples of cyanic zonation in selected progeny from controlled crosses of *P. fruticosa*.

A) cyanic pigments in a central feather
B) cyanic pigments in a wide margin
C) cyanic pigments in a narrow margin (tip of petal only)


A


B


C

around the outer edge of the petal. Each of these configurations were referred to as cyanic zonation. Observations indicated that the area of zonation was fairly uniform on one plant during the flowering period. The colour intensity of the cyanic portion did change. This change was likely temperature mediated (Robertson 1984). In cyanic-zoned plants it was possible to clearly identify the background colour of the petal. This led to the development of the ratings as outlined in Appendix 9. The background colour could not be determined with confidence for flowers that were uniformly cyanic. The resulting colour was likely an interaction of the background colour and cyanic components. All flower colour observations were based on adaxial surfaces. Abaxial surface colouration was not recorded. Colours for the two surfaces are often slightly different.

Since the intensity of colouration did change during the growing season only the most intense colours are reported. This was done to obtain a better understanding of the phenotypic expression. The colour differences during the season for several of the parental taxa have been analyzed by Robertson (1984).

Robertson (1984) determined that the degree of doubleness varied during the growing season and plant moisture status was the most highly correlated variable. In the present study petal counts were conducted on five flowers if possible. If the numbers of petals changed during the sampling period, only the mean values for the highest counts are reported. During the 1985 growing season precipitation was above average which according to Robertson (1984), should favour the expression of doubleness. Extra petal size was also rated against the size of the basic five petals of the same flower.

5.3 Results and Discussion

5.3.1 Flower Colour

5.3.1.1 Flower colour inheritance. Detailed evaluation of all progenies are presented in appendix 11 while summaries of crosses that were successful enough to secure adequate populations to observe segregation are presented in Tables 21 to 23 and illustrated in Figures 11 to 14. Insufficient seedlings were not obtained from the following crosses and reciprocals:

1) UM 8102 x UM 7904 - 97 pollinations completed
2) UM 8102 x UM 7911 - 58 pollinations completed
3) UM 7904 x UM 7911 - 111 pollinations completed

The very low success rate for these crosses is possibly due to common incompatibility alleles. Further research is required to delineate the extent of incompatibility and to develop methods to circumvent this problem. The exact parentage of these plants is unknown so it is difficult to be certain about incompatibility. However, both UM 7904 and UM 7911 were selected from the same family during the same year.

To develop a hypothesis for the inheritance of white and yellow colours, several assumptions were made. These were:

1) Dark yellow, bright yellow and light bright yellow were treated as one phenotypic class. These colours are similar and could be obtained by varying degrees of dilution of a base colour or due to environmental variability.
2) Creamy yellow, light creamy yellow and very light creamy yellow (creamy white) were treated as a second phenotypic class. Similarly these colours represent a series of

TABLE 21. Segregation of flower colour for controlled crosses* between bright yellow and white flowered plants

Parents (colour)	Total seedlings assessed	Number creamy yellow	Number bright yellow	X^2 for 3:1 ratio	Probability of higher X^2
Group I					
1) UM 8102 x UM 7901 (white x bright yellow	71	57	14	1.06	0.5 - 0.3
2) UM 7901 x UM 8102 (bright yellow x white)	28	21	7	0.0	1.0
3) UM 7901 x *P. fruticosa davurica* (bright yellow x white)	11	8	3	0.03	1.0 - 0.95
Combined 1, 2 & 3	110	86	24	0.59	0.5 - 0.3 (Homogeneity X^2 = 0.5 df = 2 not significant)
Group II					
4) *P. fruticosa* 'Goldfinger' x UM 8102 (bright yellow x white	73	22	51	1.03	0.5 - 0.3
5) *P. fruticosa* 'Goldfinger' x *P. fruticosa davurica* (bright yellow x white)	57	11	46	0.99	0.5 - 0.3
6) *P. fruticosa grandiflora* x *P. fruticosa davurica* (bright yellow x white)	68	12	56	1.96	0.2 - 0.1
7) *P. fruticosa davurica* x *P. fruticosa grandiflora* (white x bright yellow)	42	4	38	5.36	0.05 - 0.01
Combined 4-7	240	49	191	2.69	0.2 - 0.1 (Homogeneity X^2 = 6.65 df = 3 not significant)

* Female parent listed first

TABLE 22. Flower colour segregation of progeny of controlled crosses between UM 7901 (bright yellow) and UM 7904 (creamy yellow with orange)

Flower colour of progeny	Number of seedings in each colour class	
	7901 x 7904*	7904 x 7901
Dark yellow	1	0
Dark yellow with orange	0	1
Bright yellow	25	6
Bright yellow with orange	9	1
Light bright yellow	24	5
Light bright yellow with orange	9	1
Creamy yellow	10	3
Creamy yellow with pink	3	1
Creamy yellow with orange	14	1
Light creamy yellow	3	1
Light creamy yellow with orange	1	0
Light creamy yellow with pink	1	0
Orange	2	0
Salmon	2	0
Total Number of Seedlings	104	20

* Female parent listed first

TABLE 23. Flower colour segregation of progeny of controlled crosses between UM 7901 (bright yellow) and UM 7911 (creamy white with pink)

Flower colour of progeny	Number of Seedlings as in each colour class	
	7901 x 7911*	7911 x 7901
Dark yellow with orange	2	1
Bright yellow	4	7
Bright yellow with orange	5	7
Light bright yellow	23	37
Light bright yellow with orange	13	9
Light bright yellow with pink	0	1
Creamy yellow	11	12
Creamy yellow with orange	2	1
Total Number of Seedlings	61	76

* Female parent listed first

Figure 11. Examples of progeny obtained from crosses between UM 8102 and UM 7901. UM 8102 (white) is at extreme left, UM 7901 (yellow) is extreme right and progeny are in between.

Figure 12. Examples of progeny obtained from crosses between *P. fruticosa* 'Goldfinger' and UM 8102. 'Goldfinger' is at extreme left, UM 8102 at extreme right and progeny are in between.

Figure 13. Examples of progeny obtained from crosses between UM 7904 and UM 7901. UM 7904 is at extreme left, UM 7901 is at extreme right and progeny are in between.

Figure 14. Examples of progeny obtained from crosses between UM 7911 and UM 7901. UM 7911 is at extreme left, UM 7901 is at extreme right and progeny are in between.


1
2
3
4
5
6
7
8
1cm
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

dilutions or possible environmental variability.

3) The above colours may also be associated with anthocyanin pigments (cyanic zonation). The amounts of cyanic pigments were small and the background colours were easily visible.

4) Any strongly cyanic plants; colour classes orange, pink and salmon were removed from the analysis since the background colour was not identifiable. This resulted in the removal of six plants from a total of 605 seedlings.

The results presented with associated chi square statistics in Table 21 suggest that there are two groups of bright yellow plants. In group I segregations fit a 3:1 ratio with creamy types predominating. In group II (Table 21) bright yellow types predominate. The differences are not due to the white parents since UM 8102 and *P. fruticosa davurica* are common in crosses of both group I and group II. The 3:1 ratio suggests that a single gene is segregating. Following the gene nomenclature of Clausen and Heisey (1958) group I may be segregating around the Ww gene, cream colours predominating and group II segregates around Yy, bright yellow types predominating. Since UM 8102 is a common parent in both groups a heterozygous genotype of WwYy appears likely. Thus the genotype of UM 7901 is likely WwYY. This reasoning relates to the 3:1 segregation ratio. With the genotypes as outlined it would be very difficult to distinguish between plants unless an additional gene is involved or complex epistatic interactions are occurring. After the model of Clausen and Heisey (1958) an additional factor, W_2 is proposed to distinguish between white and yellow plants. Since the observed ratio suggests only a single gene segregation, then one parent is homozygous dominant (WW) while the other homozygous recessive (ww). If this factor is involved in the determination of the white genotype (Clausen and Heisey 1958) then tentatively UM 8102 should be $W_1W_1W_2w_2Y_1y_1$ and UM 7901 should be $w_1w_1W_2w_2Y_1Y_1$. White colours in this model must be homozygous dominant for W_1 locus and at least heterozygous at the W_2 locus. Bright yellow types could be obtained by having a homozygous recessive at either W loci and at least heterozygous at the Y_1 locus. Plants that are heterozygous at both W loci and the Y locus would be cream coloured. It is also very probable that epistasis is involved as was similarly observed by Clausen and Heisey (1958). The proposed genotypes of progeny from the cross between UM 8102 and UM 7901 is outlined in Table 24.

By observing the segregation of flower colours in the cross UM 7901 and UM 7904 the model can be expanded (Table 25). The anthocyanin pigments are ignored thus the cross is in effect between bright yellow and creamy yellow. A 3:1 ratio of bright yellow types to creamy yellow types was obtained. Following the model of Clausen and Heisey (1958) a fourth gene Y_2 is proposed since all attempts to work with the three genes proposed failed. The fourth gene proposed is an additional yellow factor. Since UM 7901 is bright yellow the fourth factor is proposed as $Y_2\_$ while in UM 7904 (creamy yellow) it is proposed to be y_2y_2. The latter is in the homozygous condition since it is a creamy colour. The parental genotypes proposed are: UM 7901 = $w_1w_1W_2w_2Y_1Y_1Y_2Y_1Y_1Y_2\_$; UM 7904 = $w_1w_1W_2w_2Y_1Y_1y_2y_2$. UM 7901 is likely heterozygous for the Y_2 locus. In such a situation creamy yellow plants could have genotypes of $w_1w_1W_2W_2Y_1Y_1y_2y_2$, $w_1w_1W_2w_2Y_1Y_1y_2y_2$ or $w_1w_1w_2w_2Y_1Y_1y_2y_2$. The ratio of bright yellow to creamy yellow plants in the cross UM 7901 x UM 7904 would be 5:3. The data presented in Table 25 do fit such a ratio.

TABLE 24. Proposed genotypes of progeny from a cross between UM 8102 (white) and UM 7901 (bright yellow)

P_1 = UM 8102 = $W_1W_1W_2w_2Y_1y_1$

P_2 = UM 7901 = $w_1w_1W_2w_2Y_1Y_1$

♀ ♂	$w_1W_2Y_1$	$w_1w_2Y_1$	
$W_1W_2Y_1$	$W_1w_1W_2W_2Y_1Y_1$	$W_1w_1W_2w_2Y_1Y_1$	Creamy yellow types
$W_1W_2y_1$	$W_1w_1W_2W_2Y_1y_1$	$W_1w_1W_2w_2Y_1y_1$	
$W_1w_2Y_1$	$W_1w_1W_2w_2Y_1Y_1$	$W_1w_1w_2w_2Y_1Y_1$	
$W_1w_2y_1$	$W_1w_1W_2w_2Y_1y_1$	$W_1w_1w_2w_2Y_1y_1$	Bright yellow types

TABLE 25. Segregation for flower colour in crosses between UM 7901 (bright yellow) and UM 7904 (creamy yellow)

Parents	Total seedlings assessed	Number bright yellow	Number creamy yellow	X^2 for 3:1 ratio	Prob. of higher X^2
1) UM 7901 x UM 7904 (bright yellow x creamy yellow)	100	68	32	2.61	0.2 - 0.1
2) UM 7904 x UM 7901 (creamy yellow x bright yellow)	20	14	6	0.40	0.7 - 0.5
Combined 1 & 2	120	82	38	2.84	0.1 - 0.05 (Homogeneity X^2 = 0.17 df = 1 = not significant)

(X^2 = 1.74 prob. x^2 = 0.3 - 0.2). An outline of the progeny genotypes from the cross UM 7901 x UM 7904 are presented in Table 26. The action of the Y_2 gene was not apparent in the white x bright yellow cross (UM 8102 x UM 7901). The action of the two W genes may mask any effect of the Y_2 gene.

In Table 27 the segregation of progeny from the cross UM 7901 x UM 7911 (bright yellow x creamy yellow with pink) is presented. As outlined earlier the cyanic components are ignored thus the cross is in effect between bright yellow and creamy white. Once again a 3:1 ratio between bright yellow and creamy yellow types was obtained. However, according to the initial assumptions made the creamy white colour is in the same phenotypic class as creamy yellow. Thus by adherance to these assumptions we are unable to distinguish between plants. Both crosses UM 7901 x UM 7094 and UM 7901 x UM 7911 segregated 3:1 for bright yellow types to creamy yellow types which suggests that the plants have identical genotypes. However, creamy yellow is distinct from creamy white. The difference between these colours may be due to complex epistatic interactions or to an additional bleaching gene. A bleaching gene was proposed by Clausen and Heisey (1958) but they were unable to confirm action or existence. Similarly our information base is insufficient to be definitive. The addition of a bleaching gene is considered possible considering the initial assumptions regarding the various shade of bright yellow and creamy yellow.

The Clausen and Heisey (1958) model indicated that the W genes tend to mask the effects of the Y genes and in turn the deep yellow (Y_1) tends to mask the paler yellow (Y_2) although there was not complete epistasis. Their proposal established a delicate balance with the

TABLE 26. Proposed genotypes of progeny from a cross between UM 7901 (bright yellow) and UM 7904 (creamy yellow)

P_1 = UM 7901 = $w_1w_1W_2w_2Y_1Y_1Y_2y_2$

P_2 = UM 7904 = $w_1w_1W_2w_2Y_1Y_1y_2y_2$

♀ ♂	$w_1W_2Y_1y_2$	$w_1w_2Y_1y_2$
$w_1W_2Y_1Y_2$	$w_1w_1W_2W_2Y_1Y_1Y_2y_2$	$w_1w_1W_2w_2Y_1Y_1Y_2y_2$
$w_1W_2Y_1y_2$	$w_1w_1W_2W_2Y_1Y_1y_2y_2$*	$w_1w_1W_2w_2Y_1Y_1y_2y_2$ *
$w_1w_2Y_1Y_2$	$w_1w_1W_2w_2Y_1Y_1Y_2y_2$	$w_1w_1w_2w_2Y_1Y_1Y_2y_2$
$w_1w_2Y_1y_2$	$w_1w_1W_2w_2Y_1Y_1y_2y_2$	$w_1w_1w_2w_2Y_1Y_1y_2y_2$ *

* = creamy yellow types, remainder are bright yellow

TABLE 27. Segregation for flower colour in crosses* between UM 7901 (bright yellow) and UM 7911 (creamy white)

Parents	Total seedlings assessed	Number bright yellow	Number creamy yellow	X^2 for 3:1 ratio	Prob. of higher X^2
1) UM 7901 x UM 7911 (bright yellow x pink)	60	47	13	0.36	0.7 - 0.5
2) UM 7911 x UM 7901 (pink x bright yellow)	75	62	13	2.35	0.2 - 0.1
Combined	135	109	26	2.37	0.2 - 0.1
					(Homogeneity X^2 = 0.02 df = 1 = not significant)

* Female parent listed first

intermediate forms which also could be modified by environmental factors or a bleaching gene. The observed frequencies in their study were not always in close agreement with expectations. They suggested that discrepancies were due to genetic linkage, crossing over and other modifying influences. A fourth and fifth generation would be required to test and refine the model. *P. glandulosa* can be self pollinated thus enabling easier study of genetic relationships than with obligatory cross pollinated plants.

In *P. fruticosa* bright yellow types predominate rather than the creamy types as observed in *P. glandulosa*. This shift is possible due to genetic makeup of the individuals studied. The plants used in the present study were largely obtained as advanced selections or cultivars and thus may not be representative of the entire population.

Many of the parental plant genotypes have several homozygous genes. This condition is not as common in self-incompatible cross-pollinated species (Allard 1960). However, since these plants are advanced selections that have been selected for ± 3 generations a certain amount of homozygosity can be expected. This is particularly true for the cyanic selections (UM 7904 and UM 7911). From the numbers of cyanic seedlings appearing in the controlled crosses it is suggested that gene(s) controlling anthocyanin production must be in recessive condition to be expressed (Tables 22 and 23). Observed frequencies of fully or zoned cyanic flowers were very low.

In the cross between bright yellow (UM 7901) and white (UM 8102) the Y_2 locus of UM 7901 is not distinguishable. This may be due to a masking effect of the W genes or it may be homozygous dominant and thus no segregation occurs. In the cross UM 7901 x UM 7904 the Y_2 locus of

UM 7901 should be heterozygous to be consistent with the model developed. This possible discrepancy remains unexplained and requires further study.

Attempts to develop meaningful models for cyanic flower colour inheritance were not successful. Insufficient numbers of seedlings were observed to develop a complete picture. It should be noted, however, that both fully cyanic and cyanic-zoned progeny (pink, salmon and orange) were obtained in crosses between UM 7901 x UM 7904 and UM 7911 (Tables 22 and 23). This provides a preliminary indication that at least two genes are involved, each coding for different cyanic components. The location of cyanic pigments; center of petal, feather or outer edge of petal, suggests that position genes may be involved.

Robertson (1984) suggested that temperature effects on cyanic pigments production were not uniform hence temperature sensitivity gene(s) could also be added to the model. The background colour of the petal also appears to interact with cyanic pigments to increase the range of colours.

A very preliminary model of inheritance of cyanic pigments is proposed that may be useful for further study.

1) Basic colour; yellow to white with possible interaction with cyanic pigments
2) Cyanic pigments - at least two genes
3) Location of cyanic pigments - center, feather, marginal or uniform
4) Temperature sensitivity

It is unfortunate that crosses between UM 8102, UM 7911 and UM 7904 failed to produce large enough populations to study. These could have been of considerable value in further development of the model proposed.

Fig. 15 illustrates the flower colour of five seedlings from the cross UM 7904 x UM 7911. The range of colours suggests very complex inheritance.

All models proposed are very preliminary and require considerably more research. They have been proposed as an exploratory tool rather than confirmatory one (Tukey 1981). At the initiation of the study little information was available regarding parental history or breeding. Further crossing programs are still needed however to test these models and these will have to be carefully designed considering the apparent complexity of the systems.

5.3.1.2 Relationship of colour assessments under controlled and field conditions. Linear regression of field and growth room colour assessments was used to determine the predictability of colour under different growing conditions. Previous studies (Robertson 1984) suggested that expression of acyanic and cyanic flower colour was influenced by the environment.

Regression of acyanic flower colour observations in the growth room and field was highly significant (Prob F = 0.0001). The relationship is outlined by the following equation:

$$y = 0.43 + 0.95x \qquad R^2 = 0.58$$

y = field colour assessment

x = growthroom colour assessment

There is good agreement between these paired observations.

Similarly, regression of cyanic flowers yield a significant regression equation (Prob F = 0.0001).

The relationship is outlined by the following equation:

Figure 15. Examples of progeny obtained from crosses between UM 7904 and UM 7911. UM 7904 is at extreme left, UM 7911 at extreme right and progeny are in between.

$y = 0.69 + 0.94x \qquad R^2 = 0.24$

y = field colour assessment

x = growth room colour assessment

The slope of the lines (0.95 and 0.94) suggests that a one to one relationship is evident. The variation in the R^2 values suggest that greater variability existed in cyanic colours. Studies by Robertson (1984) determined that under high temperatures (20-30°C) significant reductions in pigment production occurs.

Cool, moist weather during the assessment period of the current study allowed good expression of the cyanic components. Such weather conditions are not common. Hot often dry weather occurs during this period. In future genetic studies it is recommended that growthroom assessments be continued at least on a limited scale. This will ensure the extent of cyanic pigment production can be estimated. However, the ornamental value of a particular plant and associated flower colour is best determined under field conditions where the plant will be ultimately grown.

5.3.2 Flower Doubleness of *P. fruticosa*

5.3.2.1 Parental taxa. The mean number of petals of the parental taxa varied during the growing season (Table 28). Petal counts for both UM 8012 and UM 7901 generally increased for the first three sampling dates. Subsequent changes were smaller. Similar trends were reported by Robertson (1984). She was able to correlate increased petal numbers with decreases in plant moisture stress. During August 1985, record levels of precipitation were recorded. This should have allowed maximum expression of extra petals that were implicated to the plant moisture relationships. This period corresponded to the main time frame that

TABLE 28. Seasonal variation of the mean numbers of petals and size classifications for parents used in the controlled crossing of *P. fruticosa*

Parent	Sampling Date July 1 to July 15	July 16 to Aug. 1	Aug. 1 to Aug. 15	Aug. 16 to Sept. 1	Sept. 1 to Sept. 15	Overall seasonal means	Seasonal mean number of extra petals according to size class* Large	Medium	Small
UM 8102	7.4±0.46	8.0±0.97	10.0±1.0	13.9±0.27	14.4±0.24	10.0±0.57	4.7	0.2	0.1
UM 7901	7.1±0.70	5.9±0.55	7.4±0.87	9.8±0.35	10.4±0.37	7.9±0.44	2.0	0.7	0.2
UM 7911	5.0±0.0	5.0±0.0	5.5±0.41	5.0±0.0	5.0±0.0	5.1±0.1	0.1	0.0	0.0
UM 7904	5.0±0.0	5.0±0.0	5.0±0.0	5.0±0.0	5.0±0.0	5.0±0.0	0.0	0.0	0.0
'Goldfinger'	5.0±0.0	5.0±0.0	5.0±0.0	5.0±0.0	5.0±0.0	5.0±0.0	0.0	0.0	0.0

* Petal size classes based on comparison to the 5 basic petals

large = 100 to 75% of basic petal size
medium = 75 to 25% of basic petal size
small = $<$25% of basic petal size

seedling assessments were completed. UM 7904 and 'Goldfinger' had five petals throughout the growing season. This is the basic number for the species. UM 7911 petal counts only varied during the August 1 to 15 sampling period. In greenhouse and controlled growthroom conditions, petal counts of six to 10 have been observed. Similar values were not observed during the 1985 growing season.

Size variation of the extra petals was low for UM 8102 (Table 28). Only 6.4% of the extra petals were in the medium and small categories. In UM 7901 variation was greater with 45.0% of the extra petals below the large size range. The reasons for the variation in size of extra petals remains obscure. Reynolds and Tampion (1983) suggested that unequal partitioning of resources may be responsible. This could be due to photosynthates or hormonal balances. Genetic explanations for this phenomena could also be investigated. Further research is required to identify reasons for this variation.

It was observed that extra petals appeared to be petalized stamens (Fig. 16). Often rudimentary anther-like structures were terminally attached to petals. This was most frequently observed in the small petal size class. Linear regression of the total numbers of stamens and petals of UM 8102, UM 7901 and progeny from controlled crosses between the two yielded a highly significant equation (Prob. F = 0.0001). The equation is $y = 35.7 - 1.17x$ where y = number of stamens and x = number of petals. Stamen numbers were used as the independent variable since they are usually differentiated after petals (Reynolds and Tampion 1983). This equation indicates that there is a significant linear relationship between the gain or loss of either petals or stamens. This contributes more evidence that extra petals are petalized

Figure 16. Illustrations of petal form in a seedling from a cross between UM 7901 x UM 8102.


7901 X 8102
1
2
3
4
5
6
7
8


7901 X 8102
MM
1
2
3
4
5
6
7
8
9
10
11
12

stamens. Further anatomical and developmental research is required to confirm this hypothesis. Double flowers of P. fruticosa appear to fit into class Ic of Reynolds and Tampion (1983).

5.3.2.2 Progeny analysis. Petal counts of progeny from controlled crosses are presented in Tables 29 to 32. Cross means and parental means (from August 15 to September 15) are also presented. As outlined earlier, crosses between UM 8102 x UM 7911, UM 7911 x UM 7904 and UM 8402 x UM 7904 did not yield sufficient seedlings to be analyzed. In addition, progeny from the cross UM 7901 x P. fruticosa davurica (11 plants) were not included due to low numbers. Progeny from crosses between parents that both had five petals always yielded five petaled progeny. These crosses were P. fruticosa davurica x P. fruticosa grandiflora, P. fruticosa grandiflora x P. fruticosa davurica, and P. fruticosa 'Goldfinger' x P. fruticosa davurica.

In all cases transgressive segretates, having higher petal counts than either parent were recovered. Nugent and Snyder (1967) determined that transgressive segregates in Pelargonium hortorum Bailey were associated with modifying genes. In their study once a "trigger" for initiation was activated, expression of up to 3 modifiers was possible. In Petunia hybrida transgressive types were not observed (Saunders 1910). Double flowers were either present or not in progeny obtained from controlled crosses. None of the double flowered progeny had higher petal counts than the highest parent.

Family means for numbers of petals are all below the mid-parent (Tables 29 to 32). In the case of crosses between UM 7901 and UM 8102 both family means are below the lowest parental value. The depression of the family means is due to the large number of single flower types

TABLE 29. Segregation of progeny for extra petals from crosses* between 10 petal (UM 7901) and five petal (UM 7904) parents.

Number of petals	Number of seedlings		Total
	UM 7901 x UM 7904	UM 7904 x UM 7901	
5	83	14	97
6	10	1	11
7	2	0	2
8	2	4	6
9	2	0	2
10	1	0	1
11	0	0	0
12	1	0	1
13	0	0	0
14	1	0	1
15	2	1	3
TOTAL	104	20	124
$\bar{x}$	5.66 ± 0.19	6.15 ± 0.54	5.64 ± 0.17

Mean petal count for UM 7901 = 9.85 ± 0.36
Mean petal count for UM 7904 = 5.0 ± 0.0

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* Female parent listed first.

TABLE 30. Segregation of progeny for extra petals from crosses* between five petal (*P. fruticosa* 'Goldfinger') and 15 petal (UM 8102) parents.

Number of petals	Number of seedlings
	Goldfinger x UM 8102
5	51
6	4
7	3
8	0
9	2
10	4
11	0
12	2
13	2
14	2
15	3
TOTAL	73
$\overline{x}$	6.59 ± 0.35

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* Female parent listed first.

TABLE 31. Segregation of progeny for extra petals from crosses* between five petal (UM 7911) and 10 petal (UM 7901) parents.

Number of petals	Number of seedlings		Total
	UM 7911 x UM 7901	UM 7901 x UM 7911	
5	39	33	72
6	11	11	22
7	6	5	11
8	3	3	6
9	1	1	2
10	3	1	4
11	2	1	3
12	2	0	2
13	4	5	9
14	3	1	4
15	2	1	3
TOTAL	76	62	138
$\bar{x}$	7.05 ± 0.35	6.48 ± 0.35	6.88 ± 0.25

Mean petal count for UM 7901 = 9.85 ± 0.36
Mean petal count for UM 7911 = 5.0 ± 0.0

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* Female parent listed first.

TABLE 32. Segregation of progeny for extra petals from crosses* between 10 petal (UM 7901) and 15 petal (UM 8102) parents.

Number of petals	Number of seedlings	
	UM 7901 x UM 8102	UM 8102 x UM 7901
5	4	30
6	2	6
7	4	3
8	2	7
9	1	2
10	3	4
11	1	0
12	4	4
13	3	1
14	2	7
15	2	6
16	0	1
TOTAL	28	71
$\overline{x}$	9.67 ± 0.63	8.25 ± 0.45

Mean petal count for UM 7901 = 9.85 ± 0.36
Mean petal count for UM 8102 = 14.1 ± 0.25

* Female parent listed first.

recovered. This decided shift was also noted in Pelargonium hortorum (Nugent and Synder 1967). It should be noted, however, that as the petal counts of the parents increased there is a concomitmant increase in mean petal counts of progeny. Table 32 illustrates that there may be reciprocal differences between two parental combinations. Family means are higher when the pollen parent had a higher petal count than the maternal parent. A similar but reverse trend was noted in flowering crabapples (Sampson and Cameron 1965). They provided no explanation. Reciprocal differences will be discussed after detailed progeny analysis.

Size classification of extra petals based on family means is presented in Table 33. In most cases the number of medium and small petals is quite small. Generally, more than 80% of the extra petals are in the large category. There also is a general trend of increasing medium and small petals as the mean extra petal count increases. In relation to the development of ornamental qualities it is much more desirable to have a high frequency of petals in the large size class. This has an effect of increasing the fullness of the flower.

5.3.2.3 Extra petal inheritance model. To initiate the development of an inheritance model for petal number, comparison between single and double flowered types were made (Table 34). Ratios fit either 3:1 or 1:1 theoretical segregation patterns. A similar approach was used by Nugent and Snyder (1967).

As suspected earlier, reciprocal differences in crosses between UM 8102 and UM 7901 appeared (Table 34). In the cross UM 8102 x UM 7901 a significant 1:1 single double ratio was obtained while in the reciprocal a 3:1 ratio was significant. The cause of this reciprocal

TABLE 33. Size classification of extra petals based on family means for controlled crosses* of *P. fruticosa*

Cross	Number of seedlings assessed	Mean number of petals (± SE)	Mean number of extra petals	Mean number of extra petals by size class**			Medium & small classes as a percent of total
				Large	Medium	Small	
UM 7901 x UM 7904	104	5.66±0.19	0.66	0.53	0.09	0.04	19.7
UM 7904 x UM 7901	20	6.15±0.54	1.15	1.10	0.05	0.00	4.5
'Goldfinger' x UM 8102	73	6.59±0.35	1.59	1.35	0.16	0.00	8.8
UM 7911 x UM 7901	76	7.05±0.35	2.05	1.40	0.41	0.24	31.7
UM 7901 x UM 7911	62	6.48±0.35	1.48	1.21	0.19	0.08	18.2
UM 7901 x UM 8102	28	9.67±0.63	4.67	3.65	0.61	0.41	21.8
UM 8102 x UM 7901	71	8.25±0.45	3.25	2.78	0.32	0.15	14.5

* Female parent listed first

** Petal size classes based on comparison to the 5 basic petals
large = 100 to 75% of basic size
medium = 75 to 25% of basic size
small = <25% of basic size

TABLE 34. Observed and theoretical frequencies of double and single flowered plants in progeny of controlled crosses* of *P. fruticosa*

Cross	Phenotypic class of parents	Total number of seedlings assessed	Total number single flowers	Total number double flowers	Theoretical test ratio	X^2	Probability of X^2
UM 7901 x UM 7904	10 x 5	104	83	21	3:1	1.28	0.3-0.2
UM 7904 x UM 7901	5 x 10	20	14	6	3:1	0.27	0.7-0.5
Combined **		124	97	27	3:1	0.69	0.5-0.3
Goldfinger x UM 8102	5 x 15	73	51	22	3:1	1.03	0.5-0.3
UM 7911 x UM 7901	6 x 10	76	39	37	1:1	0.05	0.95-0.90
UM 7901 x UM 7911	10 x 6	62	33	29	1:1	0.26	0.7-0.5
Combined **		138	72	66	1:1	0.26	0.7-0.5
UM 7901 x UM 8102	10 x 15	28	4	24	1:3	1.71	0.2-0.1
UM 8102 x UM 7901	15 x 10	71	30	41	1:1	1.70	0.2-0.1

* Female parent listed first

** Homogeneity X^2 is not significant thus reciprocals may be combined.

TABLE 35. Observed and theoretical frequencies of double flowered plants in progeny of controlled crosses* of *P. fruticosa*

Cross	Phenotypic class of parents	Total number of doubled flowered seedlings	Number of plants with 6-10 petals (total count)	Number of plants with 11-16 petals (total count)	Theoretical test ratio (6-10 petals: 11-15 petals)	X^2	Probability of X^2
UM 7901 x UM 7904	10 x 5	21	17	4	3:1	0.40	0.7-0.5
UM 7904 x UM 7901	5 x 10	6	5	1	3:1	0.22	0.7-0.5
Combined **		27	22	5	3:1	0.61	0.5-0.3
Goldfinger x UM 8102	5 x 15	22	13	9	1:1	0.73	0.5-0.3
UM 7911 x UM 7901	6 x 10	37	24	13	3:1	2.03	0.2-0.1
UM 7901 x UM 7911	10 x 6	29	21	8	3:1	2.49	0.2-0.1
Combined **		66	45	21	3:1	1.64	0.3-0.1
UM 7901 x UM 8102	10 x 15	24	12	12	1:1	0.0	1.0
UM 8102 x UM 7901	15 x 10	41	22	18	1:1	0.22	0.7-0.5
Combined **		65	34	30	1:1	0.26	0.7-0.5

* Female parent listed first

** Homogeneity X^2 is not significant thus reciprocals may be combined.

TABLE 35. Observed and theoretical frequencies of double flowered plants in two classes of extra petals in progeny of controlled crosses* of _P. fruticosa_

Cross	Phenotypic class of parents	Total number of doubled flowered seedlings	Number of plants with 6-10 petals (total count)	Number of plants with 11-16 petals (total count)	Theoretical test ratio (6-10 petals: 11-15 petals)	X^2	Probability of X^2
UM 7901 x UM 7904	10 x 5	21	17	4	3:1	0.20	0.7-0.5
UM 7904 x UM 7901	5 x 10	6	5	1	3:1	0.22	0.7-0.5
Combined **		27	22	5	3:1	0.61	0.5-0.3
Goldfinger x UM 8102	5 x 15	22	13	9	1:1	0.73	0.5-0.3
UM 7911 x UM 7901	6 x 10	37	24	13	3:1	2.03	0.2-0.1
UM 7901 x UM 7911	10 x 6	29	21	8	3:1	2.49	0.2-0.1
Combined **		66	45	21	3:1	1.64	0.3-0.1
UM 7901 x UM 8102	10 x 15	24	12	12	1:1	0.0	1.0
UM 8102 x UM 7901	15 x 10	41	22	18	1:1	0.22	0.7-0.5
Combined **		65	34	30	1:1	0.26	0.7-0.5

* Female parent listed first

** Homogeneity X^2 is not significant thus reciprocals may be combined.

difference is unknown and requires further research. The possibility of error in crossing, labelling, etc. can not be totally ruled out but is remote since reciprocal differences were not observed in the segregation of flower colour. In addition, frequencies of double types alone (Table 35) did not have reciprocal differences. It is possible that the altered segregation is due to environmental causes, cytoplasmic factors, linkage to a pollen lethal, preferential fertilization or selective elimination of zygotes (Grant 1975). The last three possible causes are very rare and have been observed in only very intensively studied material. Linkage of a double flower inducing gene to a pollen lethal was found in *Mathiola incana* (Johnson 1953). Cytoplasmic inheritance of double flowers is known in *Aquilegia vulgaris* (Rousi 1968). Further research is required to determine the cause of the altered segregation in the present study.

Notwithstanding the one reciprocal difference it is still possible to develop a genetic model. It is necessary to propose two genes to explain the segregations observed. These would act as a "switch" or "trigger" for the production of extra petals. With either loci in a recessive condition extra petals are produced. Conceptually the switch may be envisioned as turning on the production of a hormone (Reynolds and Tampion 1983). With one of the two genes fully recessive then production is possible. The concept of a switch has been proposed in *Prunus amygdalus* (Lamberts 1945), *Pelargonium* (Nugent and Synder 1967) and *Mathiola incana* (Saunders 1928, Johnson 1953).

The genotypes of the parents in the crossing program could be:

P. fruticosa 'Goldfinger'	$D_1d_1D_2D_2$	- doubleness off
UM 7904	$D_1D_1D_2d_2$	- doubleness off

UM 7911 $D_1d_1D_2D_2$ - doubleness off

UM 7901 $d_1d_1D_2d_2$ - doubleness on

UM 8102 $D_1d_1d_2d_2$ - doubleness on

As previously discussed, UM 7911 occasionally produces extra petals, however, doubles were not observed during the period of progeny evaluation (August 15 to September 15). Thus, this plant is considered as a single type. It is possible that there is incomplete penetrance of one of the genes or an additional modifier gene may be involved. These may be operational only under very specific environmental conditions. Further research is required to determine the cause of this. A similar phenomenon was observed in a native plant collected near Marchand, Manitoba. Under growth room conditons occasional extra petals were produced. These were not observed in the field.

Segregation of double flowered progeny into two classes, six to 10 petals and 11 to 16 petals is presented in Table 35. The designation of these classes is based on the two double flowered parents. UM 7901 extra petal counts range from six to 10 and UM 8102 from 10 to 15. Broad class sizes are also necessary due to possible environmental influences. The segregation observed fit either a 3:1 or 1:1 theoretical ratio. No reciprocal differences are noted. These results may be explained on the basis of a double modifier gene (Dm) (Lamberts 1945, Nugent and Synder 1967). The genotypes of the parental taxa may be:

P. fruticosa 'Goldfinger' - Dm dm

UM 7904 - Dm dm

UM 7911 - Dm dm

UM 7901 - Dm dm

UM 8102 - dm dm

Only the action of the recessive homozygote would enable production of extra petals and only after the system was turned on. The initial switch (D) would allow production of between one to five extra petals while the modifier (dm dm) would enable an additional one to five petals to be produced.

Combining the two proposals the following genotypes can be proposed:

P. fruticosa 'Goldfinger' - $D_1d_1D_2D_2$Dm dm
UM 7904 - $D_1D_1D_2d_2$Dm dm
UM 7911 - $D_1d_1D_2D_2$Dm dm
UM 7901 - $d_1d_1D_2d_2$Dm dm
UM 8102 - $D_1d_1d_2d_2$dm dm

The genotype of UM 8102 is questionable due to the reciprocal differences observed. Proposed genotypes and associated chi square statistics are presented for each of the crosses in Tables 36 to 39. On the basis of chi square statistics, all observed segregation fits the model as proposed with the exception of UM 8102 x 7901 (Table 39). The principal reason for this is the large number of five petal types that occur. It is unfortunate that UM 8102 does not occur as a female in other crosses. When UM 8102 was used as a pollen parent with 'Goldfinger' and UM 7901, segregations met expectations. Only when this plant was used as a female did the altered segregation occur. This suggests differences may be due to cytoplasmic inheritance (Strickberger 1976). When UM 7901 pollen was used in other crosses no altered segregation was noted (Tables 29 and 31).

TABLE 36. Proposed genotypes of progeny from a cross between 10 petal (UM 7901) and five petal (UM 7904).

P_1 = UM 7901 = $d_1d_1D_2d_2$ Dm dm

P_2 = UM 7904 = $D_1D_1D_2d_2$ Dm dm

♂ ♀	D_1D_2Dm	D_1D_2 dm	D_1d_2 Dm	D_1d_2 dm
d_1D_2Dm	$D_1d_1D_2D_2$Dm Dm	$D_1d_1D_2D_2$Dm dm	$D_1d_1D_2d_2$Dm Dm	$D_1d_1D_2d_2$Dm dm
$d_1D_2$dm	$D_1d_1D_2D_2$Dm dm	$D_1d_1D_2D_2$dm dm	$D_1d_1D_2d_2$Dm dm	$D_1d_1D_2d_2$dm dm
d_1d_2Dm	$D_1d_1D_2d_2$Dm Dm	$D_1d_1D_2d_2$Dm dm	$D_1d_1d_2d_2$Dm Dm*	$D_1d_1d_2d_2$Dm dm*
$d_1d_2$dm	$D_1d_1D_2d_2$Dm dm	$D_1d_1D_2d_2$dm dm	$D_1d_1d_2d_2$Dm dm*	$D_1d_1d_2d_2$dm dm**

* = plants with six to 10 petals.
** = plants with 11 to 15 petals - remainder have five petals.

Ratio $\frac{12}{16}$ = 5 petals $\frac{3}{16}$ = 6-10 petals $\frac{1}{16}$ = 11-15 petals

Cross	Observed Number of petals: 5	6-10	11-15	Total	X^2	Prob. of a higher X^2
7901 x 7904	83	17	3	103	2.54	0.3-0.2
7904 x 7901	14	5	1	20	0.54	0.9-0.7
combined	97	22	4	123	2.06	0.5-0.3

(Homogeneity x^2 not significant).

TABLE 37. Proposed genotypes of progeny from a cross between five petal (*P. fruticosa* 'Goldfinger') and 15 petal (UM 8102) types

P_1 = 'Goldfinger' = $D_1d_1D_2D_2$ Dm dm

P_2 = UM 8102 = $D_1d_1d_2d_2$ dm dm

♀ \ ♂	D_1d_2 dm	d_1d_2 dm
D_1D_2Dm	$D_1D_1D_2d_2$Dm dm	$D_1d_1D_2d_2$Dm dm
D_1D_2dm	$D_1D_1D_2d_2$dm dm	$D_1d_1D_2d_2$dm dm
d_1D_2Dm	$D_1d_1D_2d_2$Dm dm	$d_1d_1D_2d_2$Dm dm*
$d_1D_2$dm	$D_1d_1D_2d_2$dm dm	$d_1d_1D_2d_2$dm dm**

* = six to 10 petal progeny.
** = 11 to 15 petal progeny - remainder are five petal types.

Ratio $\frac{6}{8}$ = 5 petals $\frac{1}{8}$ = 6-10 petals $\frac{1}{8}$ = 11-15 petals

Cross	Observed Number of Petals			Total	X^2	Prob. of a higher X^2
	5	6-10	11-15			
'Goldfinger' x UM 8102	51	13	9	73	1.90	0.5-0.3

TABLE 38. Proposed genotypes of progeny from a cross between 10 petal (UM 7901) and six petal (UM 7911) types

P_1 = UM 7901 = $d_1d_1D_2d_2$ Dm dm

P_2 = UM 7911 = $D_1d_1D_2D_2$ Dm dm

♂ ♀	D_1D_2 Dm	D_1D_2 dm	d_1D_2 Dm	d_1D_2 dm
d_1D_2Dm	$D_1d_1D_2D_2$Dm Dm	$D_1d_1D_2D_2$Dm dm	$d_1d_1D_2D_2$Dm Dm*	$d_1d_1D_2D_2$Dm dm*
$d_1D_2$dm	$D_1d_1D_2D_2$Dm dm	$D_1d_1D_2D_2$dm dm	$d_1d_1D_2D_2$Dm dm*	$d_1d_1D_2D_2$dm dm**
d_1d_2Dm	$D_1d_1D_2d_2$Dm Dm	$D_1d_1D_2d_2$Dm dm	$d_1d_1D_2d_2$Dm Dm*	$d_1d_1D_2d_2$Dm dm*
$d_1d_2$dm	$D_1d_1D_2d_2$Dm dm	$D_1d_1D_2d_2$dm dm	$d_1d_1D_2d_2$Dm dm*	$d_1d_1D_2d_2$dm dm**

* = six to 10 petal types.
** = 11 to 15 petal types - remainder have five petals.

Ratio $\frac{8}{16}$ = 5 petals $\frac{6}{16}$ = 6-10 petals $\frac{2}{16}$ = 11-15 petals

Cross	Observed Number of petals			Total	X^2	Prob. of a higher X^2
	5	6-10	11-15			
7901 x 7911	33	21	7	62	0.42	0.7-0.5
7911 x 7901	39	24	13	76	2.03	0.5-0.3
Combined	72	45	20	138	2.06	0.5-0.3

(Homogeneity X^2 not significant).

TABLE 39. Proposed genotypes of progeny from a cross between 10 petal (UM 7901) and 15 petal (UM 8102) types

P_1 = UM 7901 = $d_1d_1D_2d_2$ Dm dm

P_2 = UM 8102 = $D_1d_1d_2d_2$ dm dm

♀ \ ♂	D_1d_2 dm	d_1d_2 dm
d_1D_2Dm	$D_1d_1D_2d_2$Dm dm	$d_1d_1D_2d_2$Dm dm*
$d_1D_2$dm	$D_1d_1D_2d_2$dm dm	$d_1d_1D_2d_2$dm dm**
d_1d_2Dm	$D_1d_1d_2d_2$Dm dm*	$d_1d_1d_2d_2$Dm dm*
$d_1d_2$dm	$D_1d_1d_2d_2$dm dm**	$d_1d_1d_2d_2$dm dm**

* = six to 10 petal types.
** = 11 to 15 petal types - remainder have five petals.

Ratio $\frac{2}{8}$ = 5 petals $\frac{3}{8}$ = 6-10 petals $\frac{3}{8}$ = 11-15 petals

Cross	Observed Number of petals			Total	X^2	Prob. of a higher X^2
	5	6-10	11-15			
UM 7901 x UM 8102	4	12	12	28	1.71	0.5-0.3
UM 8102 x UM 7901	30	22	19	71	11.52	0.01-0.001 (reject)

This model for inheritance of extra petals in P. fruticosa is explanatory not confirmatory. It provides a hypothesis to base further research. Test crosses should be conducted to confirm the hypothesis proposed.

5.3.3 Character Correlations

Correlation coefficients were calculated to determine relationships that could be of utility in future breeding programs. Only correlations that were significant at the 0.01% level and having a R^2 (coefficient of determination) of 0.1 (correlation coefficient 0.32) are presented in Table 40. This was done to aid data interpretation.

Families were combined for this analysis to develop a useful synthesis. These generalized correlations should have good overall predictive capabilities. Individual family correlations can be reconstructed since both parents and progeny are long lived perennials.

Explanation of the character correlations involve two major considerations. These are genetic linkage and physiological relationships. Interpretation of Table 40 suggests that there are many complex physiological related developments. The strongest of these are seedling vigour, plant height and plant width. Vigorous plants are taller and wider. In addition, significant correlations occur between leaf colour, leaf size, number of leaflets, flower diameter, vigor, height and width. Vigorous plants are not only taller and wider but generally have larger flowers, larger leaves, dark green colouration and an increased number of leaflets.

Considering the amount of time and effort expended measuring plants, future studies need only to assess plant vigour unless specific information about a character is required. The general vigour rating is

TABLE 40. Character correlations* for progeny obtained in the flower colour and extra petal crossing program**.

	Height	Width	Leaf Size	Number of Leaflets	Leaf Colour	Leaf Vesture	Flower Diameter	Petal Insularity	Acyanic Flower Colour	Cyanic Flower Colour	Double Flowers
Vigour	+0.87	+0.79	-0.77	+0.5	-0.69	+0.32	+0.58				
Height		+0.74	-0.75	+0.83	-0.62		+0.59				
Width			-0.68	+0.40	-0.57		+0.60				
Leaf Size				-0.54	+0.60		+0.53				
Number of Leaflets					-0.37	+0.37	+0.39			+0.53	
Leaf Colour						-0.39	-0.51				
Leaf Vesture								-0.36	-0.57		-0.45
Flower Diameter											
Petal Insularity											
Acyanic Flower Colour											-0.45
Cyanic Flower Colour											
Double Flowers											

* R^2 values below 0.1 not reported.

** Population maximum = 605 seedlings.

relatively fast and easy to determine once one is familiar with the plants.

However, the principal aim of this aspect of the study was to determine if any characters were related to the occurrence of double flowered plants or cyanic flower colour. This could be of use in future breeding and selection programs through development of early screening procedures.

Double flowering plants were significantly correlated to both leaf vesture and acyanic flower colour. There is no logical physiological relationship between these thus genetic linkage is suspected. Double flowered seedlings were generally acyanic and had low pubescence ratings. Both double flowered parental plants in this study were also acyanic and nearly glabrous.

Cyanic flower colour is significantly related to the numbers of leaflets. Both cyanic parents, UM 7911 and UM 7904 have 5 to 7 leaflets whereas UM 8102, UM 7901 and 'Goldfinger' have five.

To determine if these relationships would be of potential value in screening larger populations similar coefficients were calculated for existing open pollinated families. These seedlings were established in 1984, one year earlier than the controlled crosses. This enabled winter injury and survival to be assessed as well. Character correlations generally appeared similar (Table 41). The same general physiological trends are apparent. These relate to seedling vigour, height and width. No significant correlations were obtained with double flowered plants and only one with cyanic flowered plants. The later was correlated with plant width. Both cyanic and/or double flowered plants occurred at a low frequency. On the other hand, the controlled crossing

TABLE 41. Character correlations* for progeny from open-pollinated families**.

	Width	Height	Winter Injury	Leaf Vesture	Leaf Colour	Number of Leaflets	Leaf Size	Acyanic Flower Colour	Cyanic Flower Colour	Petal Insularity	Flower Diameter	Double Flowers
Vigour	+0.87	+0.88	+0.62	-0.36		+0.54	-0.68			+0.32	+0.58	
Width		+0.85	+0.50	-0.37		+0.50	-0.67	+0.32	+0.20		+0.54	
Height			+0.37			+0.57	+0.61				+0.49	
Winter Injury				+0.32	+0.37		+0.50					
Leaf Vesture					-0.47		+0.36	-0.53				
Leaf Colour												
Number of Leaflets							-0.39	-0.56			+0.35	
Leaf Size											+0.40	
Acyanic Flower Colour										+0.37	-0.40	
Cyanic Flower Colour												
Petal Insularity												
Flower Diameter												
Double Flowers												

* R^2 values below 0.1 not reported.

** Population maximum = 1002 seedlings.

program revolved around these two characters so that the frequency of occurrence was much higher. This may be the reason for the discrepancy between the two populations. It appears, however, that strong and easy to screen character associations are not evident. None of the characters assessed could be confidently used to select prior to flowering.

Since the open-pollinated population has been established in 1984, apparent winter injury could be assessed in the spring of 1985. All other characters were measured during mid to late summer of 1985. Winter injury after one growing season is strongly related to the physiological vigour complex (Table 41). Vigorous plants in 1984 had little injury during the 1984/85 winter. Plants which suffered extensive damage during the winter did not recover and grow vigorously. Thus, the first winter may be very effective natural screening procedure for identification of vigorous plants. Winter injury is generally not a major concern in established cultivars. This may be due to early natural removal of seedlings from the source populations.

6.0 GENERAL DISCUSSION

Taxonomic studies on plants that have been subjects of selection and breeding programs for many years can be difficult. 'Mongrelization' may have clouded distinct phenetic differences that existed between taxa collected in the wild and those commonly used by man (Small 1978). This situation may have developed in P. fruticosa but overall similarity based on the assessments conducted suggest strong divergence has not taken place. The relative positioning of all taxa in the multivariate statistical analysis suggest that the cultivars are variants of a common central theme. Results of the non-metric multi-dimensional scaling effectively illustrated this. The majority of the cultivars were positioned in the inner portions of the figure and European, Asian and North American taxa located towards the edges. Theoretically, the inner locations suggest that hybridization has occurred, however, this hypothesis requires further research. This could be tested by conducting numerical analyses on the progeny from the controlled crosses. It would be beneficial, however, to have a wider diversity of parental types to better sample the genetic potential.

Phenotypic plasticity of many of the characters assessed has contributed to taxonomic confusion. Many of the earlier taxonomists could only look at plants in isolation, and consequently presented a less than complete overview. For example, Handel-Mazetti (1939) only viewed herbarium specimens from Asian representatives, Juzepchuk (1941) only studied Russian representatives and Löve (1954) looked primarily at North American and Northern European specimens. The importance of test gardens to provide reasonably uniform conditions for plant growth has not had a long taxonomic history (Stace 1980). These enable uniform assessments of diverse types in one environment. Selection of "good" taxonomic characters is easier under these conditions. "Good" characters as defined by Stace (1980) are stable and useful in taxa discrimination. The selection of good quantitative characters in the present study proved to be very difficult. The genotype by environment interaction in the time study of taxonomic characters resulted in many being deleted. Only selected ratios of components were retained in the calculation of the similarity coefficients for the major study. However, plasticity was not investigated for ranked or qualitative data. Do these characters change during the growing season? Are the changes in quantitative characters biologically meaningful or do they only have statistical significance. These are several questions that remain unanswered and require further research.

Phenotypic plasticity was also observed in the breeding aspect of this study. The two principal characters studied, namely flower colour and doubleness often changed significantly during the growing season. Cyanic flower colour was the most sensitive to environmental factors. These observations confirm earlier work by Robertson (1984). Stability of the characters remains an important goal in the breeding program. Compromises will be required until seedlings are obtained that maximize character expression over a diverse range of environments.

The majority of taxa investigated were self incompatible. A perfect flowered tetraploid representative was a significant exception.

It would consistently produce self pollinated seed but the seedlings lacked vigour and grew poorly.

Self incompatibility can be used to an advantage in a breeding program (North 1979). Isolated crossing plots could be developed by planting selected parents in close proximity to each other in a remote location or alternatively, isolation cages could be used. Bees should be introduced to pollinate flowers. Pollinations by natural vectors were generally more successful in terms of seed set than hand pollinations. Seed set was generally higher on open pollinated plants when compared to controlled crosses completed in the field, greenhouse or growth room. The physical disturbance of handling the flowers in the crossing and bagging process likely influenced seed set. In this respect the breeding relationships reported are likely under-estimates. If each parental combination was grown in isolation and allowed to cross pollinate via natural vectors seed set would likely be higher. There is generally no problem in timing of flowering since these taxa flower over a very long period. A small plot was established during the course of this study to determine if the isolation concept was feasible. Unfortunately drought, weeds and other problems caused a complete failure of the trial. The procedure does have merit but it is not without pitfalls.

Differential ability of parents to set seed was noted in both the experimental taxonomy study and the breeding investigations. Seed yield has important implications in breeding programs and for natural survival. Seed reproduction is reported to be the most important means of dispersal in wild populations (Tornbloom 1911, Elkington and Woodel 1963). Vegetative reproduction is not considered a major avenue for increase. In breeding programs seed production is important since large populations are required to obtain the desired character combinations. Parent UM 7901 was a far superior parent in the colour and doubleness study. Populations of sufficient size to observe segregation were consistently obtained. Poor seed set may be a result of common incompatibility alleles. This was suspected in crosses involving UM 8102, UM 7911 and UM 7904. Seed set was very low on all combinations. Careful consideration and early screening is required to ensure the parents are cross compatible, produce good quality seed and are of the same ploidy level.

Seed handling is important, particularly for material obtained from controlled crosses. To ensure rapid and uniform germination and emergence seed should be after-ripened for a period of 30-45 days. Interpretation of experimental results suggests that maximum percentages are not affected but rates of emergence are. Uniform emergence will enable more efficient handling of seedlings.

This study has opened many doors that require further research and evaluation. The data collected from both the taxonomy study and the seedling evaluation programs outline significant potential for further breeding. Many unique character combinations have not been incorporated into existing cultivars. Some examples include low mound forming white flowered plants, tall, upright plants with blue-green foliage, and very floriferous large flowered types. In addition, many new flower colours were observed as well as double flowering types.

The woody x herbaceous crossing program has yielded useful information. The potential for crossing these diverse types is significant, however, progress will not be easy. Embryo rescue techniques may improve success rates (Macfarlane-Smith and Jones 1985 b). Success rates were extremely low in the present study with only 3 putative hybrids obtained from over 1000 pollinations. If this value is extrapolated to the number of ovules potentially fertilized the picture is even bleaker. Most P. fruticosa representatives have in excess of 25 ovules per fruit.

Incorporation of herbaceous flowering characteristics would be a very significant achievement. Herbaceous plants have a broader range of characteristics including flower colours, extra petals and large flower diameter. Development of woody plants with these characters could greatly improve aesthetic qualities.

The seedling populations developed during the course of the study will be useful in many ways. Firstly, direct selection of superior plants may result in direct release as a new cultivar. Several individuals with both superior floral and vegetative characteristics have been identified. These will be increased and screened closely.

Secondly, plants with singly unique characters have been identified. Some examples are plant size, plant habit, leaf characteristics; flower size, flower colour and double flowering types. These should be useful in future breeding studies. In effect the populations generated can act as a source population. Since these are perennial and easily propagated by softwood cuttings the seedlings can be retained for a long period and/or be concurrently evaluated under different environmental conditions. Such a study would be very useful to gain a better comprehension of phenotypic plasticity. Identification of genotypes that are stable across several environments would be very valuable.

The genetic models for inheritance of flower colour and flower doubleness require testing and confirmation. This is very evident in the model for doubleness. The reciprocal differences for the progeny from the cross UM 8102 and UM 7901 requires further study. These crosses should be redone as well as back crosses of F_1 individuals. Large populations will undoubtedly be required to gain a further understanding of events.

Interpretation of observational evidence suggests that extra petals arise from the petalization of stamens. To confirm this, developmental studies will be required. Anatomical and histological research investigating flower development would provide a valuable insight to events. Concommittent with this, resource partitioning studies could be initiated. The size of extra petals varied in the seedling populations. This may be due to unequal partioning of resources (Reynolds and Tampion 1983) or due to genetic factors. Attempts to unearth genetic explanations were not successful. Plant nutrition and hormone balances may be fruitful avenues of investigation to discover the cause of petal size variation.

While reviewing the literature, no comprehensive breeding programs were encountered. The majority of plants have been selected from open pollinated populations of either naturally occurring taxa or previously existing cultivars. This suggests that there has not been any major effort to breed for specific characters.

Future breeding programs have many approaches open. As previously identified the seedling populations developed have a wide variety of characteristics from which selections can be made. However, native plant types should not be overlooked. Observations of progeny from the breeding relationship study suggest that a considerable range of variability exists. This is most evident in Asian representatives. This group has not been well studied and likely still retain significant genetic potential that could be exploited. The majority of representatives available in botanic gardens, arboreta and other collections were obtained by early plant explorers. Few attempts have been made to obtain additional material. Many botanic gardens, etc. provide a seed exchange service and seed from various sources can be obtained relatively easily. However most of the institutions have large collections of similar plants and consequently genetic contamination may occur. This is particularly possible in a species like Potentilla fruticosa. It is cross pollinated and has few breeding barriers. Thus seed obtained via exhange to represent a particular geographic district may in fact be badly mixed with a wide variety of sources. Unless populations of plants from one region are retained in isolation, genetic contamination may result. One must be particularly cautious since mixing may have occurred several times in the past. Over a period of 50 years exchanges between botanic gardens may have occurred many times and each time contamination may have resulted.

A limited degree in breeding via sibling mating may be useful to identify potentially valuable recessive characteristics. Such characters are masked by dominant genes. Cyanic flower colour is likely determined by recessive characters. Few plants with cyanic components were observed and thus recessive gene action is suspected.

Sibmating, however, will be confounded by two aspects. Firstly common incompatibility alleles may prevent the desired mating from occurring. Secondly inbreeding depression or expression of deleterious recessive genes may reduce progeny numbers. Selfing of the tetraploid is a good example. Vigour ratings were very low for the progeny obtained. Seedlings often died at a very early age.

The maximum petal count obtained was 16. As suspected by Robertson (1984) there appears to be a genetic limit to the numbers of petals obtained. This observation is in agreement with the model of inheritance proposed. Sources of genetic material for extra petals other than U. of M. selections are limited. 'Hersi' or 'Snowflake' is a cultivar that occasionally produces extra petals. Unfortunately it is a triploid (3n = 21) and is very difficult to use in a breeding program. Crosses with this plant were largely unsuccessful. 'McKay's White', a new cultivar originating from Wisconsin (McKay's Nursery, P.O. Box 85, Waterloo, Wisconsin, U.S.A. 53594) is reported to produce a total of six to eight petals. Plants have been ordered and will be available for future breeding studies. No other sources are known to the author. As a consequence mutation breeding should be considered. Mutation induction has been very successfully used in ornamental horticulture (van Harten 1982). Rooted softwood cuttings, which are readily obtained could be exposed to mutation agents such as X-Rays or gamma rays. The resulting plants could then be grown out and evaluated for interesting characteristics. Such an approach is not restricted to double flower types. This breeding method could be valuable in cyanic flower types as well as other plant characteristics.

Potentilla fruticosa has proved to be a useful research plant. It is small, easy to propagate, grows quite quickly and has a wide variety of characteristics that warrant further study. The time from seed germination to flowering in the field can be as short as three months, however, flowers are not in abundance. In greenhouse conditions flowering was observed in as little as two months. These observations coupled with the fact that it is a valuable landscape plant, should stimulate further research. An unofficial survey conducted by the author estimates world wide annual production of P. fruticosa cultivars is valued at US $15,000,000. It is indeed an important plant and warrants further study.

7.0 SUMMARY AND CONCLUSIONS

On the basis of research conducted, the following can be concluded.

7.1 Experimental Taxonomy

1. Many taxonomic characters that were quantitively assessed were phenotypically plastic and consequently could not be used directly in the taxonomic study. Various ratios of components sampled during August were used in the calculation of similarity coefficients.
2. Cluster and non-metric multidimensional scaling multivariate statistical techniques were used to assist in relationship determination. No strong divergence from the common central theme was observed. Overall similarity as determined by the Gower coefficient between cultivars and native representatives is large.
3. 'Mongrelization' may have clouded any distinct phenetic differences between taxa collected in the wild and those used in the ornamental horticulture industry.
4. Diploid potentillas are generally self-incompatible as well as perfect flowered. The only tetraploid studied was perfect flowered and self-compatible. Seedlings from self pollinations lacked vigour.

5. Significant variation in ability to set seed both from controlled crosses and open pollinated flowers exists.

6. With the exception of heteroploid matings all taxa of Potentilla studied could be successfully crossed and viable progeny obtained. There were some reciprocal differences but all homoploid combinations were successful.

7. Breeding relationships should be based on both seed set and seedling yield data. Using either data alone does not outline a complete picture.

8. Backcrossing to existing F_1 hybrids was successful. Viable progeny were obtained. F_1 hybrids studied are fertile.

9. Success rates were very low for matings between woody and herbaceous plant types. Only three putative hybrids were obtained after over 1000 pollinations and none of these have produced viable seed.

10. The majority of taxa studied are diploid. Only two tetraploids and one triploid were observed.

11. On the basis of this study Potentilla fruticosa L. should be used as the species name for the shrubby cinquefoil complex. Further research is required, particularly on Asian representatives.

7.2 Plant Propagation

1. Potentilla fruticosa cuttings are easy-to-root. Cuttings can be rooted throughout the growing season. Success is highest in the early part of the season. Hardwood cuttings will root but success rates were lower.

2. Rooting of North American native plants was variable and often below the average of all taxa (64) evaluated.
3. Rooting success was influenced by environmental conditions at the time of sampling. High temperatures just prior to rooting corresponded to lower success rates for rooting.
4. Germination rates slow with lower temperatures. Temperature did not effect the germination maximums.
5. Response to after-ripening treatments varied. Emergence rates and maximums generally increased with increasing after-ripening duration. Two taxa originally obtained from the Rocky Mountains were noted by very low emergence maximums.

7.3 Inheritance of Flower Colour and Extra Petals

1. A preliminary model of inheritance of flower colour was derived. Two whitening genes W_1 and W_2, and two yellowing genes Y_1 and Y_2 are proposed. The action of a bleaching gene is also suspected.

   A genetic model for cyanic colours could not be developed due to failure of several crosses. A very preliminary hypothesis was proposed and involves the background petal colour, cyanic pigments and their distribution and genes involved in temperature sensitivity.
2. Good correlations between greenhouse and field flower colour observations were obtained. The relatively cool growing season undoubtedly effected this.
3. Numbers of extra petals varied between parents and sampling date. Greater stability occurred during the later part of the growing

season. Petal size variation also was documented.

4. Extra petals appear to be a result of petalization of stamens.
5. A preliminary model of inheritance of extra petals was derived. It involves a two gene switch, D_1 and D_2 to turn on production of up to five extra petals and a modifier gene Dm that accounts for an additional one to five extra petals.
6. Interpretation of reciprocal differences between crosses of UM 8102 and UM 7901, suggest that cytoplasmic inheritance or a pollen lethal gene may be involved.
7. A large number of physiological relationships were documented in the character correlation study. Correlations for cyanic flower colour and extra petals to other characters were very low and are likely of little value as preliminary screening tools.

7.4 General

1. *Potentilla fruticosa* has proven to be an excellent experimental plant. It is easy to propagate, relatively small in size and grows quickly.

8.0 RECOMMENDATIONS FOR FURTHER STUDY AND RESEARCH

8.1 Experimental Taxonomy

1. Seasonal variation of taxonomic characters should be investigated more fully. Significant variation was discovered for quantitative data. Does the same variation occur in ranked data? If quantitative data are converted to ranked data do significant interactions between sampling date and taxa occur?

2. Does the significant interaction of sampling date and data have wider implications for numerical taxonomy? Studies of other species that have been classified by numerical procedures should be investigated.

3. All measurements in the present study were made on living material growing in a test garden under "uniform" conditions. Are they comparable to studies of dried herbarium specimens collected from diverse locations at different times of the year?

4. *P. fruticosa glabra* and *P. fruticosa* European ($2n = 4x$) were positioned close to each other in both cluster analyses, however, their spacial relationships were quite different in the non-metric dimensional scaling analysis. This apparent discrepancy should be

investigated to see if it is possible to determine which technique better represents the data.

5. Variable seed set from controlled crosses should be studied further. If crossing techniques could be refined success rates may be higher and less variable. These are important considerations for future breeding programs.
6. The degree and extent of the self-incompatibility system should be investigated further. Knowledge of the system would be very useful in future breeding programs. Identification of self-compatible types would be useful in inheritance studies. Knowledge of methods to circumvent the incompatibility system would be useful.
7. Cytogenetic investigations of progeny from both homoploid and heteroploid matings should be initiated.
8. The existing progeny from woody x herbaceous matings should be evaluated more fully. Attempts of crossing should continue. Embryo rescue technique may be useful and consequently increase success rates.
9. Due to variability of sex expression in tetraploid plants, studies should be launched to determine the full range of variability. Sexuality at other ploidy levels should also be investigated.
10. Examination of European and Asian native taxa is required to help confirm or reject the hypothesis of a single species.

8.2 Plant Propagation

1. The drop of rooting success of cuttings appeared to be correlated to a period of high temperatures. This aspect should be studied

more fully to develop better guidelines for propagators.

2. Cuttings of Potentilla formed roots quite readily in the mist chamber. How many roots are required for successful establishment? Does the number of roots have any effect on subsequent growth?
3. Cuttings can be rooted during a very wide period of the growing season. Does this have any functional implications to the commercial propagator. Do plants rooted early reach a larger size by the end of the growing season than cuttings rooted in midseason? Do cuttings rooted in mid or late season develop sufficiently to be hardened-off for winter?
4. Significant differences were noted for germination of seeds collected from plants originating in the Rocky Mountains and Manitoba. The reasons for this variability should be investigated. It is possible that the plants from the Rockies have evolved a more intricate dormancy system to enable continued survival under harsh growing conditions.

8.3 Inheritance of Flower Colour and Extra Petals

1. Models for inheritance of flower colour and petal number are preliminary and require extensive testing to confirm or reject them.
2. Variation in the size of extra petals was observed. Developmental studies should be undertaken to determine the cause. Large-petalled flowers are more desirable.
3. Initiate a mutation breeding program.

4. Reciprocal differences between crosses of UM 8102 and UM 7901 suggest that cytoplasmic inheritance or a pollen lethal gene may be involved. Further research to determine the cause of these differences is required.

9.0 LIST OF REFERENCES

ADAMS, D.G. and ROBERTS, A.N. 1967. A morphological time scale for predicting rooting potential in Rhododendron cuttings. Proc. Am. Soc. Hort. Sci. 91: 753-761.

ALLARD, R.W. 1960. Principles of plant breeding. John Wiley & Sons, New York. 485 p.

ASKER, S. 1970. An intergeneric Fragaria x Potentilla hybrid. Hereditas 64: 135-139.

ASKER, S. 1971. Some viewpoints on Fragaria x Potentilla intergeneric hybridization. Hereditas 67: 181-190.

ASKER, S. 1977. Pseudogamy, hybridization and evolution in Potentilla. Heriditas 87: 179-184.

BAER, J. and KHO, Y.O. 1971. An investigation into the cause of sterility in double flowered Freesia varieties and the possibility of restoring fertility. Euphytica 20: 493-497.

BAKER, H.G. 1970. Taxonomy and the biological species concept in cultivated plants. pp. 49-68 in Genetic Resources in Plants - Their Exploration and Conservation. O.H. Frankel and E. Gennett Ed., IBP Handbook #11, F.A. Davis Co., Phil. Pa.

BAKER, R.L. and LINK, C.B. 1963. The influence of photoperiod on the rooting of cuttings of some woody ornamentals. Proc. Am. Soc. Hort. Sci. 82: 596-601.

BEATTY, A.V. 1937. A statistical study of flower doubling in Eschscholtzia californica Cham. Genetica 19: 447-494.

BENSON, L. 1959. Plant Classification. D.C. Heath Co., Lexington, Mass., 688 p.

BESANT, H. 1927. Potentilla fruticosa var. farreri. Gardener's Chronicle Series 3 82: 327.

BOWDEN, W.M. 1957. Cytotaxonomy of Potentilla fruticosa allied species and cultivars. J. of Arnold Arboretum 38: 381-388.

BRADSHAW, A.D. 1965. Evolutionary significance of phenotypic plasticity in plants. Adv. Genet. 13: 115-155.

BRANDENBURG, W.A. 1984. Biosystematics and hybridization in horticultural plants. p. 611-632. In: *Plant Biosystematics*. Ed. W.F. Grant, Academic Press, Toronto. 675 pp.

BRIGGS, D. and WALTERS, S.M. 1984. *Plant Variation and Evolution*. 2nd Ed., Cambridge University Press, 412 p.

CAMP, W.H. and GILLY, C.L. 1943. The structure and origin of species. Brittonia *4*: 324-385.

CLAUSEN, J., KECK, D.D. and HIESEY, W.M. 1940. Experimental studies on the nature of species. I. Effects of varied environments on western North American plants. Carnegie Inst., Publ. 520, Wash. D.C.

CLAUSEN, J. and HIESEY, W. 1958. Experimental studies on the nature of species. IV. Genetic structure of ecological races. Carnegie Institution of Wash. Publ. 615, Washington, D.C.

COLLICUTT, L.M. 1981. Propagation of the Parkland rose series by leaf bud cuttings. M.Sc. Thesis, U. of Manitoba.

CORMACK, R.M. 1971. A review of classification. Royal Stat. Soc. Proc. *134*: 321-367.

CRAM, W.H. and LINDQUIST, C.H. 1961. Moisture content as an index to the rooting capacity of Caragana softwood cuttings. Proc. Am. Soc. Hort. Sci. *77*: 533-543.

CRANE, M.B. and LAWRENCE, W.J.C. 1929. Genetical and cytological aspects of incompatibility and sterility in cultivated fruits. J. of Pomol. Hort. Sci. *7*: 276-301.

CRANE, M.B. and LAWRENCE, W.J.C. 1938. *The Genetics of Garden Plants*. MacMillan & Co., London, 287 p.

CRANE, M.B. and LEWIS, D. 1942. Genetical studies in Pears III. Incompatibility and sterility. J. of Genetica *43*: 31.

CRANTZ, H. 1766. *Fragaria fruticosa*, Institutiones rei herbariae, Viennae 2 vol., p. 176.

CRITCHFIELD, W.B. 1960. Leaf dimorphism in *Populus trichocarpa*. Am. J. Bot. *47*(8): 699-711.

CRITCHFIELD, W.B. 1971. Shoot growth and heterophyllly in *Acer*. J. of Arn. Arb. *52*: 240-265.

CROCKER, W. 1916. Mechanics of seed dormancy. Am. J. of Bot. *3*: 99-120.

CURRAH, R., SMRECIU, A. and van DYK, M. 1983. *Prairie Wildflowers, an illustrated manual of species suitable for cultivation and grassland restoration*. Friends of the Devonian Botanic Garden, Edmonton, Alberta. 300 p.

DAVIDSON, C.G. 1979. Performance and survival models of *Prunus virginiana melanocarpa* L. and *Cornus stolonifera* Michx. sown on abandoned farmland. M.Sc. Thesis, University of Manitoba, 96 p.

deNETTANCOURT, D. 1977. *Incompatibility in Angiosperms*. Monograph of Theoretical and Applied Genetics #3. Springer-Verlag, New York, 230 p.

DON, D. 1825. *Prodromus Florae Nepalensis Sive Enumeratio Vegetabilium Quae*. p. 230.

DUNLOP, S. and SHAYKEWICH, C.F. 1979. Southern Manitoba's climate and agriculture. Manitoba Agriculture Publ. MG-9256.

DUNN, G. and EVERITT, B.S. 1982. *An Introduction to Mathematical Taxonomy*. Cambridge Univ. Press, London, 152 p.

EDEY, S.N. 1977. Growing degree-days and crop production in Canada. Agric. Canada Publ. 1635. 64 p.

ELKINGTON, T.T. and WOODEL, S.R.J. 1963. *Potentilla fruticosa* L. J. of Ecol. *53*: 769-781.

ELKINGTON, T.T. 1969. Cytotaxonomic variation in *Potentilla fruticosa* L.. New Phytol. *68*: 151-160.

ELLIS, J.R. 1962. *Fragaria* - *Potentilla* intergeneric hybridization and evolution in *Fragaria*. Proc. Linn. Soc. Bot., London *173*: 99-106.

FARRER, R. 1916. *Potentilla* F188. Royal Horticultural Society Journal *42*: 90-91.

FASHAM, M.J.R. 1977. A comparison of non-metric multidimensional scaling, principal components and reciprocal averaging for the ordination of simulated coenclines and coenoplanes. Ecology *58*: 551-561.

FERNALD, M.L. 1935. *Potentilla fruticosa* L. forma *villosissima*. Critical plants of the Upper Great Lakes region of Ontario and Michigan. Rhodora *37*: 272-341.

FREELAND, K.S. 1977. Propagation of potentilla. Proc. International Plant Propagators Society *27*: 441-442.

GARROD, J.F. and HARRIS, G.P. 1974. Studies on glasshouse carnation: effect of temperature and growth substances on petal number. Ann. Bot. *38*: 1025-1031.

GILMOUR, J.S.L. 1960. The deme terminology. Scott. Plant Breed. Stn. Report, p. 99-105.

GOMEZ, K.A. and GOMEZ, A.A. 1984. *Statistical Procedures for Agriculture Research*. 2nd Ed., John Wiley & Sons, New York, 680 p.

GOSWAMI, D.A. and MATFIELD, B. 1974. Pseudogamy in the genus Potentilla. New Phytol. 73: 1243-1247.

GOWER, J.C. 1971. A general coefficient of similarity and some of its properties. Biometrics 27: 857-871.

GORNALL, R.J. and BOHM, B.A. 1984. Breeding systems and relationships among species of Boykinia and related genera (Saxifragaceae). Can. J. of Bot. 62: 33-37.

GRANT, V. 1975. Genetics of Flowering Plants. Columbia University Press, New York, 514 p.

GRANT, V. 1981. Plant Speciation, 2nd ed., Columbia University Press, New York.

GREWEL, M.S. and ELLIS, J.R. 1972. Sex determination in Potentilla fruticosa. Heredity 29: 359-362.

HANDEL-MAZZETTI, H. 1939. Plantae Sinenses 151 XXXVII. Rosaceae 1, Potentillinae, Acta Hort. Gothoburg 13: 299-334.

HARA, H. 1952. Contributions to the study of variations in the Japanese plants closely related to those of Europe or North America. J. of Fac. Sci., Uni. of Tokyo, Sect. III, Bot. 1: 96.

HARTMAN, H.T. and KESTER, D. 1983. Plant Propagation, Principles and Practices. 4 Ed. Prentice Hall, New Jersey, 727 p.

HAWKES, J.G. 1970. The taxonomy of cultivated plants. p. 69-85. In: Genetic Resources in Plants - Their Exploration and Conservation. O.H. Frankel and E. Bennet. Ed. IBP Handbook #11, F.A. Davis Co. Phil. Pa.

HAWKES, J.G. 1981. Biosystematic studies of cultivated plants as an aid to breeding research and plant breeding. Kulturpflanze 29: 327-335.

HEYWOOD, V.H. 1976. Plant Taxonomy. 2nd Ed. Studies in Biology No. 5. Arnold Publ., London, 418 pp.

HULTEN, E. 1971. The Circumpolar Plants II. Dicotyledons. Almquist & Wicksell Pub. Stockholm, Sweden, p. 124.

HURLBERT, S.H. 1984. Pseudoreplication and design of ecological field experiments. Ecol. Monog. 54(2): 187-211.

JANICK, J. 1979. Horticultural Science. 3rd Ed., W.H. Freeman Co., California, 608 p.

JELENKOVIC, G., WILSON, M.L. and HARDING, P.J. 1984. An evaluation of intergeneric hybridization of Fragaria spp. x Potentilla spp. as a means of haploid production. Euphytica 33: 143-152.

JOHNSON, B.L. 1953. Evidence for irregularity in crossing over of the S locus in the eversporting type of Mathiola incana (L.) R. Gr. Genetics 38: 229-243.

JUZEPCHUK, S.V. 1941. Rosaceae - Rosoideae, Prunoides. Vol. X in Flora of the USSR. Ed. V.L. Komarov. Izdatel'stvo Akademii Nauk SSSR, Maskva-Leningrad.

KALKMAN, C. 1968. Potentilla Duchesnea and Fragaria in Malasia (Rosaceae). Blumea 16: 325-354.

KELLY, J.D. 1965. Rooting of cuttings as influenced by photoperiod of the stock plant. Proc. Intl. Pl. Prop. Soc. 15: 186-190.

KENDER, W.J. 1965. Some factors affecting the propagation of lowbush blueberries by softwood cuttings. Proc. Am. Soc. Hort. Sci. 86: 301-306.

KHAN, A.A. 1977. Seed dormancy: changing concepts and theories. p. 29-50. In: The Physiology and Biochemistry of Seed Dormancy and Germination. Ed. A.A. Khan. North Holland Publ. Co., Amersterdam, Holland.

KRUSKAL, J.B. 1964a. Multidimensional scaling by optimizing goodness of fit to a non-metric hypothesis. Pyschometrika 29: 1-27.

KRUSKAL, J.B. 1964b. Non-metric multidimensional scaling. A numerical method. Pyschometrika 29: 115-129.

LAMBERTS, W.E. 1945. The breeding of ornamental edible peaches for mild climates. I. Inheritance of tree and flower characters. Am. J. of Bot. 32: 53-61.

LEGENDRE, L. and LEGENDRE, P. 1983. Numerical Ecology. Elsevier Scientific Publ. Co., New York, 419 p.

LEHMANN, J.G.C. 1831. Novarum et minus cognitarum stripium pugillus. Vol. 3. Hamburg, Germany.

LENZ, L.M. 1977. 'Sundance' Potentilla. Canadian Horticultural Council Report of the Committee on Horticultural Research, p. 245.

LINAEAUS, C. von. 1753. Species Plantarum. Reprinted by Bernard Tuaritch, London (1957), 560 pp.

LINAEAUS, C. von. 1738. Genera Plantarum. Reprinted by Hafner, New York (1960), 500 pp.

LOVE, A. 1954. Cytotaxonomical remarks on some American species of circumpolar taxa. Svensk Bot. Tid. 48: 211-232.

LOVE, A. 1982. IOPB Chromosome Number Report LXXV. Taxon 31: 342-368.

MACFARLANE-SMITH, W.H. and JONES, J.K. 1985a. Intergeneric crosses with *Fragaria* and *Potentilla* I. Crosses between *Fragaria moschata* and *Potentilla fruticosa*. Euphytica *34*: 725-735.

MACFARLANE-SMITH, W.H. and JONES, J.K. 1985b. Intergeneric crosses with *Fragaria* and *Potentilla* II. Crosses between the progeny of *Fragaria moschata* x *Potentilla fruticosa* and the original parents. Euphytica *34*: 707-744.

MAYR, E. 1942. *Systematics and the Origin of Species*. Columbia University Press, New York, 540 p.

McNEIL, J. 1984. Numerical taxonomy and biosystematics. p. 395-415. In: *Plant Biosystematics*. Ed. W.F. Grant. Acad. Press., Toronto, 675 pp.

MESHINEV, T.A. 1973. The effect of light on the germination of *Potentilla fruticosa* L. seeds. Comptes rendes de l'Academie bulgare des Sciences *26*(5): 691-693.

MILTHORPE, F.L. and MOORBY, J. 1979. *An Introduction to Crop Physiology*. 2nd Ed., Cambridge University Press, Cambridge, England, 244 p.

MOE, R. 1971. Factors affecting flower abortion and malformation in roses. Physiol. Plant *24*: 291-300.

MORISET, P. and BOUTIN, C. 1984. The biosystematic importance of phenotypic plasticity. p. 293-306. In: *Plant Biosystematics*. Ed. W.F. Grant. Acad. Press, Toronto.

MUNTZING, A. and MUNTZING, G. 1944. A pentaploid F_1 hybrid between two diploid *Potentilla* species. Hereditas *30*: 631-638.

MUSSEL, H. 1971. The range of *Potentilla fruticosa* at Weinhemstephan. Deutsche Baumschule *23*: 6-11.

NIEMIROWICZ-SZCZYTT, K. 1982. Seed regeneration in *Fragaria ananassa* varieties and *Fragaria* x *Potentilla* crosses. p. 203-207. IN: *Seed Regeneration in Cross-Pollinated Species*. Proc. CEC/EUCARPIA Seminar, Ed. E. Porceddu and G. Jenkins. A.A. Balkama, Rotterdam.

NIKOLAEVA, M.G. 1977. Factors controlling the seed dormancy. p. 51-74. In: *The Physiology and Biochemistry of Seed Dormancy and Germination*. Ed. A.A. Khan, North Holland Publ. Co., Amersterdam, Holland.

NORTH, C. 1979. *Plant Breeding and Genetics in Horticulture*. MacMillan Press Ltd., London, 150 p.

NUGENT, P.E. and SNYDER, R.J. 1967. The inheritance of floret doubleness, floret center colour and plant habit in *Pelargonium hortorum* Bailey. Proc. Am. Soc. Hort. Sci. *91*: 680-690.

NYGREN, A. 1967. Apomixis in angiosperms. In: Encyclopedia of Plant Physiology 18: 551-596.

ORLOCI, L. and KENKEL, N.C. 1985. Introduction to Data Analysis with Examples from Population and Community Ecology. Stat. Eol. Mono I., International Co-operative Publishing House. Maryland, U.S.A. 339 p.

PARIS, C.D., HANEY, W.J. and WILSON, G.B. 1960. A survey of the interaction of genes for flower colour, Mich. State University, Agricultural Experimental Station Tech. Bull. 281, 132 p.

POWELL, G.R., TOSH, K.J. and MacDONALD, J.E. 1982. Indeterminate shoot extension and heteropylly in Acer saccharum. Can. J. of Bot. 12: 166-170.

PURSH, F. 1814. Flora Americae Septentrionalis; a systematic arrangement of plants of North America. Vol. 1. London White Cochrane & Co., New York.

RAFINESQUE, C.S. 1840. Dasiphora fruticosa. Autikon. Botanikon 16: 167.

RAVEN, P.H. 1976. Systematics and plant population biology. Systematic Botany 1: 284-316.

REYNOLDS, J. and TAMPION, J. 1983. Double Flowers; a Scientific Study. Scientific and Academic Edition, Van Nostrand Reinhold Co. Inc., New York, 183 p.

RHEDER, A. 1922. Potentilla fruticosa var. purdomi. J. of Arnold Arboretum 3: 209.

RHEDER, A. 1924. Potentilla fruticosa var. davurica. J. of Arnold Arboretum 5: 200.

RHEDER, A. 1929. Potentilla fruticosa var. grandiflora. Linnean Society of London, Botanical Journal 48: 175.

RHEDER, A. 1939. Potentilla fruticosa forma Wardii. J. of Arnold Arboretum 20: 97.

RHEDER, A. 1960. Manual of Cultivated Trees and Shrubs Hardy in North America. 2nd Ed. The MacMillan Co., New York, 996 p.

RHODES, H.L.J. 1954. The cultivated shrubby Potentilla. Baileya 2: 89-96.

RICHARDS, A.J. 1975. Notes on the sex and age of Potentilla fruticosa in the upper Teesdale, England. Natural His. Soc. of Northumbria: Transactions 42(3): 85-92.

ROBERTSON, M. 1984. The effect of environmental factors on flower colour and petal number of *Potentilla fruticosa* L. M.Sc. Thesis. University of Manitoba, 118 pp.

ROUSI, A. 1968. Cytoplasmic inheritance in *Aquilegia vulgaris*. Hereditas *60*: 223-232.

ROYAL HORTICULTURAL SOCIETY. 1938. *Royal Horticultural Society Colour Charts*. Vol. I. London, England.

ROYAL HORTICULTURAL SOCIETY. 1941. *Royal Horticultural Society Colour Charts*. Vol. II. London, England.

RYDEBERG, P.A. 1898. A monograph of North American Potentileae. Ph.D. Thesis. Columbia University. 2 Vol.

RYDEBERG, P.A. 1908. Rosaceae, Flora North America *22*(3): 239-366.

SALISBURY, F.B. and ROSS, C.W. 1978. *Plant Physiology*. 2nd Ed. Wadworth Publ. Co., California. 422 p.

SAMPSON, D.R. and CAMERON, D.F. 1965. Inheritance of bronze foliage, extra petals and pendulous habit in ornamental crabapples. Proc. Am. Soc. Hort. Sci. *86*: 717-722.

SAUNDERS, E.R. 1910. Studies in the inheritance of doubleness in flowers. I. *Petunia*. J. of Gen. *1*: 57-69.

SAUNDERS, E.R. 1928. Further studies on inheritance in *Mathiola incana*. II. Plastid colour and doubling. J. of Gen. *20*: 53-76.

SCHOPMEYER, C.S. 1974. *Seeds of Woody Plants in the United States*. USDA Forest Service Agriculture Handbook 450, Washington, D.C., 883 pp.

SHEPARD, R.N. 1974. Representation of structure in similarity data: problems and prospects. Pyschometrika *39*: 373-421.

SMALL, E. 1978. A numerical taxonomic analysis of the *Daucus carota* complex. Can. J. of Bot. *56*: 248-276.

SNEATH, P.H.A. 1957. The application of computers to taxonomy. J. Gen. Microbiol. *17*: 201-226.

SNEATH, P.H.A. and SOKAL, R.R. 1973. *Numerical Taxonomy*. W.A. Freeman Co. San Francisco, U.S.A.

SOKAL, R.R. and SNEATH, P.H.A. 1963. *Principles of Numerical Taxonomy*, W.L. Freeman Co., San Francisco, U.S.A.

SORENSEN, D.C. and COORTS, G.D. 1968. The effect of nutrient mist on the propagation of selected woody ornamental plants. Proc. Am. Soc. Hort. Sci. *92*: 696-703.

STACE, C.A. 1980. Plant Taxonomy and Biosystematics. Edward Arnold Ltd., London, England, 279 p.

STEBBINS, Leyard. 1971. Chromosonal evolution in higher plants. Edward Arnold Publ. Co., London, 127 pp.

STEEL, R.G.D. and TORRIE, J.H. 1980. Principles and Procedures of Statistics, 2nd Ed., McGraw Hill Co., 633 p.

STOUT, A.B. and CHANDLER, C. 1942. Heriditary transmission of induced tetraploidy and compatibility in fertilization. Sci. 96: 259-261.

STRICKBERGER, M.W. 1976. Genetics 2nd Ed. MacMillan Pub. Co., New York, 914 pp.

TORNBLOM, G. 1911. Om Potentilla fruticosa L. Pä Öland. Svensk. Botanisk Tidskrift 5: 89-131.

TUKEY, J.W. 1980. We need both explanatory and confirmatory. Am. Stat. 34: 23-25.

van de Laar, H.J. 1982. Potentilla fruticosa. Dendroflora 19: 29-43.

vanderKloet, S.P. 1980. The taxonomy of the highbush blueberry, Vaccinium corymbosum. Can. J. of Bot. 58: 1187-1201.

van HARTEN, A.M. 1982. Mutation breeding in vegetatively propagated crops with emphasis on contributions from The Netherlands. p. 22-30. In: Induced Variability in Plant Breeding. Ed. C. Broertjes Center for Agricultural Publishing and Documentation, Wageningen, Netherlands.

VICKERY, R.K. 1984. Biosystematics 1983, p. 1-24 in Plant Biosystematics. Ed. W.F. Grant. 675 p. Academic Press Canada.

VILLIERS, T.A. 1972. Seed dormancy. p. 219-281. In: Seed Biology II. Ed. T.T. Kozlowski, Academic Press, New York.

WAGNER, W.H. 1984. A comparison of taxonomic methods in biosystematics. p. 634-654. In: Plant Biosystematics. Ed. W.F. Grant. Academic Press, Canada. 675 p.

WATTS, S. 1873. Potentilla fruticosa var. parvifolia. Proc. Am. Acad Arts and Sci. 8: 561.

WILLDENOWS, A. 1813. Potentilla fruticosa var. grandiflora. Magazin: Gesellschaft naturforschinder (Berlin) 7: 285.

WOH, J.A. and TUKEY, H.B. 1965. Propagation of cuttings under nutrient mist. Proc. Int. Plant Prop. Soc. 15: 86-94.

ZASTRE, J.A. 1985. Controlled environment propagation and culture of Castilleja coccinea L., Anemone patens wolfgangiana (Bess) Koch. and Cypripedium calceolous parviflorum (Aalisb) Fern. M.Sc. Thesis. University of Manitoba. 158 pp.

Appendix 1

TAXA USED IN THE TAXONOMIC STUDY OF THE SHRUBBY CINQUEFOIL

A. North American Native Representatives

Plant Number*	Location of Collection
1	Whitemouth, Manitoba
3	Bow Pass, Alberta
4	Bow Pass, Alberta
19	Marchand, Manitoba
28	Consolation Lake, Alberta
36	Consolation Lake, Alberta
37	Consolation Lake, Alberta
38	Consolation Lake, Alberta
39	Consolation Lake, Alberta
46	Bow Pass, Alberta
49	Peyto Lake, Alberta
50	Peyto Lake, Alberta
51	Peyto Lake, Alberta
52	Peyto Lake, Alberta
53	Peyto Lake, Alberta
54	Peyto Lake, Alberta
55	Peyto Lake, Alberta
56	Bow Pass, Alberta
61	Peyto Lake, Alberta
69	Cowan, Manitoba
70	Cowan, Manitoba
76	Snow Lake, Manitoba
77	Snow Lake, Manitoba
78	Kiski, Manitoba
79	Olds, Alberta
80	Olds, Alberta
81	Olds, Alberta
82	Cypress Hills, Saskatchewan
83	Cypress Hills, Saskatchewan
84	Cypress Hills, Saskatchewan
85	Pontum (30 miles south), Manitoba
86	Pontum (30 miles south), Manitoba
87	Grand Rapids, Manitoba
88	Grand Rapids, Manitoba
89	Grand Rapids, Manitoba
90	Devil's Lake, Manitoba
91	Devil's Lake, Manitoba
92	Devil's Lake, Manitoba

Plant Number	Location of Collection
93	Cowan, Manitoba
94	Cowan, Manitoba
95	Kiski, Manitoba
96	Kiski, Manitoba
97	Mafeking, Manitoba
98	Mafeking, Manitoba
99	Arborg, Manitoba
100	Stuartburn, Manitoba
101	Simonhouse Lake, Manitoba
102	Simonhouse Lake, Manitoba
103	Athabaska Falls, Alberta
116	Angling Lake, Manitoba
120	Emma Lake, Saskatchewan

B. Eurasian Representatives

Plant Number	Name
2	P. arbuscula
6	P. x Sulfurescens (P. arbuscula x P. glabra)
7	p. fruticosa - European 2n = 2x
8	P. x Rhederiana (P. parvifolia x P. fruticosa)
9	P. parvifolia
11	P. davurica
13	P. x Friedrichsenii (P. fruticosa x P. glabra)
14	P. glabra
15	P. fruticosa - European 2n = 4x
17	P. fruticosa - Scandinavia

C. Cultivars

Plant Number	Name
5	Purdomi
10	Coronation Triumph
12	Mandshuria
16	Moonlight
18	Hersi
20	Hachman's Giant
21	Buttercup
22	Sandved
23	Kathrine Dykes
24	Veitchi
25	Farreri
26	Mt. Everest
27	Lemon Drop
29	Irving
30	Yellow Single
31	Primrose Beauty
32	Roseacre
33	Farreri White

Plant Number	Name
34	Sutter's Gold
35	Tangerine
40	Darts Nugget
41	Beesi
42	Sunset
43	Tenuloba
44	Jackman
45	Fran Lady Daresbury
47	Tangerine
48	Longacre
57	Hurstborne
58	700
59	White Gold
60	Daydawn
62	Hallman's Dwarf
63	Darts Golddigger
64	Nyewood Form
65	Oeland
66	UM 8102
67	UM 7901
68	Orangeman
71	Waltonensis
72	Klondike
73	Minima
74	Hollandia
75	White Rain
104	Goldstar
105	Pink Dawn
106	Micandra
108	Nyewood
109	Sandwadena
110	Hallman's Dwarf
111	Stockers
112	Butter
113	Darts Gold
114	Hollandia Gold
115	Dakota Sunrise
117	Ban Banoch
118	Gold Teppich
119	Beani
121	Gold Fried
122	Berlin Beauty
123	Subalbicans
124	Abbotswood
125	Ochroleuca
126	Friesengold
127	Northman
128	Knaphill

* Plant numbers correspond to numbers used in the cluster and non-metric multidimensional scaling analysis.

Appendix 2

GOWER COEFFICIENT AND COMPUTER PROGRAMMING

A. Gower Coefficient (Gower 1971)

This coefficient permits the combination of different types of descriptors after having processed each according to its own mathematical type. For qualitative data or binary descriptors values are treated as simple matching agreement (Si = 1) or disagreement (Si = 0). For quantitative descriptors the deviations are first computed ($y_{i1} = y_{i2}$) and then this value is divided by the maximum deviation (R_1). Since this is then a normalized distance it is subtracted from 1 to produce a similarity.

Therefore Si = 1 − [$y_{i1} = y_{i2}$ /R]. The coefficient has additional flexibility in that missing values may be deleted (Legendre and Legendre 1983). Weighting of each descriptor is possible but has not been done for the present study. Semi-quantitative characters or ranked data can be treated as quantitative types or as qualitative (matching) depending on circumstance. The difference interval between ranks must be approximately equal if the quantitative approach is used. If intervals are not equal qualitative descriptors are best (Legendre and Legendre 1983).

The following Fortran program for the Gower coefficient was written by Dr. Norm Kenkel, Dept. of Botany, University of Manitoba, for which the author is indebted. It is presented in complete form for use on the University of Manitoba Amdal mainframe computer. A second program is listed for use on the Apple microcomputer (Apple basic). This was not used in the present study but is included for the sake of completeness. "Dumby" data was used to test the programs and copies of these are presented.

B. Fortran Program

File = FORTSCR

```
SCRATCH DA = infile.dat
scratch Da = outfile.dat
allocate Da = infile.dat  format (FB, 255, 1800) size (2T, 1)
allocate Da = outfile.dat  format (FD, 255, 1800) size (2T, 1)
```

```
  File = FORTRUN

     T allocate F (FT10F001) DSN (infile.dat)
     T allocate F (FT11F001) DSN (outfile.dat)
     T allocate F (FT04F001) DSN (*)

  File = Gower

  $ Job
  C Program name is gower
  C Unit 4 - Screen read and write (interactive)
  C Unit 10 - Read (input) file
  C Unit 11 - Write (output) file
  C Reads in a N (individuals) by P (variables) matrix
  C First line must have variable affinities

(6 spaces) REAL FMTIN (20), FMTOUT (20)
           REAL Y(120), Q(120), X(120,50), S(120,120)
           INTEGER P,N,NN,L
           WRITE(4,10)
   10      FORMAT('Specify number of individuals:')
           READ(4,*)N
   34      WRITE(4,20)
   20      FORMAT('Specify number of variables:')
           READ(4,*)P
           WRITE(4,30)
   30      FORMAT('Type input format, include brackets:')
           READ(4,35) FMTIN
   35      FORMAT(20A4)
           WRITE(4,40)
   40      FORMAT('Type output format, include brackets:')
           READ(4,35)FMOUT
  c
  c Read in data
  c
           READ(10,FMTIN)(Y(I),I=1,P)
           DO 90 I=1,N
   90      READ (10,FMTIN) (X(I,J),J=1,P)
           DO 100 J=1,P
           Q(J)=0
           DO 100 I=1,N
           IF (X(I,J).LE. Q(J)) GOTO 100
           Q(J)=X(I,J)
  100      Continue
           DO 110 J=1,N
           DO 110 K=1,N
  110      S(J,K)=0
           NN=N-1
           DO 200 J=1,NN
           L=J+1
           DO 200 K=L,N
           DE=0
           DO 190 I=1,P
```

```
      IF (X(J,I).LT.0.) GOTO 190
      IF (X(K,I).LT.0.) GOTO 190
      IF (Y(I).GT.1.) GOTO 180
      S (J,K)=S(J,K)+(1.-(ABS(X(J,I)-X(K,I))/Q(I)))
      GOTO 188
180   IF(Y(I).EQ.3.) GOTO 185
      IF(X(J,I).EQ.0.) GOTO 188
      IF(X(K,I).EQ.0.) GOTO 188
      S(J,K)=S(J,K)+1
      GOTO 188
185   IF(X(J,I).EQ.X(K,I)) GOTO 187
      GOTO 188
187   S(J,K)=S(J,K)+1
188   DE=DE+1
190   Continue
      S(J,K)=S(J,K)/DE
      S(K,J)=S(J,K)
200   Continue
      DO 210 I.1,N
210   S(I,I)=1
      DO 220 I=1,N
220   Write (11,FMTOUT)(S(I,J), J=1,N)
      STOP
      END
$ENTRY
```

C. Execution of Program

Step 1 execute FORTSCR
2 execute FORTRUN
3 SAVE DATA TO INFILE.DAT
4 SAVE PROGRAM TO TEMP.FOR
5 TWATFIV TEMP.FOR
6 input data format
eg. 9F 8.5 = 9 columns (rows) with 8 character and 5 places after the decimal.
7 input output format
eg. 7F 8.4
8 Copy DA = outfile.dat to mantas file

NOTE - the first row of the data matrix must have the variable affinites
1.0 = quantitative
2.0 = rank order
3.0 = qualitative

D. Test Data

```
2.0    1.0    3.0    2.0    1.0     (variable affinities)
 0      2      1      0     10
 1      3      2      1      3
 1      5      3      1      4
 0      0      3      0      7
 1      4      2      1      6
```

0	5	1	1	2
1	7	1	0	0
1	6	3	1	4

E. Gower Coefficient Program in Apple Basic Language

```
10  REM PROGRAM GOWER - CALCULATES GOWERS GENERAL INDEX.
15  CLEAR :D$ = CHR$ (4)
20  INPUT "SPECIFY # ROWS (VARS)";P
30  INPUT "SPECIFY # COLS (INDS):";N
40  INPUT "SPECIFY RAW DATA FILENAME:";NAME$
50  INPUT "SPECIFY AFFINITY FILE:";N$
60  INPUT "SPECIFY FILENAME TO STORE OUTPUT:";SIM$
70  DIM X(P,N),Y(P),Q(P)
80  PRINT D$;"OPEN";NAME$
90  PRINT D$;"READ";NAME$
100  FOR I = 1 TO P
110 Q(I) = 0.
120  FOR J = 1 TO N
130  INPUT X(I,J): IF X(I,J) >Q(I) THEN LET Q(I) = X(I,J)
140  NEXT J,I
150  PRINT D$;"CLOSE";NAME$
160  PRINT D$;"OPEN";N$
170  PRINT D$;"READ";N$
180  FOR I = 1 TO P: INPUT Y(I): NEXT I
190  PRINT D$;"CLOSE";N$
200  FOR J = 1 TO N - 1
210  FOR K = J + 1 TO N
220 DE = 0
230  FOR I = 1 TO P
240  IF X(I,J) < 0 THEN 300
242  IF X(I,K) < 0 THEN 300
245  IF Y(I) >1 THEN 260
250 S(J,K) = S(J,K) + (1 - ( ABS (X(I,J) - X(I,K)) / Q(I)))
255  GOTO 290
260  IF Y(I) = 3 THEN 285
265  IF X(I,J) = 0. THEN 290
270  IF X(I,K) = 0. THEN 290
275 S(J,K) = S(J,K) + 1
280  GOTO 290
285  IF X(I,J) = X(I,K) THEN S(J,K) = S(J,K) + 1
290 DE = DE + 1
300  NEXT I
310 S(J,K) = S(J,K) / DE
320 S(K,J) = S(J,K)
330  NEXT K,J
340  FOR I = 1 TO N
350 S(I,I) = 1
360  NEXT I
370  PRINT D$;"OPEN";SIM$
380  PRING D$;"WRITE";SIM$
390  FOR I = 1 TO N: FOR J = 1 TO N: PRINT S(I,J): NEXT J,I
400  PRINT D$;"CLOSE";SIM$
```

```
405    PRINT D$;"PR#1"
410    FOR I = 1 TO N
420    FOR J = 1 TO N
430    PRINT S(I,J);" ";: NEXT J: PRINT : NEXT I
435    PRINT D$:"PR#0"
440    END
```

* NOTE: variables are in rows and individuals are in columns (reverse of the FORTRAN program)

Appendix 3

MEAN VALUES FOR ASSESSMENTS AND MEASUREMENTS FOR EACH OPERATIONAL TAXONOMIC UNIT (OTU). Key to abbreviations are at the end of this appendix.

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
1	90.0	115.0	3.0	1.0	8.0	1.0	3.0	2.0	3.0	2.0	1.0	2.0
2	60.0	125.0	3.0	3.0	6.0	1.0	3.0	2.0	3.0	2.0	2.0	3.0
3	80.0	110.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
1	3.0	3.0	4.0	2.0	4.0	1.0	3.0	1.0	1.0	3.0	4.0	1.0
2	4.0	4.0	4.0	3.0	3.0	1.0	3.0	1.0	3.0	2.0	3.0	2.0
3	3.0	3.0	3.0	2.0	2.0	1.0	2.1	1.0	3.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLLEN	TLLWID	SLLLEN	SLLWID	STLEN	STWID	STNOT	DNOT	NLL
1	29.0	8.0	30.6	17.0	4.8	14.8	4.0	7.2	4.6	1.6	1.0	5.0
2	17.4	3.2	22.6	10.0	4.2	10.6	3.4	7.6	3.8	1.0	2.2	5.0
3	22.5	7.5	22.5	12.0	3.5	11.0	2.5	5.5	4.0	1.0	2.5	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
1	5.0	18.6	5.0	8.4	7.2	11.8	4.0	2.6	11.6	3.6	1.0
2	5.0	22.0	3.2	9.6	10.4	13.6	5.6	2.6	15.8	6.2	2.0
3	5.0	17.5	8.5	6.5	6.0	14.5	6.5	3.0	15.0	6.0	1.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
4	80.0	120.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	1.0	2.0
5	100.0	130.0	1.0	2.0	6.0	1.0	3.0	5.0	1.0	1.0	3.0	2.0
6	60.0	105.0	3.0	2.0	5.0	1.0	3.0	3.0	3.0	2.0	1.0	2.0
7	100.0	120.0	1.0	1.0	5.0	1.0	3.0	5.0	1.0	2.0	1.0	2.0
8	100.0	125.0	4.0	1.0	3.6	3.8	2.2	2.2	3.8	2.0	1.0	2.4

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
4	4.0	4.0	4.0	2.0	2.0	1.0	3.0	1.0	1.0	3.0	3.0	1.0
5	3.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	3.0	4.0	2.0
6	2.0	1.0	2.0	2.0	3.0	1.0	1.0	1.0	3.0	2.0	3.0	2.0
7	3.0	3.0	2.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
8	3.8	1.6	4.4	2.0	3.0	1.0	2.0	1.0	1.0	2.0	3.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
4	28.4	7.2	30.2	14.0	4.8	.	.	5.0	3.0	1.0	1.0	6.1
5	18.2	4.2	22.0	12.8	3.8	11.4	3.0	6.8	4.4	1.0	2.0	4.8
6	16.0	3.6	20.4	10.4	2.6	10.4	2.2	6.4	2.8	1.0	2.4	5.0
7	25.6	7.0	26.0	14.8	3.8	12.6	3.2	7.2	4.0	1.0	2.2	5.8
8	15.8	3.2	17.0	9.6	3.2	9.2	3.0	6.0	3.4	1.0	1.6	7.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
4	5.0	10.8	4.3	4.8	3.2	20.1	9.0	10.2	.	.	.
5	5.0	16.8	7.8	7.6	7.0	10.2	3.8	2.4	8.6	2.2	1.0
6	5.0	21.6	3.8	9.6	9.6	14.2	5.2	3.0	16.8	6.8	2.0
7	5.0	27.2	4.4	11.6	11.2	13.0	5.4	3.2	12.4	4.4	2.0
8	5.0	20.8	8.8	8.4	8.0	13.8	5.0	2.8	14.0	5.4	1.6

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
9	90.0	110.0	1.0	1.0	7.0	1.0	3.0	3.0	1.0	2.0	1.0	2.0
10	105.0	130.0	4.0	1.0	5.0	1.0	2.0	5.0	1.0	1.0	2.0	2.0
11	.	.	.	2.0	2.0	1.0	3.0	.	.	.	1.0	2.0
12	30.0	30.0	3.0	4.0	2.0	1.0	3.0	0.0	2.0	3.0	3.0	4.0
13	110.0	135.0	1.0	2.0	6.0	1.0	2.0	3.0	3.0	2.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
9	2.0	2.0	2.0	2.0	3.0	1.0	2.0	1.0	3.0	3.0	3.0	1.0
10	3.0	2.0	2.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
11	3.0	2.0	2.0	3.0	.	1.0	3.0	.	.	.	.	1.0
12	4.0	4.0	4.0	4.0	3.0	1.0	2.0	.	.	1.0	2.0	.
13	3.0	3.0	2.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	3.6	1.1

CODE	LLEN	PETOLEN	LWID	TLLEN	TLLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
9	16.6	4.2	15.0	8.8	4.0	7.8	3.2	5.6	2.6	1.0	1.2	5.4
10	22.4	5.0	22.4	13.0	3.8	12.8	3.4	8.6	3.4	1.0	3.4	7.0
11	27.8	6.6	27.6	15.6	6.4	14.4	5.4	7.6	3.4	2.0	0.0	6.2
12	19.0	3.0	20.2	10.4	2.8	10.4	3.8	8.8	3.0	1.0	3.0	5.0
13	25.2	6.2	24.0	15.2	4.8	13.4	3.8	7.4	2.2	1.0	2.0	5.4

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
9	5.0	20.8	8.6	8.2	7.6	11.8	4.8	2.4	10.2	3.8	1.4
10	5.0	23.6	6.6	9.8	8.2	13.8	5.4	2.6	14.8	5.8	1.6
11	5.0	20.4	8.4	9.2	8.1	.	.	.	.	.	.
12	5.0	.	.	.	.	.	.	.	.	.	.
13	5.0	19.2	10.0	9.0	7.4	13.0	4.8	2.4	9.4	3.8	1.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
14	40.0	130.0	3.0	1.0	1.0	1.0	3.0	0.0	2.0	3.0	1.0	3.0
15	70.0	100.0	1.0	1.0	3.0	1.0	1.0	3.0	4.0	1.0	2.0	1.0
16	125.0	140.0	2.0	1.0	6.0	1.0	3.0	3.0	3.0	1.0	1.0	2.0
17	120.0	140.0	2.0	1.0	6.0	1.0	3.0	3.0	3.0	1.0	1.0	2.0
18	110.0	115.0	1.0	3.0	2.0	1.0	3.0	4.0	1.0	1.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
14	3.0	3.0	3.0	3.0	2.0	1.0	2.0	.	.	1.0	2.0	.
15	1.0	4.0	4.0	2.6	3.0	.	2.0	2.0	1.0	2.5	3.0	1.1
16	4.0	4.0	4.0	4.0	4.0	1.0	2.0	1.0	3.0	2.0	4.0	1.0
17	4.0	4.0	4.0	4.0	4.0	1.0	2.0	1.0	3.0	2.0	4.0	1.0
18	2.0	2.0	3.0	3.0	4.0	1.0	3.0	1.0	3.0	2.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
14	19.6	4.6	18.8	10.6	3.6	10.2	3.2	6.6	1.8	2.0	0.0	5.0
15	17.4	3.8	17.6	9.2	3.4	9.2	2.8	6.4	3.4	1.0	2.4	6.0
16	28.4	4.2	30.8	17.2	6.4	16.0	4.8	8.2	4.6	1.0	3.8	5.0
17	25.4	5.6	25.0	12.6	4.0	11.4	3.4	7.0	3.0	1.0	3.0	5.0
18	28.4	8.0	21.4	12.6	6.6	11.6	6.0	5.2	2.4	1.0	1.6	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
14	5.0	20.0	4.0	8.0	9.0	.	.	.	.	.	.
15	5.0	20.0	9.2	8.0	7.6	12.8	5.0	2.4	8.8	2.6	1.0
16	5.0	18.2	5.0	6.6	6.8	14.8	5.6	3.0	15.8	6.0	2.2
17	5.0	16.2	5.0	6.6	6.2	13.2	5.2	2.8	14.0	5.6	2.0
18	5.6	20.4	9.4	8.2	8.0	16.4	6.6	2.4	16.0	6.6	2.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
19	80.0	65.0	2.0	5.0	1.0	1.0	3.0	3.0	3.0	3.0	1.0	1.0
20	50.0	90.0	3.0	1.0	1.0	1.0	3.0	3.0	3.0	2.0	1.0	2.0
21	55.0	100.0	3.0	2.0	5.0	1.0	2.0	3.0	3.0	2.0	1.0	2.0
22	100.0	135.0	3.0	1.0	9.0	1.0	2.4	4.0	3.0	1.0	1.0	2.0
23	50.0	115.0	3.0	1.0	6.0	1.0	2.0	2.0	3.0	2.0	1.0	1.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
19	2.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
20	2.0	2.0	2.0	3.0	4.0	1.0	2.0	1.0	3.0	2.0	3.0	1.0
21	2.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	1.0	2.0	2.0	1.0
22	3.0	4.0	3.0	3.0	4.0	1.0	3.0	1.0	3.0	3.0	4.0	1.0
23	2.0	2.0	2.0	3.0	3.0	1.0	2.0	1.0	3.0	1.0	2.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLLEN	TLLWID	SLLLEN	SLLWID	STLEN	STWID	STNOT	DNOT	NLL
19	19.0	4.4	20.8	12.2	2.8	10.8	2.4	5.4	2.8	1.0	1.8	5.0
20	20.4	3.8	22.2	14.0	3.4	12.4	3.2	5.4	3.6	1.0	1.4	5.2
21	16.4	4.4	18.4	10.0	2.4	9.8	2.2	7.4	3.8	1.0	2.8	6.2
22	22.4	4.8	22.0	14.0	4.0	12.6	3.6	6.4	3.6	1.0	3.0	6.0
23	17.4	3.2	18.8	10.0	4.0	10.2	3.4	6.0	3.8	1.0	2.6	6.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
19	5.0	18.0	5.8	6.6	6.6	14.6	5.0	2.6	14.2	5.0	1.8
20	5.0	18.4	5.6	7.6	7.8	10.6	4.0	2.6	11.2	3.8	1.0
21	5.0	21.	2.6	9.6	9.0	11.2	4.0	2.6	13.2	5.2	1.6
22	5.0	20.0	5.2	8.2	8.0	13.4	5.0	2.8	13.2	4.8	1.4
23	5.2	18.0	5.8	7.6	7.6	12.0	5.0	2.4	12.4	4.6	1.2

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
24	130.0	160.0	1.0	2.0	2.0	1.0	2.0	3.0	3.0	2.0	2.0	2.0
25	85.0	100.0	4.0	2.0	1.0	1.0	3.0	4.0	1.0	1.0	1.0	2.0
26	105.0	140.0	3.0	1.0	2.0	1.0	3.0	2.0	3.0	2.0	1.0	2.0
27	115.0	110.0	1.0	2.0	6.0	1.0	2.0	3.0	3.0	2.0	1.0	2.0
28	70.0	90.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	3.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
24	3.0	3.0	3.0	3.0	4.0	2.0	2.0	1.0	3.0	2.0	4.0	1.0
25	3.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	3.0	4.0	1.0
26	3.0	3.0	4.0	3.0	4.0	1.0	3.0	1.0	3.0	2.0	3.0	1.0
27	2.0	2.0	2.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
28	3.0	4.0	3.0	3.0	3.0	1.0	3.0	1.0	1.0	2.0	2.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
24	22.8	5.0	23.0	11.8	4.8	12.0	4.2	7.8	3.8	1.0	1.6	5.6
25	12.4	2.2	15.6	7.4	2.2	7.0	2.0	3.6	2.2	1.0	1.2	6.2
26	21.4	3.8	21.4	10.4	5.8	10.6	5.0	8.4	3.4	1.0	2.4	5.0
27	20.6	3.8	22.2	14.0	3.4	12.4	3.2	5.4	3.6	1.0	1.4	5.2
28	31.0	8.2	35.6	17.0	5.2	16.8	4.4	9.0	4.2	1.0	2.0	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
24	5.0	19.0	11.4	7.8	7.2	12.8	5.2	2.6	11.8	4.0	1.6
25	5.0	19.2	5.4	7.8	7.8	12.0	5.2	2.8	12.4	4.8	1.0
26	5.2	18.4	5.2	7.6	7.6	13.2	5.4	4.8	12.6	3.8	1.2
27	5.0	18.4	5.6	7.6	7.8	10.6	4.0	2.6	11.2	3.8	1.0
28	5.0	.	.	.	.	.	.	.	.	.	.

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
29	70.0	120.0	3.0	2.0	1.0	1.0	3.0	3.0	3.0	1.0	2.0	3.0
30	95.0	105.0	3.0	2.0	6.0	1.0	3.0	2.0	3.0	2.0	1.0	1.0
31	100.0	120.0	3.0	4.0	7.0	1.0	3.0	4.0	1.0	1.0	2.0	4.0
32	100.0	100.0	4.0	1.0	2.0	1.0	3.0	4.0	1.0	1.0	1.0	3.0
33	100.0	100.0	4.0	1.0	2.0	1.0	3.0	4.0	1.0	1.0	1.0	3.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
29	4.0	4.0	3.0	2.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
30	3.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	3.0	2.0	3.0	1.0
31	4.0	4.0	4.0	4.0	4.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
32	2.0	3.0	3.0	3.0	4.0	1.0	3.0	1.0	3.0	3.0	4.0	1.0
33	2.0	3.0	3.0	3.0	4.0	1.0	3.0	1.0	3.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
29	22.6	5.2	24.6	11.8	3.6	12.2	3.2	5.4	3.0	1.0	1.6	5.4
30	17.2	3.6	17.8	9.2	3.4	10.2	3.2	6.0	2.6	1.0	1.2	7.0
31	14.2	2.45	15.8	8.0	2.8	7.6	2.8	6.4	3.6	1.0	2.0	5.0
32	28.6	7.6	23.6	15.0	7.2	12.8	6.2	6.8	2.6	1.0	2.0	5.0
33	21.2	3.8	24.2	12.8	4.8	12.6	4.4	7.0	3.8	1.0	1.8	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
29	5.0	20.0	6.4	8.2	8.2	13.2	5.6	3.0	12.4	4.4	1.0
30	5.0	19.4	7.2	8.0	7.2	12.0	5.0	2.8	13.2	5.0	1.0
31	5.0	19.0	5.4	8.0	8.6	13.8	5.6	3.0	14.6	5.6	1.8
32	5.6	20.8	9.0	7.8	8.4	16.6	6.6	2.4	16.8	7.0	2.0
33	5.0	18.8	9.2	7.0	6.8	13.2	5.0	2.6	13.2	4.8	2.4

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
34	65.0	135.0	3.0	3.0	6.0	1.0	3.0	2.0	3.0	2.0	2.0	3.0
35	90.0	140.0	3.0	2.0	3.0	1.0	2.0	1.0	3.0	3.0	2.0	3.0
36	75.0	115.0	3.0	5.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
37	60.0	105.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	2.0	2.0
38	80.0	100.0	1.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
34	4.0	4.0	4.0	4.0	3.0	1.0	3.0	1.0	3.0	2.0	3.0	1.0
35	3.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	3.0	1.0	4.0	1.0
36	3.0	4.0	3.0	2.0	3.0	1.0	3.0	1.0	3.0	3.0	4.0	1.0
37	3.0	3.0	3.0	2.0	3.0	1.0	3.0	1.0	1.0	3.0	3.0	1.0
38	3.0	3.0	2.0	2.0	2.0	1.0	3.0	1.0	1.0	3.0	3.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
34	18.4	2.0	24.4	11.2	4.0	11.6	3.6	12.2	4.8	1.0	2.6	5.2
35	14.6	3.0	19.6	8.8	2.8	9.2	2.8	5.8	2.6	1.0	1.8	5.6
36	23.6	7.8	24.0	12.6	4.0	12.0	4.0	5.6	3.6	1.0	1.6	6.2
37	24.5	10.0	26.5	12.0	4.0	11.5	3.0	7.0	3.5	1.0	1.5	5.0
38	27.0	10.0	27.0	15.0	5.0	13.0	3.0	7.0	4.0	1.0	1.0	7.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
34	5.4	23.2	4.2	9.4	10.0	15.2	5.8	2.6	16.4	6.2	2.2
35	5.0	20.4	7.2	8.6	10.0	13.0	5.0	3.0	15.4	6.2	2.2
36	5.0	21.8	9.4	9.0	9.0	14.2	5.8	3.0	13.8	5.0	1.0
37	5.0	19.0	22.0	7.5	7.0	14.5	6.0	3.0	17.5	6.5	1.5
38	5.0	17.0	12.0	8.0	7.0	14.0	6.0	3.0	12.0	5.0	1.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
39	65.0	100.0	3.0	5.0	1.0	1.0	3.0	2.0	3.0	3.0	2.0	2.0
40	90.0	140.0	3.0	1.0	1.0	1.0	2.0	5.0	1.0	1.0	2.0	2.0
41	100.0	125.0	1.0	4.0	7.0	1.0	3.0	4.0	1.0	1.0	2.0	3.0
42	75.0	110.0	3.0	2.0	8.0	1.0	2.0	1.0	3.0	3.0	1.0	2.0
43	100.0	135.0	3.0	5.0	1.0	1.0	3.0	3.0	3.0	2.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
39	4.0	4.0	3.0	2.0	2.0	1.0	3.0	1.0	1.0	3.0	3.0	1.0
40	4.0	4.0	4.0	4.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
41	4.0	4.0	4.0	4.0	4.0	2.0	2.0	1.0	3.0	3.0	4.0	1.0
42	3.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	3.0	1.0	4.0	1.0
43	4.0	4.0	4.0	3.0	3.0	1.0	3.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
39	25.4	8.0	25.0	12.8	4.2	12.4	3.6	7.0	3.6	1.0	1.2	6.4
40	26.8	6.2	28.4	15.0	4.8	14.4	4.0	7.0	3.6	1.2	1.4	6.2
41	18.2	3.6	20.8	10.6	3.8	10.6	3.8	9.8	5.4	1.0	4.8	5.0
42	15.4	4.2	19.6	9.0	4.2	9.4	3.0	8.2	4.2	1.0	2.0	7.0
43	38.5	14.0	27.5	18.0	4.0	18.0	3.5	7.5	5.0	1.0	3.5	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
39	5.0	21.2	8.0	8.8	6.8	15.4	5.8	3.0	15.2	5.4	1.2
40	5.0	25.0	3.2	10.6	9.6	14.8	5.0	3.2	13.4	4.2	1.8
41	5.2	19.4	3.8	8.0	8.2	13.8	5.6	2.8	14.2	5.0	2.0
42	5.0	16.2	6.2	7.2	8.4	11.6	4.4	2.8	13.8	5.6	2.8
43	5.0	22.0	5.5	8.5	7.0	15.0	5.5	3.5	15.0	5.0	1.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
44	105.0	130.0	1.0	5.0	1.0	1.0	3.0	5.0	3.0	2.0	1.0	1.0
45	75.0	140.0	3.0	3.0	6.0	1.0	3.0	2.0	3.0	2.0	2.0	3.0
46	50.0	110.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	2.0	3.0
47	80.0	125.0	3.0	1.0	3.0	1.0	2.0	1.0	3.0	3.0	2.0	3.0
48	80.0	115.0	3.0	1.0	6.0	1.0	3.0	3.0	3.0	2.0	2.0	3.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
44	4.0	4.0	4.0	3.0	4.0	1.0	3.0	1.0	3.0	3.0	4.0	1.0
45	4.0	3.0	3.0	2.0	3.0	1.0	3.0	1.0	3.0	2.0	3.0	2.0
46	3.0	3.0	3.0	2.0	2.0	1.0	3.0	1.0	1.0	3.0	4.0	1.0
47	3.0	2.0	2.0	2.0	3.0	1.0	2.0	1.0	3.0	1.0	4.0	1.0
48	3.0	3.0	4.0	2.0	4.0	1.0	3.0	1.0	3.0	2.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
44	37.0	9.2	36.6	21.6	6.0	19.2	5.4	9.2	3.8	1.0	1.4	6.4
45	23.4	4.4	25.4	12.4	5.4	12.2	4.8	11.4	5.2	1.0	3.8	5.0
46	25.2	7.6	29.2	13.4	4.8	13.6	3.6	6.0	3.6	1.0	1.2	5.6
47	17.4	3.8	20.0	10.2	3.6	9.8	3.6	6.4	4.2	1.0	1.4	4.8
48	20.0	4.8	23.2	11.4	3.8	10.8	3.4	9.2	4.4	1.0	3.2	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
44	5.0	21.4	4.4	9.8	10.0	15.0	5.0	3.8	12.0	4.0	1.2
45	5.0	19.8	3.6	8.0	8.4	14.2	5.4	2.6	15.6	6.0	2.0
46	5.0	20.2	4.8	7.9	7.6	.	.	.	.	.	.
47	5.0	20.8	5.8	8.0	10.0	12.0	4.0	3.0	14.4	4.8	3.0
48	5.0	24.4	2.0	9.2	10.4	14.4	4.6	3.6	16.2	4.8	2.6

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
49	90.0	130.0	3.0	5.0	1.0	1.0	3.0	2.0	3.0	2.0	2.0	2.0
50	85.0	110.0	3.0	1.0	1.0	1.0	3.0	3.0	3.0	2.0	2.0	2.0
51	65.0	90.0	3.0	5.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
52	75.0	110.0	3.0	5.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
53	80.0	100.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	2.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
49	3.0	3.0	3.0	2.0	2.0	1.0	3.0	1.0	1.0	3.0	4.0	1.0
50	2.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
51	3.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
52	3.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
53	3.0	4.0	3.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
49	26.8	8.2	26.8	12.8	4.6	11.2	3.8	7.0	5.8	1.0	1.2	5.2
50	23.6	6.8	24.2	13.2	4.2	12.2	3.6	6.8	4.0	1.0	1.4	5.4
51	24.8	7.6	24.2	14.2	4.4	13.8	3.4	5.0	3.6	1.0	1.4	6.6
52	25.0	8.0	28.0	14.5	3.0	11.0	3.0	5.0	3.0	1.0	1.0	5.5
53	22.2	9.0	18.2	11.2	3.8	10.2	3.0	4.2	3.4	1.0	1.2	5.8

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
49	5.0	20.6	10.2	9.8	9.2	12.8	4.6	3.2	11.6	3.4	1.2
50	5.0	20.2	7.8	8.8	7.4	14.8	6.6	3.2	13.6	6.2	1.2
51	5.0	17.8	8.8	7.4	6.0	11.8	4.8	2.2	10.4	3.6	1.2
52	5.0	17.0	8.0	6.5	5.5	11.0	5.0	2.0	8.0	3.0	1.0
53	5.0	18.2	8.1	7.4	7.2	.	.	.	.	.	.

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
54	85.0	90.0	2.0	5.0	1.0	1.0	3.0	2.0	3.0	3.0	2.0	2.0
55	70.0	100.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	1.0	2.0
56	80.0	100.0	3.0	5.0	1.0	1.0	3.0	1.0	3.0	3.0	1.0	2.0
57	80.0	100.0	3.0	2.0	9.0	1.0	3.0	4.0	1.0	1.0	2.0	3.0
58	65.0	130.0	3.0	1.0	6.0	1.0	3.0	2.0	3.0	2.0	3.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
54	3.0	4.0	3.0	2.0	2.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
55	3.0	4.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
56	4.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
57	2.0	2.0	2.0	2.0	4.0	1.0	1.0	1.0	1.0	2.0	3.0	1.0
58	4.0	4.0	3.0	2.0	4.0	1.0	3.0	1.0	3.0	2.0	3.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
54	22.6	7.0	23.6	12.2	4.0	11.6	3.8	7.6	4.0	1.0	1.6	5.2
55	16.6	4.0	18.8	9.6	3.6	9.0	2.8	5.8	3.0	1.0	1.8	5.4
56	21.0	6.0	24.0	12.0	4.0	11.0	3.0	8.0	4.0	1.0	2.0	5.0
57	16.0	3.4	17.8	8.6	2.8	8.6	2.0	4.8	2.2	1.0	2.2	7.0
58	20.8	2.6	27.6	12.6	5.2	13.4	4.8	11.4	4.8	1.0	3.0	5.6

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
54	5.0	22.6	11.4	10.0	9.0	14.2	5.8	3.0	15.2	5.4	1.8
55	5.0	18.4	11.6	7.4	6.6	13.6	5.8	3.2	12.2	4.0	1.0
56	5.0	19.0	7.0	7.0	6.0	12.0	5.0	2.0	10.0	4.0	1.0
57	5.0	20.8	3.6	8.4	8.0	12.6	4.6	2.8	14.2	5.2	1.0
58	5.4	24.2	3.4	10.0	10.8	16.4	6.6	3.2	18.0	7.2	2.8

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
59	75.0	115.0	3.0	1.0	6.0	1.0	3.0	2.0	3.0	2.0	3.0	4.0
60	80.0	110.0	3.0	2.0	6.0	1.0	2.0	1.0	3.0	3.0	2.0	3.0
61	80.0	105.0	3.0	1.0	1.0	1.0	3.0	1.0	3.0	3.0	2.0	2.0
62	75.0	115.0	3.0	1.0	9.0	1.0	3.0	4.0	1.0	1.0	2.0	2.0
63	85.0	120.0	3.0	1.0	5.0	1.0	3.0	5.0	1.0	1.0	2.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
59	4.0	3.0	3.0	4.0	4.0	1.0	2.0	1.0	3.0	2.0	3.0	1.0
60	3.0	2.0	2.0	2.0	2.0	1.0	2.0	1.0	3.0	1.0	2.0	1.0
61	3.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
62	3.0	4.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
63	4.0	3.0	3.0	3.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLLEN	TLLWID	SLLLEN	SLLWID	STLEN	STWID	STNOT	DNOT	NLL
59	17.6	2.4	23.4	11.0	4.0	11.0	4.0	10.0	4.0	1.0	2.0	5.4
60	17.8	5.0	19.0	9.8	3.0	9.2	3.0	6.4	4.0	1.0	1.6	5.8
61	22.0	8.0	24.0	12.0	3.0	12.0	3.0	4.0	4.0	1.0	1.0	5.0
62	21.0	4.4	24.0	12.2	3.2	12.6	3.0	8.6	3.4	1.0	2.6	5.6
63	21.8	4.0	26.8	13.0	4.4	12.4	3.6	9.2	4.0	1.0	3.6	4.8

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
59	5.09	25.0	3.4	10.6	12.0	15.8	6.4	3.0	15.6	6.2	2.4
60	5.0	22.4	6.8	8.6	9.8	13.6	4.6	3.0	16.0	5.2	3.0
61	5.0	20.0	7.0	6.0	6.0	14.0	5.0	3.0	15.0	6.0	2.0
62	5.0	22.4	3.0	9.4	9.8	13.8	5.0	3.0	15.0	5.6	1.2
63	5.0	28.4	4.4	11.6	12.8	16.0	6.4	3.4	16.2	6.2	2.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
64	50.0	90.0	3.0	1.0	1.0	1.0	2.0	1.0	3.0	3.0	2.0	2.0
65	84.5	114.3	1.0	3.0	5.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
66	105.0	145.0	3.0	3.0	2.0	1.0	3.0	5.0	1.0	1.0	2.0	2.0
67	90.0	100.0	1.0	1.0	5.0	1.0	3.0	4.0	1.0	1.0	1.0	2.0
68	55.0	100.0	3.0	2.0	3.0	1.0	2.0	1.0	3.0	2.0	2.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
64	3.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	3.0	1.0	4.0	1.0
65	3.0	2.0	3.0	2.0	4.0	1.0	2.0	1.0	1.0	3.0	3.0	1.0
66	2.0	2.0	2.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	2.0
67	3.0	1.0	2.0	2.0	3.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
68	2.0	1.0	2.0	2.0	3.0	1.0	2.0	1.0	3.0	1.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLLWID	SLLLEN	SLLWID	STLEN	STWID	STNOT	DNOT	NLL
64	12.4	2.2	16.2	7.4	2.2	7.6	1.6	5.2	2.2	1.0	1.8	5.4
65	25.8	6.8	25.2	12.2	4.4	11.2	3.6	9.6	3.8	1.0	2.4	5.2
66	25.4	4.2	25.4	15.4	7.2	13.2	6.2	8.6	4.8	1.0	2.4	6.2
67	23.4	5.8	23.4	12.8	5.0	11.4	3.6	7.0	3.8	1.0	2.0	4.8
68	18.4	3.2	20.8	10.8	4.6	10.8	4.4	9.2	3.8	1.0	1.4	4.8

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
64	5.0	17.0	4.0	6.0	5.6	11.0	4.2	2.8	12.0	4.8	1.2
65	5.0	20.4	11.6	9.2	8.2	11.8	5.2	2.4	9.4	3.2	1.0
66	9.0	21.2	5.6	8.6	9.0	11.6	3.8	2.4	13.4	4.2	1.8
67	7.6	18.8	2.8	8.4	7.8	11.0	3.4	2.4	12.6	3.8	1.8
68	5.0	22.0	11.0	9.8	9.6	12.8	5.0	3.0	13.0	5.4	2.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
69	.	.	3.0	4.0	5.0	1.0	3.0	3.0	3.0	3.0	2.0	2.0
70	.	.	1.0	1.0	5.0	1.0	3.0	3.0	3.0	2.0	1.0	2.0
71	.	.	2.0	4.0	6.0	1.0	3.0	2.0	3.0	3.0	2.0	2.0
72	.	.	1.0	2.0	7.0	1.0	2.0	3.0	1.0	2.0	1.0	2.0
73	.	.	1.0	1.0	7.0	1.0	2.0	3.0	1.0	2.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
69	3.0	3.0	4.0	4.0	3.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
70	3.0	3.0	3.0	2.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
71	3.0	3.0	3.0	4.0	4.0	1.0	2.0	1.0	3.0	3.0	2.0	1.0
72	2.0	1.0	2.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
73	3.0	1.0	2.0	2.0	3.0	1.0	2.0	1.0	3.0	2.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
69	27.4	6.0	28.0	17.4	5.6	15.4	5.2	8.0	4.4	1.4	0.8	7.0
70	24.0	5.6	25.6	14.6	3.8	13.0	3.4	5.6	2.2	1.0	1.6	5.6
71	20.2	4.4	19.6	10.0	3.6	8.6	2.6	7.6	4.2	1.0	2.2	5.4
72	16.8	3.4	18.4	10.0	3.8	9.6	2.8	6.4	3.2	1.0	2.2	6.0
73	16.0	2.4	18.8	9.8	4.4	9.6	4.0	6.8	4.4	1.0	2.6	5.6

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
69	5.8	21.0	8.2	8.8	7.6	13.8	4.6	3.4	13.6	4.2	1.8
70	5.0	21.0	11.8	8.6	7.2	14.0	5.8	2.8	14.2	5.6	1.2
71	5.6	22.8	5.2	8.8	9.2	13.4	4.0	3.0	13.6	4.4	2.0
72	5.0	18.0	7.2	7.2	7.4	10.8	4.6	2.4	11.4	4.6	1.2
73	5.0	21.8	9.2	9.6	9.0	13.4	5.4	3.0	12.4	5.2	2.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
74	.	.	1.0	1.0	6.0	1.0	3.0	3.0	3.0	2.0	1.0	3.0
75	.	.	1.0	1.0	2.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
76	.	.	4.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
77	.	.	2.0	1.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	3.0
78	.	.	1.0	1.0	1.0	1.0	3.0	2.0	3.0	3.0	2.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
74	3.0	4.0	3.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	3.0	1.0
75	2.0	3.0	4.0	3.0	3.0	1.0	2.0	1.0	3.0	2.0	4.0	1.0
76	2.0	3.0	3.0	3.0	3.0	1.0	2.0	1.0	1.0	2.0	2.0	1.0
77	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
78	3.0	4.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
74	20.4	4.4	21.8	12.0	3.8	10.8	3.2	6.6	3.0	1.0	2.8	6.2
75	22.2	4.6	22.0	12.8	5.8	11.6	3.8	6.6	3.6	1.0	2.4	5.6
76	27.2	6.2	28.6	16.2	4.8	13.8	4.4	7.4	5.4	1.0	1.6	5.8
77	23.6	7.0	21.2	12.8	3.8	10.2	3.4	9.0	5.0	1.0	1.4	6.0
78	27.6	6.8	28.6	17.0	4.6	13.4	4.0	8.0	4.2	1.0	1.8	5.8

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
74	5.0	18.2	6.2	7.0	7.8	12.4	5.0	2.8	13.4	5.0	1.2
75	5.2	19.8	7.4	8.6	6.6	14.0	5.6	2.4	14.4	5.4	1.4
76	5.0	24.0	10.4	9.8	9.2	16.8	5.8	3.8	17.8	6.0	2.4
77	.	.	.	.	.	.	.	.	.	.	.
78	.	.	.	.	.	.	.	.	.	.	.

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
79	.	.	1.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	3.0
80	.	.	1.0	3.0	1.0	1.0	1.0	2.0	3.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
79	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
80	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
79	23.2	4.4	27.2	15.2	4.8	14.0	3.8	8.2	4.2	1.0	2.0	5.2
80	20.2	5.0	21.4	10.6	2.4	8.8	2.6	6.6	3.8	1.0	1.4	5.6

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
79	5.0	.	.	.	.	.	.	.	.	.	.
80	5.0	.	.	.	.	.	.	.	.	.	.

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
84	.	.	3.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
85	.	.	1.0	4.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
86	.	.	1.0	5.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	3.0
87	.	.	1.0	4.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
88	.	.	4.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
84	3.0	4.0	4.0	3.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
85	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
86	2.0	2.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
87	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
88	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
84	22.2	4.4	22.2	13.2	2.6	11.6	2.6	7.4	4.0	1.0	1.4	5.2
85	21.3	3.7	24.3	13.7	3.3	13.7	3.7	10.3	6.3	1.0	2.0	5.7
86	21.6	3.8	25.0	13.8	4.0	14.0	3.8	9.0	5.0	1.0	2.8	6.2
87	22.4	4.2	25.2	13.8	3.8	13.0	3.2	9.0	5.2	1.0	2.4	6.2
88	26.8	6.8	27.5	15.0	5.8	13.5	5.5	6.5	4.8	1.0	2.3	7.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
84	.	.	.	.	.	.	.	.	.	.	.
85	5.0	24.0	7.7	9.7	9.3	14.3	6.7	3.0	13.0	5.7	1.7
86	5.0	20.4	6.4	8.2	7.8	13.0	5.0	2.4	12.4	5.0	1.0
87	5.0	21.0	9.0	8.2	8.0	15.6	6.4	3.0	14.8	5.6	1.6
88	5.0	23.0	13.3	9.0	8.3	15.0	5.5	3.0	16.0	6.0	2.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
89	.	.	3.0	4.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
90	.	.	1.0	1.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
91	.	.	1.0	1.0	1.0	1.0	2.0	1.0	3.0	3.0	1.0	2.0
92	.	.	2.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
93	.	.	3.0	1.0	1.0	1.0	2.0	3.0	3.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
89	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
90	3.0	3.0	4.0	3.0	3.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
91	2.0	3.0	3.0	3.0	3.0	1.0	2.0	1.0	1.0	2.0	2.0	1.0
92	3.0	3.0	3.0	3.0	4.0	1.0	3.0	1.0	3.0	3.0	4.0	1.0
93	3.0	2.0	3.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
89	20.6	5.0	22.4	11.4	4.2	10.0	3.2	7.6	4.4	1.0	1.6	5.0
90	26.3	9.7	25.0	14.3	5.3	11.7	4.7	6.3	4.3	1.0	2.3	5.0
91	26.6	6.8	27.2	15.2	4.4	14.4	4.0	6.4	4.2	1.0	1.0	6.0
92	28.4	9.0	27.0	15.4	4.2	15.0	3.2	7.6	5.4	1.0	1.6	6.2
93	21.8	5.4	25.2	14.2	4.2	13.4	3.8	7.4	4.2	1.0	2.2	6.4

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
89	5.0	19.2	6.8	7.4	6.0	12.0	5.0	2.4	11.4	4.4	1.0
90	5.0	17.7	12.7	6.3	6.7	11.0	4.3	2.7	12.0	4.3	1.7
91	.	.	.	.	.	.	.	.	.	.	.
92	5.0	20.6	17.0	8.4	7.6	16.8	6.4	3.2	16.8	6.0	1.6
93	5.0	21.4	10.8	8.2	7.0	15.6	6.0	3.2	15.4	6.0	1.6

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
94	.	.	2.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
95	.	.	3.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	1.0	1.0
96	.	.	1.0	4.0	9.0	1.0	3.0	3.0	3.0	3.0	2.0	2.0
97	.	.	1.0	4.0	1.0	1.0	3.0	2.0	3.0	3.0	2.0	1.0
98	.	.	1.0	4.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
94	3.0	3.0	3.0	2.0	4.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
95	3.0	3.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
96	3.0	3.0	4.0	3.0	4.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
97	3.0	4.0	4.0	2.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
98	3.0	3.0	2.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLLEN	TLLWID	SLLLEN	SLLWID	STLEN	STWID	STNOT	DNOT	NLL
94	25.8	5.6	25.6	15.0	3.4	14.2	3.4	8.6	4.4	1.0	1.6	6.8
95	23.2	5.2	25.0	13.8	3.4	11.6	3.0	6.6	2.8	1.0	1.8	5.0
96	25.6	7.0	26.8	15.9	4.4	13.0	3.6	7.8	4.6	1.0	1.4	5.2
97	22.4	4.6	25.0	14.6	4.0	12.4	3.2	7.4	4.8	1.0	1.4	5.0
98	24.0	7.0	51.0	18.0	5.0	15.0	4.0	7.0	5.0	1.0	2.0	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
94	5.2	25.0	14.2	10.4	8.8	20.0	8.2	3.6	20.6	7.8	1.6
95	5.4	16.2	14.6	6.0	5.4	15.0	6.2	2.6	14.6	5.4	1.2
96	5.0	21.4	7.2	9.2	8.4	14.4	4.6	3.0	15.6	4.6	1.6
97	.	.	.	.	.	.	.	.	.	.	.
98	5.0	20.0	9.0	6.0	7.0	13.0	5.0	3.0	12.0	4.0	1.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
99	.	.	1.0	1.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
100	.	.	3.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
101	.	.	3.0	1.0	1.0	1.0	2.0	2.0	3.0	2.0	1.0	2.0
102	.	.	4.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	1.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
99	3.0	3.0	4.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
100	2.0	3.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
101	3.0	2.0	4.0	3.0	2.0	1.0	3.0	1.0	1.0	3.0	4.0	1.0
102	3.0	4.0	4.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
99	30.8	6.5	35.3	19.5	5.8	16.3	4.8	6.8	4.8	1.0	1.5	5.0
100	22.6	4.8	25.0	12.6	3.6	13.0	3.0	7.0	3.4	1.0	1.6	5.0
101	26.8	4.6	26.8	15.2	5.2	14.8	5.0	7.4	4.4	1.0	1.8	5.0
102	21.2	3.8	22.8	13.0	3.2	10.0	2.8	4.8	3.2	1.0	1.0	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
99	5.0	16.3	20.5	6.5	6.3	11.3	4.0	3.0	13.0	5.0	2.0
100	5.0	22.4	11.4	9.0	7.8	17.6	6.8	3.0	15.6	6.8	1.0
101	5.0	22.4	11.4	9.0	7.8	17.6	6.8	3.0	17.2	6.8	1.0
102	.	.	.	.	.	.	.	.	.	.	.

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
104	.	.	1.0	4.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
105	.	.	1.0	1.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
106	.	.	4.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	1.0	2.0
107	.	.	1.0	4.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	2.0
108	.	.	3.0	1.0	5.0	1.0	3.0	3.0	1.0	2.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
104	3.0	3.0	4.0	4.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
105	3.0	4.0	4.0	4.0	5.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
106	2.0	4.0	4.0	3.0	4.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
107	3.0	3.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
108	3.0	4.0	3.0	2.0	3.0	1.0	3.0	1.0	1.0	3.0	4.0	2.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
104	21.6	4.2	23.2	13.6	3.6	11.0	3.4	5.2	3.4	1.0	1.6	5.2
105	24.0	4.5	26.5	15.5	3.5	14.0	3.5	7.0	5.0	1.0	1.5	5.0
106	27.0	5.5	26.5	15.5	5.5	13.5	4.5	7.5	5.5	1.0	1.5	5.0
107	24.6	4.8	27.6	14.6	4.6	14.6	3.8	8.6	4.6	1.0	3.0	6.0
108	24.0	4.6	30.0	14.2	4.8	14.4	4.2	11.4	5.6	1.0	5.4	5.8

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
104	5.0	16.0	5.2	6.0	5.4	11.0	3.6	2.8	11.0	3.2	1.4
105	5.0	19.5	6.0	7.0	5.5	12.0	4.0	3.0	11.5	3.5	1.0
106	5.0	14.0	16.5	7.5	7.0	15.5	4.5	3.5	16.0	5.0	2.0
107	.	.	.	.	.	.	.	.	.	.	.
108	5.0	29.0	5.4	12.0	13.0	17.4	7.0	3.8	17.6	5.8	3.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
109	.	.	1.0	1.0	4.0	1.0	3.0	1.0	2.0	3.0	1.0	2.0
110	.	.	3.0	1.0	5.0	1.0	3.0	3.0	1.0	2.0	2.0	2.0
111	.	.	2.0	1.0	2.0	1.0	2.0	2.0	1.0	2.0	1.0	2.0
112	.	.	3.0	2.0	1.0	1.0	3.0	1.0	3.0	3.0	2.0	2.0
113	.	.	3.0	2.0	7.0	1.0	1.0	4.0	1.0	2.0	2.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
109	3.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	3.0	1.0	4.0	1.0
110	2.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	1.0	2.0	3.0	2.0
111	3.0	2.0	3.0	3.0	4.0	1.0	3.0	1.0	1.0	2.0	3.0	1.0
112	3.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0
113	3.0	2.0	2.0	2.0	3.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
109	15.0	4.4	16.0	8.2	3.0	7.2	2.8	6.2	3.0	1.0	1.0	5.4
110	13.0	2.0	18.0	8.6	2.4	9.2	2.0	7.8	3.4	1.0	3.4	5.4
111	25.0	5.4	28.0	15.2	5.8	15.6	5.0	9.2	3.8	1.2	2.0	5.2
112	9.8	1.4	13.0	6.2	2.0	5.8	1.8	3.8	2.0	1.0	1.8	5.2
113	21.2	3.6	24.8	14.2	4.8	14.2	4.8	10.0	4.2	1.0	4.0	6.2

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
109	5.0	23.0	8.0	9.6	11.0	14.6	4.4	3.2	15.2	4.8	2.2
110	5.0	21.6	3.0	9.4	9.2	13.4	5.4	2.8	14.8	5.6	1.4
111	5.2	19.4	6.6	7.6	8.0	15.6	6.2	3.4	15.8	5.8	1.8
112	5.0	16.6	2.6	6.8	5.6	12.0	4.8	2.2	13.2	5.0	1.4
113	5.2	24.6	11.4	9.8	9.6	15.4	6.6	3.0	15.2	5.8	1.8

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
114	.	.	1.0	4.0	.	.	.	.	.	.	1.0	2.0
115	.	.	1.0	4.0	.	.	.	.	.	.	1.0	1.0
116	.	.	1.0	2.0	1.0	1.0	3.0	1.0	3.0	2.0	2.0	2.0
117	.	.	1.0	1.0	5.0	1.0	3.0	3.0	1.0	2.0	2.0	2.0
118	.	.	1.0	1.0	6.0	1.0	2.0	4.0	1.0	2.0	1.0	3.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
114	3.0	2.0	3.0	2.0	.	1.0	2.0	.	.	.	.	1.0
115	1.0	2.0	1.0	1.0	.	1.0	2.0	.	.	.	.	1.0
116	2.0	2.0	2.0	2.0	3.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0
117	3.0	2.0	3.0	3.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
118	4.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NL
114	22.2	5.2	23.2	13.0	4.2	11.0	3.4	5.2	3.0	1.0	1.4	5.0
115	23.8	4.6	21.0	14.4	4.4	11.2	3.8	7.4	3.4	1.0	3.2	5.0
116	12.8	3.6	13.6	7.8	1.8	7.2	2.0	4.4	1.8	1.0	1.0	4.4
117	18.5	3.0	22.0	10.5	4.0	11.0	4.0	7.0	5.0	1.0	2.0	5.5
118	22.2	4.4	22.0	13.2	3.8	11.4	4.0	7.4	3.4	1.0	2.0	7.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
114	.	.	.	.	.	.	.	.	.	.	.
115	.	.	.	.	.	.	.	.	.	.	.
116	.	.	.	.	.	.	.	.	.	.	.
117	5.0	25.5	3.0	11.0	10.5	16.0	5.0	4.0	14.0	4.5	2.0
118	5.0	19.6	3.8	7.6	8.6	13.2	4.2	3.2	13.6	4.0	2.0

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
119	.	.	1.0	1.0	6.0	1.0	2.0	4.0	1.0	2.0	1.0	3.0
120	.	.	1.0	1.0	1.0	1.0	3.0	2.0	3.0	3.0	1.0	3.0
121	.	.	3.0	4.0	.	1.0	3.0	1.0	3.0	3.0	1.0	3.0
122	.	.	3.0	1.0	1.0	1.0	3.0	.	2.6	2.3	2.0	3.0
123	100.0	125.0	1.0	3.0	2.0	1.0	2.0	4.0	2.0	3.0	1.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
119	4.0	3.0	3.0	2.0	2.0	1.0	2.0	1.0	3.0	3.0	4.0	1.0
120	3.0	4.0	3.0	2.0	3.0	1.0	2.0	1.0	1.0	3.0	4.0	1.0
121	3.0	4.0	4.0	4.0	4.0	1.0	2.0	1.0	3.0	1.0	4.0	1.0
122	4.0	4.0	3.0	4.0	4.0	1.0	2.0	1.0	1.0	1.0	2.0	1.0
123	3.0	3.0	2.0	2.6	1.0	1.0	2.1	1.0	1.0	1.0	3.6	1.1

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
119	21.6	3.4	27.0	13.0	5.0	13.0	4.6	13.8	5.8	1.0	5.0	5.2
120	44.6	13.0	44.4	25.8	5.6	22.8	5.2	11.8	4.6	1.2	2.0	5.0
121	18.8	2.0	25.6	11.8	4.8	12.0	4.0	10.8	5.0	1.0	3.2	5.4
122	19.0	4.5	20.0	10.0	3.5	9.5	2.5	9.5	3.5	1.0	2.0	5.5
123	30.4	7.8	24.2	15.0	8.0	13.6	7.4	7.0	3.4	1.0	3.2	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
119	.	.	.	.	.	.	.	.	.	.	.
120	.	.	.	.	.	.	.	.	.	.	.
121	.	.	.	.	.	.	.	.	.	.	.
122	5.0	22.0	3.5	8.5	8.5	14.0	5.5	3.0	12.5	4.5	1.5
123	5.4	23.6	11.4	9.4	9.8	17.8	7.2	3.0	16.4	6.6	2.4

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
124	130.0	110.0	2.0	2.0	6.0	1.0	2.0	3.0	3.0	2.0	2.0	3.0
125	90.0	100.0	1.0	1.0	5.0	1.0	2.0	3.0	3.0	2.0	1.0	1.0
126	135.0	120.0	2.0	2.0	6.0	1.0	3.0	3.0	3.0	2.0	1.0	1.0
127	100.0	130.0	4.0	1.0	1.0	1.0	3.0	2.0	2.0	2.0	1.0	2.0
128	75.0	110.0	3.0	1.0	2.0	1.0	3.0	4.0	1.0	1.0	4.0	2.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
124	2.0	3.0	2.0	2.6	2.0	1.0	2.1	1.0	1.0	2.0	3.6	1.1
125	2.0	3.0	2.0	2.6	2.0	1.0	2.1	3.0	3.0	2.0	3.6	1.1
126	2.0	2.0	2.0	2.0	2.0	1.0	2.1	1.0	2.0	2.0	3.6	1.0
127	3.0	3.0	2.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	3.6	1.0
128	3.0	2.0	2.0	2.6	2.0	1.0	2.1	1.0	1.0	3.0	3.6	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLLWID	SLLEN	SLLWID	STLEN	STWID	STNOT	DNOT	NLL
124	26.4	6.6	23.0	14.6	5.2	13.2	4.4	9.2	3.0	1.2	1.6	5.0
125	25.6	6.0	24.6	14.2	5.0	12.8	3.8	8.4	3.2	1.0	2.0	5.4
126	22.6	4.6	21.6	13.2	4.2	12.8	3.6	5.6	4.0	1.0	2.6	5.0
127	23.8	6.4	20.4	12.8	4.0	11.6	4.0	9.0	2.8	1.2	0.8	5.0
128	20.6	3.6	19.4	12.0	4.0	11.2	3.8	4.6	2.2	1.0	1.6	5.0

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
124	5.0	21.0	10.4	8.4	7.8	13.2	5.0	3.0	10.2	4.0	1.0
125	5.0	20.8	15.0	8.6	8.0	13.6	5.6	3.0	10.2	3.6	1.2
126	5.0	19.0	10.2	8.0	7.4	12.8	5.4	2.6	10.2	3.8	1.0
127	5.0	16.8	11.0	7.0	7.4	13.6	5.8	3.0	15.4	6.2	2.0
128	5.0	22.2	10.8	10.2	9.0	156.0	6.6	2.0	14.2	5.6	1.6

CODE	HGHT	WID	FOM	LCOL	FCOL	STCOL	SDCOL	FLORR	TIM	DUR	ISTPUB	OSTPUB
129	100.0	125.0	1.0	1.0	7.0	1.0	3.0	3.0	3.0	2.0	1.0	2.0
130	140.0	130.0	1.0	1.0	6.0	1.0	2.0	3.0	3.0	2.0	2.0	3.0
131	75.0	130.0	3.0	3.0	1.0	1.0	2.0	3.0	3.0	2.0	1.0	3.0
132	45.0	100.0	3.0	2.0	5.0	1.0	1.0	3.0	3.0	2.0	1.0	1.0

CODE	ULPUB	LLPUB	MRPUB	PETPUB	PEDPUB	LVEIN	LTEX	ESEP	EBCT	PROSED	ABSED	STMEM
129	2.0	3.0	2.0	2.6	2.0	2.0	2.1	1.0	1.0	3.0	3.6	1.0
130	3.0	4.0	2.0	2.6	2.0	2.0	2.1	1.0	1.0	3.0	3.6	1.0
131	2.0	3.0	2.0	2.6	2.0	1.0	2.1	1.0	1.0	3.0	3.6	1.0
132	1.0	2.0	2.0	2.6	2.0	1.0	2.1	1.0	1.0	2.0	2.0	1.0

CODE	LLEN	PETOLEN	LWID	TLLEN	TLWID	SLLEN	SLWID	STLEN	STWID	STNOT	DNOT	NLL
129	24.0	4.4	26.0	15.6	4.4	12.2	4.0	4.6	2.2	1.0	1.6	4.6
130	23.2	4.4	23.8	12.6	4.4	12.4	3.4	8.4	3.4	1.0	1.8	5.0
131	13.8	1.8	18.2	8.2	3.2	8.4	2.8	8.0	3.2	1.0	3.0	5.0
132	14.2	1.6	19.0	8.2	2.6	9.2	2.0	6.8	2.8	1.0	2.4	6.2

CODE	NPET	FLD	PEDL	PETL	PETW	SEPD	SLEN	SWID	BRD	BRLEN	BRWID
129	5.0	21.8	10.2	9.2	8.4	12.6	5.4	2.6	9.8	3.8	1.0
130	5.0	22.4	7.4	9.4	9.2	16.6	6.6	3.0	18.2	7.4	2.8
131	5.0	23.0	9.2	10.0	10.0	15.8	6.2	3.2	16.4	6.4	6.4
132	5.0	24.2	8.8	10.2	10.2	14.4	6.0	3.2	15.0	6.4	2.0

CODE =	TAXA*	CODE =	TAXA	CODE =	TAXA
1	'Whitemouth'	50	'Peytolak5'	101	'Mafking1'
2	'Arbuscula'	51	'Petolak4'	102	'Arbourg'
3	'Bowflats1'	52	'Peytolak3'	104	'Stuartburn'
4	'BowflatsD'	53	'Peytolak2'	105	'Simon2'
5	'Purdomi'	54	'Peytolak1'	106	'Simon1'
6	'Sutter'	55	'Peytoview'	107	'Athabask'
7	'Grandiflora'	56	'BF3'	108	'Goldstar'
8	'Rheder'	57	'Hurstborn'	109	'Pinkdawn'
9	'Parvifolia'	58	'700'	110	'Mic2'
10	'Coront'	59	'Whitegold'	111	'Mtever2'
11	'Davurica'	60	'Daydawn'	112	'Nyeform2'
12	'Mandsh'	61	'Peytolak6'	113	'Sandwadena'
13	'Fried'	62	'Halldwarf'	114	'Halldw2'
14	'Glabra'	63	'Dartsgolddig'	115	'Stockers'
15	'Micandra'	64	'Nyeform'	116	'Buttercup2'
16	'Moon1'	65	'Oeland'	117	'Dartgolddig2'
17	'Maaneley'	66	'8102'	118	'Hollgold#2'
18	'Hersi'	67	'7901'	119	'Daksunrise'
19	'Marchand'	68	'Orangem'	120	'Angling1'
20	'Hach'	69	'Cowan2'	121	'Banbanoch'
21	'Butter'	70	'Cowan1'	122	'Goldteppich'
22	'Sandved'	71	'Walton'	123	'Beani'
23	'K Dyke'	72	'Klond'	124	'Emmalake'
24	'Veitchi'	73	'Minima'	125	'Goldfried'
25	'Farreri'	74	'Hollandg'	126	'Berlinbeauty'
26	'Mt Ever'	75	'Whiterain'	127	'Subalbicans'
27	'Lemon'	76	'Snowlak2'	128	'Abbotwood'
28	'Conlake5'	77	'Snowlak1'	129	'Ochrole'
29	'Irving'	78	'K1SK13'	130	'Freisengold'
30	'Yellowsingle'	79	'Olds2'	131	'Northman1'
31	'Primrose'	80	'Olds1'	132	'Knaphill'
32	'Roseacre'	84	'Olds3'		
33	'Farreriwhite'	85	'Cyphill1'		
34	'Suttergold'	86	'Cyphill2'		
35	'Tanger'	87	'Cyphill3'		
36	'Conlak1'	88	'Microtow2'		
37	'Conlak2'	89	'Microtow3'		
38	'Conlak3'	90	'Grandrap1'		
39	'Conlak4'	91	'Grandrap2'		
40	'Dartsnug1'	92	'Grandrap3'		
41	'Beesi'	93	'Devill1'		
42	'Sunset'	94	'Devill2'		
43	'Tenulob'	95	'Devill3'		
44	'Jack'	96	'Cowan3'		
45	'Fran'	97	'Cowan4'		
46	'BF2'	98	'Kiski1'		
47	'Tanger2'	99	'Kiski2'		
48	'Long'	100	'Mafking2'		
49	'Peytostream'				

* For a complete list of names of taxa, see appendix 1.

Key to Abbreviations for Character Assessments

HGHT = Height
WID = Width
FOM = Form
LCOL = Leaf colour
FCOL = Flower colour
STCOL = Stamen colour
SDCOL = Fruit colour
FLORR = Floriferous rating
TIM = Timing of bloom
DUR = Duration of bloom
ISTPUB = Inner stipule vesture
OSTPUB = Outer stipule vesture
ULPUB = Upper leaf vesture
LLPUB = Lower leaf vesture
MRPUB = Mid rib vesture
PETPUB = Petiole vesture
PEDPUB = Peduncle vesture
LVEIN = Leaf venation
LTEX = Leaf texture
ESEP = Edge of sepal
EBCT = Edge of bract
PROSET = Prominance of fruit
ABSETD = Abundance of fruit
STMEM = Stipules membranous
LLEN = Leaf length
PETOLEN = Petiole length
LWID = Leaf width
TLLLEN = Terminal leaflet length
TLLWID = Terminal leaflet width
SLLLEN = Secondary leaflet length
SLLWID = Secondary leaflet width
STLEN = Stipule length
STWID = Stipule width
STNOT = Stipule notch
DNOT = Depth of notch
NLL = Number of leaflets
NPET = Number of petals
FLD = Flower diameter
PEDL = Peduncle length
PETL = Petal length
PETW = Petal width
SEPD = Calyx diameter
SLEN = Sepal length
SWID = Sepal width
BRD = Epicalyx bract diameter
BRLEN = Bract length
BRWID = Bract width

Appendix 4

SIMILARITY COEFFICIENTS FOR PAIR WISE COMPARISONS BETWEEN 127 SHRUBBY CINQUEFOIL TAXA

(S_1 = Code #1, S_2 = Code #2, etc. as listed in appendix 3)

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                                        SAS

OBS   S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

  1 1.000  0.798  0.781  0.986  0.907  0.723  0.780  0.794  0.714  0.815  0.736  0.751
  2 0.798  1.000  0.768  0.744  0.816  0.749  0.745  0.839  0.788  0.806  0.777  0.782
  3 0.781  0.768  1.000  0.737  0.780  0.761  0.832  0.746  0.746  0.781  0.700  0.722
  4 0.986  0.744  0.737  1.000  0.914  0.678  0.740  0.738  0.678  0.766  0.693  0.765
  5 0.907  0.816  0.780  0.914  1.000  0.700  0.711  0.780  0.741  0.747  0.715  0.736
  6 0.723  0.749  0.761  0.678  0.700  1.000  0.806  0.839  0.694  0.790  0.810  0.711
  7 0.780  0.745  0.832  0.740  0.711  0.806  1.000  0.795  0.740  0.829  0.758  0.765
  8 0.794  0.839  0.746  0.738  0.780  0.839  0.795  1.000  0.784  0.883  0.885  0.761
  9 0.714  0.788  0.746  0.678  0.741  0.694  0.740  0.784  1.000  0.778  0.789  0.683
 10 0.815  0.806  0.781  0.766  0.747  0.790  0.829  0.883  0.778  1.000  0.814  0.781
 11 0.736  0.777  0.700  0.693  0.715  0.810  0.758  0.885  0.789  0.814  1.000  0.698

OBS   S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

  1 0.691  0.736  0.738  0.656  0.793  0.791  0.762  0.867  0.846  0.754  0.798  0.781
  2 0.629  0.729  0.701  0.700  0.793  0.791  0.752  0.807  0.822  0.767  0.813  0.759
  3 0.744  0.745  0.693  0.724  0.835  0.835  0.793  0.768  0.813  0.738  0.795  0.811
  4 0.688  0.710  0.752  0.623  0.748  0.756  0.741  0.818  0.786  0.695  0.743  0.733
  5 0.692  0.718  0.724  0.631  0.747  0.753  0.705  0.895  0.780  0.741  0.741  0.699
  6 0.602  0.801  0.602  0.685  0.740  0.739  0.750  0.737  0.742  0.776  0.727  0.711
  7 0.663  0.785  0.669  0.701  0.770  0.776  0.780  0.768  0.861  0.873  0.761  0.809
  8 0.631  0.778  0.674  0.723  0.799  0.794  0.799  0.811  0.827  0.827  0.817  0.781
  9 0.601  0.704  0.624  0.706  0.764  0.760  0.706  0.753  0.791  0.786  0.771  0.787
 10 0.638  0.776  0.691  0.754  0.816  0.824  0.849  0.799  0.892  0.799  0.817  0.839
 11 0.590  0.782  0.627  0.701  0.763  0.766  0.752  0.740  0.774  0.836  0.840  0.790

OBS   S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

  1 0.762  0.814  0.822  0.771  0.859  0.824  0.819  0.779  0.783  0.794  0.800  0.795
  2 0.748  0.794  0.846  0.803  0.778  0.822  0.787  0.761  0.789  0.816  0.777  0.736
  3 0.770  0.727  0.845  0.751  0.792  0.810  0.833  0.823  0.778  0.791  0.945  0.781
  4 0.726  0.774  0.772  0.723  0.870  0.785  0.779  0.736  0.753  0.753  0.743  0.756
  5 0.676  0.802  0.801  0.750  0.914  0.855  0.757  0.738  0.727  0.727  0.803  0.722
  6 0.742  0.859  0.707  0.849  0.696  0.798  0.801  0.747  0.723  0.747  0.721  0.746
  7 0.776  0.810  0.804  0.812  0.735  0.794  0.881  0.744  0.769  0.781  0.796  0.829
  8 0.775  0.856  0.805  0.853  0.765  0.823  0.800  0.793  0.811  0.833  0.752  0.752
  9 0.734  0.771  0.789  0.785  0.717  0.774  0.784  0.724  0.731  0.755  0.767  0.752
 10 0.808  0.833  0.841  0.847  0.736  0.796  0.866  0.832  0.845  0.861  0.794  0.792
 11 0.766  0.855  0.759  0.829  0.708  0.793  0.772  0.766  0.797  0.808  0.722  0.787

OBS   S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

  1 0.946  0.911  0.901  0.885  0.714  0.746  0.822  0.872  0.829  0.807  0.910  0.824
  2 0.830  0.790  0.817  0.823  0.806  0.728  0.768  0.761  0.797  0.760  0.822  0.783
  3 0.836  0.753  0.743  0.809  0.720  0.782  0.767  0.745  0.797  0.952  0.770  0.781
  4 0.882  0.919  0.910  0.831  0.679  0.700  0.772  0.877  0.780  0.750  0.924  0.753
  5 0.913  0.943  0.935  0.957  0.751  0.692  0.737  0.926  0.844  0.762  0.929  0.734
  6 0.730  0.698  0.761  0.742  0.748  0.743  0.738  0.671  0.733  0.768  0.730  0.719
  7 0.803  0.723  0.739  0.758  0.672  0.709  0.837  0.679  0.754  0.838  0.726  0.777
  8 0.814  0.777  0.837  0.794  0.816  0.787  0.761  0.750  0.808  0.748  0.794  0.784
  9 0.762  0.719  0.732  0.770  0.750  0.689  0.766  0.706  0.721  0.748  0.721  0.783
 10 0.839  0.754  0.822  0.791  0.762  0.820  0.798  0.715  0.802  0.793  0.758  0.820
 11 0.754  0.719  0.742  0.776  0.849  0.743  0.780  0.710  0.737  0.723  0.745  0.800
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                                        SAS

OBS  S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

  1 0.841 0.909 0.876 0.929 0.965 0.930 0.948 0.926 0.951 0.729 0.817 0.800
  2 0.856 0.870 0.864 0.847 0.757 0.816 0.806 0.837 0.821 0.768 0.816 0.799
  3 0.875 0.790 0.783 0.775 0.735 0.755 0.821 0.793 0.751 0.753 0.894 0.881
  4 0.758 0.831 0.831 0.864 0.971 0.930 0.879 0.870 0.937 0.698 0.762 0.754
  5 0.780 0.925 0.865 0.926 0.899 0.942 0.889 0.944 0.949 0.728 0.804 0.758
  6 0.762 0.802 0.790 0.772 0.675 0.750 0.767 0.757 0.749 0.830 0.741 0.739
  7 0.803 0.758 0.792 0.777 0.743 0.723 0.793 0.782 0.741 0.834 0.808 0.801
  8 0.815 0.833 0.867 0.834 0.743 0.809 0.814 0.837 0.818 0.821 0.796 0.792
  9 0.780 0.772 0.805 0.785 0.680 0.735 0.742 0.780 0.754 0.760 0.784 0.785
 10 0.838 0.803 0.861 0.811 0.775 0.775 0.848 0.814 0.777 0.829 0.834 0.835
 11 0.777 0.795 0.838 0.800 0.697 0.758 0.768 0.779 0.770 0.827 0.769 0.756

OBS  S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

  1 0.818 0.906 0.796 0.776 0.834 0.825 0.715 0.802 0.792 0.813 0.799 0.849
  2 0.736 0.866 0.841 0.826 0.759 0.832 0.746 0.800 0.750 0.820 0.863 0.791
  3 0.803 0.758 0.782 0.777 0.765 0.798 0.778 0.740 0.777 0.778 0.757 0.825
  4 0.753 0.913 0.746 0.723 0.791 0.775 0.658 0.740 0.745 0.758 0.766 0.769
  5 0.745 0.896 0.802 0.769 0.759 0.832 0.689 0.710 0.703 0.748 0.814 0.779
  6 0.760 0.767 0.815 0.804 0.710 0.784 0.850 0.813 0.740 0.712 0.777 0.753
  7 0.801 0.749 0.783 0.777 0.809 0.817 0.780 0.824 0.855 0.787 0.808 0.774
  8 0.739 0.855 0.894 0.910 0.770 0.876 0.831 0.903 0.758 0.795 0.911 0.792
  9 0.754 0.778 0.786 0.771 0.763 0.777 0.712 0.738 0.750 0.729 0.797 0.727
 10 0.791 0.817 0.849 0.831 0.820 0.849 0.783 0.895 0.814 0.794 0.863 0.822
 11 0.769 0.802 0.881 0.900 0.806 0.812 0.811 0.839 0.782 0.762 0.844 0.721

OBS  S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

  1 0.754 0.790 0.799 0.849 0.818 0.860 0.860 0.817 0.827 0.836 0.826 0.895
  2 0.771 0.775 0.832 0.824 0.819 0.855 0.849 0.818 0.797 0.856 0.746 0.811
  3 0.722 0.757 0.834 0.820 0.759 0.782 0.762 0.750 0.771 0.749 0.713 0.772
  4 0.714 0.740 0.750 0.798 0.764 0.860 0.871 0.826 0.834 0.839 0.832 0.823
  5 0.734 0.694 0.817 0.785 0.820 0.883 0.878 0.843 0.849 0.857 0.849 0.881
  6 0.817 0.767 0.792 0.729 0.711 0.729 0.772 0.716 0.715 0.697 0.690 0.780
  7 0.809 0.811 0.784 0.812 0.762 0.715 0.740 0.695 0.691 0.702 0.676 0.788
  8 0.864 0.855 0.879 0.840 0.808 0.856 0.885 0.837 0.812 0.819 0.765 0.848
  9 0.776 0.787 0.809 0.781 0.836 0.790 0.773 0.776 0.748 0.791 0.729 0.794
 10 0.886 0.916 0.863 0.876 0.811 0.817 0.838 0.790 0.774 0.780 0.731 0.844
 11 0.846 0.840 0.808 0.763 0.817 0.758 0.793 0.790 0.730 0.802 0.729 0.786

OBS  S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

  1 0.894 0.868 0.881 0.908 0.807 0.868 0.841 0.874 0.876 0.846 0.845 0.881
  2 0.793 0.788 0.849 0.789 0.790 0.825 0.830 0.822 0.854 0.828 0.828 0.830
  3 0.821 0.781 0.814 0.778 0.709 0.783 0.752 0.770 0.763 0.804 0.749 0.750
  4 0.832 0.838 0.820 0.896 0.813 0.817 0.792 0.827 0.838 0.784 0.844 0.885
  5 0.847 0.819 0.902 0.844 0.811 0.806 0.832 0.800 0.878 0.778 0.867 0.870
  6 0.737 0.675 0.755 0.703 0.686 0.702 0.751 0.710 0.757 0.768 0.756 0.792
  7 0.783 0.738 0.766 0.744 0.711 0.750 0.768 0.770 0.784 0.783 0.707 0.766
  8 0.821 0.777 0.829 0.807 0.814 0.803 0.842 0.819 0.861 0.818 0.822 0.877
  9 0.757 0.784 0.792 0.735 0.780 0.772 0.827 0.789 0.797 0.738 0.734 0.753
 10 0.840 0.801 0.811 0.830 0.802 0.835 0.825 0.849 0.841 0.842 0.782 0.826
 11 0.735 0.794 0.776 0.715 0.770 0.789 0.863 0.818 0.811 0.740 0.723 0.760
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                                        SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

  1 0.874 0.854 0.836 0.823 0.818 0.842 0.826 0.888 0.777 0.836 0.740 0.709
  2 0.856 0.843 0.859 0.836 0.826 0.792 0.777 0.829 0.830 0.802 0.786 0.816
  3 0.762 0.749 0.779 0.732 0.735 0.703 0.699 0.746 0.816 0.767 0.806 0.736
  4 0.850 0.816 0.794 0.836 0.762 0.863 0.840 0.883 0.716 0.766 0.695 0.694
  5 0.882 0.849 0.858 0.844 0.822 0.866 0.844 0.872 0.787 0.753 0.731 0.733
  6 0.762 0.730 0.746 0.686 0.742 0.680 0.648 0.769 0.805 0.761 0.837 0.707
  7 0.756 0.773 0.750 0.696 0.719 0.665 0.669 0.750 0.816 0.812 0.894 0.729
  8 0.864 0.832 0.820 0.804 0.801 0.780 0.757 0.870 0.885 0.832 0.871 0.803
  9 0.796 0.810 0.823 0.791 0.766 0.713 0.746 0.754 0.761 0.759 0.781 0.777
 10 0.834 0.831 0.812 0.764 0.777 0.758 0.736 0.816 0.824 0.876 0.856 0.804
 11 0.775 0.843 0.850 0.804 0.776 0.697 0.758 0.768 0.836 0.754 0.853 0.805

OBS S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

  1 0.833 0.795 0.783 0.747 0.784 0.797 0.792 0.798 0.823 0.841 0.796 0.723
  2 0.791 0.744 0.759 0.702 0.758 0.759 0.775 0.737 0.841 0.763 0.724 0.720
  3 0.769 0.762 0.714 0.671 0.716 0.706 0.785 0.755 0.725 0.803 0.735 0.756
  4 0.789 0.743 0.797 0.741 0.798 0.817 0.736 0.786 0.837 0.831 0.811 0.695
  5 0.841 0.705 0.741 0.685 0.794 0.776 0.731 0.717 0.843 0.784 0.826 0.700
  6 0.794 0.789 0.720 0.687 0.788 0.746 0.783 0.755 0.716 0.647 0.634 0.749
  7 0.829 0.819 0.745 0.731 0.816 0.735 0.750 0.712 0.708 0.747 0.676 0.746
  8 0.798 0.818 0.796 0.764 0.792 0.857 0.843 0.831 0.840 0.738 0.731 0.789
  9 0.779 0.746 0.740 0.687 0.720 0.719 0.768 0.715 0.730 0.702 0.712 0.726
 10 0.802 0.873 0.808 0.790 0.807 0.810 0.855 0.840 0.797 0.760 0.716 0.754
 11 0.772 0.832 0.731 0.716 0.725 0.801 0.840 0.821 0.741 0.673 0.697 0.787

OBS    S121      S122      S123      S124      S125      S126      S127      S128      S129

  1    0.679     0.727     0.803     0.787     0.771     0.780     0.735     0.829     0.740
  2    0.735     0.716     0.774     0.819     0.810     0.823     0.773     0.789     0.745
  3    0.757     0.740     0.789     0.737     0.749     0.749     0.774     0.799     0.743
  4    0.662     0.705     0.756     0.764     0.746     0.747     0.713     0.770     0.707
  5    0.672     0.648     0.748     0.794     0.765     0.788     0.745     0.816     0.740
  6    0.773     0.700     0.820     0.723     0.832     0.789     0.778     0.755     0.745
  7    0.768     0.805     0.835     0.745     0.770     0.778     0.724     0.789     0.848
  8    0.740     0.793     0.814     0.816     0.863     0.875     0.828     0.816     0.808
  9    0.710     0.708     0.756     0.774     0.766     0.778     0.765     0.779     0.770
 10    0.742     0.818     0.836     0.799     0.850     0.894     0.805     0.805     0.790
 11    0.768     0.787     0.772     0.797     0.867     0.811     0.839     0.844     0.817
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                                      SAS

OBS  S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

12   0.751  0.782  0.722  0.765  0.736  0.711  0.765  0.761  0.683  0.781  0.698  1.000
13   0.691  0.629  0.744  0.688  0.692  0.602  0.663  0.631  0.601  0.638  0.590  0.686
14   0.736  0.729  0.745  0.710  0.718  0.801  0.785  0.778  0.704  0.776  0.782  0.771
15   0.738  0.701  0.693  0.752  0.724  0.602  0.669  0.674  0.624  0.691  0.627  0.762
16   0.656  0.700  0.724  0.623  0.631  0.685  0.701  0.723  0.706  0.754  0.701  0.650
17   0.793  0.793  0.835  0.748  0.747  0.740  0.770  0.799  0.764  0.816  0.763  0.722
18   0.791  0.791  0.835  0.756  0.753  0.739  0.776  0.794  0.760  0.824  0.766  0.733
19   0.762  0.752  0.793  0.741  0.705  0.750  0.780  0.799  0.706  0.849  0.752  0.793
20   0.867  0.807  0.768  0.818  0.895  0.737  0.768  0.811  0.753  0.799  0.740  0.753
21   0.846  0.822  0.813  0.786  0.780  0.742  0.861  0.827  0.791  0.892  0.774  0.775
22   0.754  0.767  0.738  0.695  0.741  0.776  0.873  0.827  0.786  0.799  0.836  0.758

OBS  S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

12   0.686  0.771  0.762  0.650  0.722  0.733  0.793  0.753  0.775  0.758  0.727  0.725
13   1.000  0.668  0.783  0.660  0.687  0.689  0.641  0.694  0.673  0.641  0.616  0.664
14   0.668  1.000  0.723  0.747  0.752  0.765  0.724  0.738  0.739  0.791  0.774  0.773
15   0.783  0.723  1.000  0.647  0.661  0.674  0.638  0.692  0.745  0.636  0.636  0.700
16   0.660  0.747  0.647  1.000  0.736  0.740  0.688  0.735  0.739  0.705  0.746  0.743
17   0.687  0.752  0.661  0.736  1.000  0.976  0.832  0.819  0.842  0.727  0.866  0.821
18   0.689  0.765  0.674  0.740  0.976  1.000  0.848  0.811  0.836  0.728  0.861  0.817
19   0.641  0.724  0.638  0.688  0.832  0.848  1.000  0.783  0.822  0.725  0.814  0.769
20   0.694  0.738  0.692  0.735  0.819  0.811  0.783  1.000  0.835  0.774  0.780  0.766
21   0.673  0.739  0.745  0.739  0.842  0.836  0.822  0.835  1.000  0.828  0.841  0.880
22   0.641  0.791  0.636  0.705  0.727  0.728  0.725  0.774  0.828  1.000  0.784  0.849

OBS  S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

12   0.775  0.786  0.800  0.777  0.763  0.771  0.819  0.696  0.771  0.774  0.738  0.756
13   0.639  0.608  0.719  0.587  0.753  0.684  0.657  0.741  0.671  0.671  0.748  0.671
14   0.810  0.766  0.736  0.872  0.681  0.771  0.805  0.698  0.718  0.715  0.740  0.797
15   0.614  0.671  0.719  0.602  0.745  0.697  0.676  0.625  0.692  0.679  0.678  0.678
16   0.717  0.680  0.733  0.719  0.664  0.728  0.710  0.698  0.698  0.716  0.715  0.690
17   0.818  0.761  0.875  0.788  0.741  0.823  0.821  0.854  0.839  0.852  0.873  0.758
18   0.823  0.757  0.885  0.782  0.751  0.830  0.831  0.855  0.848  0.844  0.873  0.764
19   0.835  0.796  0.867  0.780  0.735  0.790  0.800  0.822  0.908  0.898  0.809  0.752
20   0.762  0.825  0.794  0.819  0.881  0.860  0.786  0.783  0.788  0.807  0.787  0.747
21   0.807  0.829  0.874  0.833  0.808  0.834  0.862  0.793  0.833  0.858  0.825  0.800
22   0.794  0.831  0.753  0.883  0.777  0.801  0.846  0.705  0.713  0.735  0.755  0.834

OBS  S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

12   0.786  0.771  0.781  0.761  0.696  0.660  0.763  0.765  0.748  0.718  0.759  0.723
13   0.682  0.702  0.657  0.703  0.620  0.689  0.653  0.686  0.632  0.711  0.696  0.678
14   0.755  0.690  0.756  0.743  0.714  0.688  0.791  0.676  0.760  0.758  0.713  0.752
15   0.716  0.732  0.724  0.720  0.667  0.580  0.661  0.678  0.657  0.686  0.751  0.715
16   0.713  0.648  0.675  0.709  0.709  0.694  0.675  0.637  0.700  0.706  0.640  0.725
17   0.816  0.698  0.729  0.766  0.784  0.854  0.760  0.771  0.829  0.834  0.716  0.778
18   0.816  0.705  0.732  0.773  0.789  0.841  0.760  0.769  0.836  0.831  0.720  0.771
19   0.808  0.710  0.752  0.746  0.721  0.812  0.756  0.715  0.821  0.800  0.727  0.740
20   0.887  0.832  0.881  0.886  0.789  0.764  0.758  0.828  0.864  0.746  0.876  0.753
21   0.865  0.787  0.813  0.817  0.770  0.760  0.812  0.737  0.826  0.800  0.801  0.846
22   0.767  0.756  0.778  0.779  0.752  0.675  0.861  0.706  0.711  0.747  0.755  0.800
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OBS  S49   S50   S51   S52   S53   S54   S55   S56   S57   S58   S59   S60

12  0.756 0.768 0.763 0.768 0.780 0.745 0.756 0.764 0.741 0.765 0.743 0.732
13  0.698 0.649 0.661 0.681 0.675 0.694 0.693 0.712 0.699 0.647 0.721 0.753
14  0.751 0.760 0.775 0.770 0.721 0.718 0.774 0.759 0.736 0.739 0.752 0.748
15  0.697 0.709 0.741 0.737 0.756 0.726 0.717 0.735 0.723 0.643 0.693 0.715
16  0.740 0.699 0.750 0.707 0.620 0.672 0.731 0.718 0.657 0.703 0.732 0.718
17  0.885 0.758 0.811 0.769 0.741 0.743 0.813 0.798 0.769 0.755 0.887 0.880
18  0.880 0.765 0.816 0.771 0.756 0.744 0.817 0.800 0.765 0.768 0.892 0.884
19  0.804 0.760 0.787 0.755 0.743 0.713 0.788 0.768 0.717 0.809 0.798 0.786
20  0.792 0.859 0.876 0.904 0.816 0.900 0.892 0.931 0.889 0.776 0.770 0.767
21  0.868 0.828 0.877 0.849 0.794 0.806 0.859 0.839 0.809 0.823 0.861 0.874
22  0.772 0.793 0.809 0.801 0.703 0.764 0.760 0.800 0.787 0.855 0.767 0.757

OBS  S61   S62   S63   S64   S65   S66   S67   S68   S69   S70   S71   S72

12  0.743 0.757 0.741 0.728 0.722 0.772 0.732 0.746 0.752 0.769 0.771 0.750
13  0.688 0.693 0.684 0.673 0.685 0.674 0.644 0.610 0.662 0.697 0.638 0.740
14  0.806 0.735 0.753 0.721 0.759 0.777 0.709 0.745 0.786 0.720 0.808 0.757
15  0.701 0.776 0.689 0.674 0.738 0.681 0.607 0.647 0.657 0.674 0.701 0.686
16  0.678 0.695 0.753 0.718 0.704 0.717 0.689 0.723 0.718 0.687 0.738 0.706
17  0.757 0.784 0.827 0.842 0.783 0.779 0.729 0.808 0.747 0.792 0.825 0.839
18  0.752 0.777 0.827 0.839 0.786 0.793 0.723 0.808 0.751 0.790 0.839 0.838
19  0.725 0.734 0.799 0.807 0.752 0.822 0.815 0.828 0.764 0.750 0.810 0.782
20  0.737 0.871 0.829 0.802 0.791 0.832 0.761 0.767 0.746 0.802 0.841 0.803
21  0.813 0.854 0.822 0.822 0.870 0.823 0.772 0.843 0.842 0.809 0.837 0.833
22  0.840 0.770 0.793 0.791 0.821 0.830 0.767 0.788 0.861 0.756 0.814 0.766

OBS  S73   S74   S75   S76   S77   S78   S79   S80   S81   S82   S83   S84

12  0.772 0.735 0.775 0.802 0.729 0.770 0.766 0.727 0.742 0.735 0.729 0.763
13  0.592 0.607 0.694 0.728 0.666 0.702 0.688 0.674 0.661 0.669 0.682 0.663
14  0.824 0.795 0.802 0.767 0.761 0.716 0.754 0.770 0.740 0.749 0.739 0.764
15  0.599 0.642 0.712 0.719 0.746 0.755 0.735 0.717 0.682 0.720 0.664 0.696
16  0.719 0.733 0.773 0.765 0.742 0.722 0.731 0.724 0.737 0.710 0.679 0.725
17  0.743 0.806 0.872 0.867 0.778 0.820 0.807 0.793 0.764 0.807 0.739 0.778
18  0.743 0.808 0.871 0.868 0.777 0.819 0.805 0.788 0.762 0.800 0.735 0.777
19  0.792 0.811 0.792 0.860 0.746 0.741 0.755 0.722 0.765 0.722 0.712 0.792
20  0.804 0.751 0.861 0.845 0.848 0.905 0.897 0.880 0.880 0.875 0.834 0.906
21  0.794 0.850 0.838 0.869 0.867 0.839 0.833 0.806 0.780 0.840 0.747 0.838
22  0.873 0.826 0.800 0.774 0.854 0.759 0.768 0.784 0.756 0.799 0.752 0.818

OBS  S85   S86   S87   S88   S89   S90   S91   S92   S93   S94   S95   S96

12  0.766 0.730 0.773 0.774 0.733 0.765 0.764 0.748 0.781 0.761 0.732 0.777
13  0.724 0.662 0.745 0.686 0.661 0.629 0.645 0.634 0.675 0.710 0.701 0.697
14  0.759 0.755 0.754 0.729 0.745 0.776 0.793 0.800 0.772 0.766 0.718 0.771
15  0.699 0.706 0.728 0.746 0.747 0.709 0.717 0.713 0.763 0.665 0.672 0.707
16  0.741 0.724 0.726 0.706 0.713 0.731 0.737 0.731 0.732 0.734 0.704 0.679
17  0.849 0.818 0.815 0.824 0.753 0.835 0.803 0.835 0.827 0.828 0.774 0.774
18  0.843 0.821 0.815 0.822 0.746 0.837 0.802 0.838 0.833 0.827 0.768 0.765
19  0.811 0.751 0.773 0.784 0.731 0.811 0.765 0.796 0.792 0.810 0.738 0.764
20  0.886 0.828 0.910 0.834 0.832 0.837 0.869 0.837 0.911 0.836 0.894 0.887
21  0.848 0.834 0.837 0.839 0.839 0.868 0.861 0.865 0.854 0.845 0.803 0.835
22  0.753 0.766 0.788 0.706 0.829 0.777 0.844 0.793 0.788 0.749 0.741 0.790
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                                        SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

12  0.769 0.750 0.765 0.729 0.729 0.752 0.710 0.774 0.727 0.774 0.723 0.800
13  0.675 0.653 0.638 0.657 0.685 0.687 0.650 0.710 0.659 0.675 0.670 0.645
14  0.764 0.801 0.785 0.739 0.785 0.684 0.701 0.762 0.734 0.743 0.737 0.734
15  0.745 0.737 0.716 0.717 0.671 0.724 0.694 0.708 0.673 0.731 0.684 0.691
16  0.723 0.734 0.728 0.706 0.713 0.666 0.678 0.689 0.730 0.704 0.733 0.687
17  0.819 0.792 0.802 0.779 0.789 0.784 0.748 0.783 0.789 0.799 0.768 0.783
18  0.817 0.805 0.807 0.775 0.782 0.784 0.748 0.776 0.778 0.802 0.765 0.783
19  0.783 0.775 0.780 0.697 0.752 0.719 0.692 0.761 0.756 0.794 0.765 0.827
20  0.889 0.877 0.852 0.885 0.867 0.825 0.814 0.885 0.796 0.777 0.774 0.775
21  0.838 0.842 0.843 0.814 0.806 0.780 0.785 0.811 0.791 0.853 0.840 0.798
22  0.762 0.830 0.816 0.781 0.785 0.684 0.753 0.791 0.791 0.780 0.855 0.784

OBS S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

12  0.783 0.767 0.814 0.768 0.781 0.777 0.713 0.688 0.763 0.725 0.732 0.718
13  0.716 0.624 0.694 0.662 0.680 0.672 0.624 0.622 0.660 0.786 0.770 0.687
14  0.758 0.773 0.799 0.761 0.741 0.696 0.819 0.797 0.736 0.671 0.632 0.829
15  0.744 0.606 0.688 0.628 0.722 0.691 0.666 0.652 0.766 0.705 0.768 0.679
16  0.679 0.721 0.716 0.723 0.651 0.674 0.721 0.673 0.671 0.643 0.639 0.722
17  0.754 0.775 0.744 0.708 0.712 0.761 0.828 0.827 0.770 0.838 0.770 0.749
18  0.754 0.768 0.745 0.704 0.716 0.760 0.824 0.817 0.778 0.834 0.774 0.759
19  0.749 0.793 0.769 0.728 0.748 0.770 0.789 0.765 0.727 0.756 0.689 0.812
20  0.833 0.754 0.774 0.752 0.807 0.776 0.763 0.722 0.857 0.792 0.754 0.761
21  0.839 0.809 0.778 0.754 0.818 0.762 0.797 0.765 0.789 0.804 0.768 0.738
22  0.858 0.811 0.765 0.760 0.845 0.746 0.763 0.746 0.721 0.719 0.706 0.779

OBS     S121     S122     S123     S124     S125     S126     S127     S128     S129

12      0.733    0.678    0.795    0.770    0.788    0.758    0.705    0.733    0.758
13      0.639    0.620    0.627    0.654    0.680    0.607    0.617    0.643    0.641
14      0.873    0.823    0.829    0.740    0.749    0.804    0.836    0.815    0.770
15      0.698    0.676    0.649    0.812    0.687    0.690    0.653    0.696    0.658
16      0.713    0.799    0.719    0.659    0.716    0.732    0.729    0.714    0.753
17      0.735    0.762    0.828    0.779    0.781    0.796    0.818    0.763    0.727
18      0.750    0.773    0.826    0.789    0.791    0.807    0.823    0.766    0.731
19      0.716    0.753    0.796    0.761    0.830    0.791    0.746    0.774    0.740
20      0.743    0.748    0.809    0.802    0.793    0.829    0.795    0.840    0.788
21      0.737    0.804    0.836    0.822    0.823    0.836    0.773    0.835    0.822
22      0.798    0.785    0.825    0.741    0.778    0.789    0.778    0.854    0.907
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                                                 SAS

OBS   S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

23  0.798 0.813 0.795 0.743 0.741 0.727 0.761 0.817 0.771 0.817 0.840 0.727
24  0.781 0.759 0.811 0.733 0.699 0.711 0.809 0.781 0.787 0.839 0.790 0.725
25  0.762 0.748 0.770 0.726 0.676 0.742 0.776 0.775 0.734 0.808 0.766 0.775
26  0.814 0.794 0.727 0.774 0.802 0.859 0.810 0.856 0.771 0.833 0.855 0.786
27  0.822 0.846 0.845 0.772 0.801 0.707 0.804 0.805 0.789 0.841 0.759 0.800
28  0.771 0.803 0.751 0.723 0.750 0.849 0.812 0.853 0.785 0.847 0.829 0.777
29  0.859 0.778 0.792 0.870 0.914 0.696 0.735 0.765 0.717 0.736 0.708 0.763
30  0.824 0.822 0.810 0.785 0.855 0.798 0.794 0.823 0.774 0.796 0.793 0.771
31  0.819 0.787 0.833 0.779 0.757 0.801 0.881 0.800 0.784 0.866 0.772 0.819
32  0.779 0.761 0.823 0.736 0.738 0.747 0.744 0.793 0.724 0.832 0.766 0.696
33  0.783 0.789 0.778 0.753 0.727 0.723 0.769 0.811 0.731 0.845 0.797 0.771

OBS   S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

23  0.616 0.774 0.636 0.746 0.866 0.861 0.814 0.780 0.841 0.784 1.000 0.848
24  0.664 0.773 0.700 0.743 0.821 0.817 0.769 0.766 0.880 0.849 0.848 1.000
25  0.639 0.810 0.614 0.717 0.818 0.823 0.835 0.762 0.807 0.794 0.842 0.807
26  0.608 0.766 0.671 0.680 0.761 0.757 0.796 0.825 0.829 0.831 0.784 0.759
27  0.719 0.736 0.719 0.733 0.875 0.885 0.867 0.794 0.874 0.753 0.864 0.836
28  0.587 0.872 0.602 0.719 0.788 0.782 0.780 0.819 0.833 0.883 0.813 0.842
29  0.753 0.681 0.745 0.664 0.741 0.751 0.735 0.881 0.808 0.777 0.746 0.747
30  0.684 0.771 0.697 0.728 0.823 0.830 0.790 0.860 0.834 0.801 0.819 0.753
31  0.657 0.805 0.676 0.710 0.821 0.831 0.800 0.786 0.862 0.846 0.792 0.870
32  0.741 0.698 0.625 0.698 0.854 0.855 0.822 0.783 0.793 0.705 0.832 0.747
33  0.671 0.718 0.692 0.698 0.839 0.848 0.908 0.788 0.833 0.713 0.856 0.777

OBS   S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

23  0.842 0.784 0.864 0.813 0.746 0.819 0.792 0.832 0.856 0.879 0.817 0.806
24  0.807 0.759 0.836 0.842 0.747 0.753 0.870 0.747 0.777 0.796 0.831 0.837
25  1.000 0.762 0.852 0.848 0.723 0.817 0.825 0.785 0.795 0.813 0.789 0.843
26  0.762 1.000 0.757 0.845 0.775 0.889 0.859 0.793 0.810 0.832 0.738 0.798
27  0.852 0.757 1.000 0.762 0.797 0.801 0.845 0.818 0.882 0.889 0.869 0.788
28  0.848 0.845 0.762 1.000 0.731 0.835 0.853 0.738 0.747 0.773 0.766 0.831
29  0.723 0.775 0.797 0.731 1.000 0.839 0.773 0.724 0.739 0.740 0.807 0.752
30  0.817 0.889 0.801 0.835 0.839 1.000 0.825 0.849 0.812 0.825 0.820 0.803
31  0.825 0.859 0.845 0.853 0.773 0.825 1.000 0.776 0.782 0.796 0.845 0.867
32  0.785 0.793 0.818 0.738 0.724 0.849 0.776 1.000 0.852 0.865 0.849 0.760
33  0.795 0.810 0.882 0.747 0.739 0.812 0.782 0.852 1.000 0.973 0.800 0.751

OBS   S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

23  0.853 0.729 0.742 0.782 0.826 0.809 0.812 0.758 0.835 0.788 0.742 0.827
24  0.810 0.722 0.733 0.753 0.741 0.719 0.864 0.688 0.748 0.810 0.717 0.871
25  0.802 0.707 0.738 0.752 0.754 0.804 0.830 0.702 0.799 0.779 0.720 0.809
26  0.837 0.791 0.839 0.842 0.805 0.758 0.811 0.757 0.778 0.736 0.833 0.753
27  0.855 0.762 0.786 0.805 0.749 0.790 0.789 0.764 0.832 0.845 0.770 0.805
28  0.800 0.754 0.814 0.785 0.778 0.732 0.838 0.723 0.773 0.757 0.773 0.819
29  0.886 0.935 0.894 0.922 0.745 0.679 0.749 0.882 0.806 0.769 0.912 0.750
30  0.873 0.825 0.826 0.888 0.829 0.814 0.785 0.807 0.833 0.806 0.875 0.773
31  0.856 0.770 0.801 0.812 0.711 0.737 0.881 0.718 0.798 0.844 0.772 0.811
32  0.816 0.708 0.704 0.776 0.798 0.942 0.752 0.743 0.816 0.797 0.737 0.760
33  0.817 0.721 0.736 0.759 0.758 0.811 0.744 0.725 0.812 0.782 0.763 0.765
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                                              SAS

OBS  S49   S50   S51   S52   S53   S54   S55   S56   S57   S58   S59   S60

23  0.854 0.793 0.817 0.788 0.741 0.753 0.816 0.801 0.758 0.790 0.860 0.824
24  0.834 0.752 0.809 0.781 0.729 0.725 0.783 0.779 0.743 0.761 0.860 0.855
25  0.811 0.773 0.791 0.773 0.728 0.735 0.817 0.777 0.725 0.772 0.804 0.806
26  0.764 0.849 0.880 0.878 0.779 0.846 0.831 0.862 0.842 0.889 0.756 0.751
27  0.894 0.820 0.829 0.805 0.769 0.764 0.822 0.814 0.776 0.771 0.897 0.878
28  0.800 0.823 0.843 0.827 0.728 0.791 0.804 0.823 0.795 0.820 0.774 0.777
29  0.789 0.879 0.840 0.893 0.862 0.909 0.870 0.923 0.885 0.772 0.828 0.796
30  0.828 0.870 0.895 0.881 0.794 0.875 0.866 0.899 0.861 0.866 0.837 0.828
31  0.846 0.806 0.818 0.833 0.787 0.785 0.842 0.825 0.783 0.860 0.862 0.860
32  0.831 0.772 0.797 0.769 0.732 0.755 0.816 0.792 0.751 0.795 0.823 0.856
33  0.847 0.766 0.824 0.769 0.749 0.731 0.788 0.784 0.739 0.810 0.827 0.831

OBS  S61   S62   S63   S64   S65   S66   S67   S68   S69   S70   S71   S72

23  0.785 0.784 0.879 0.842 0.817 0.779 0.758 0.821 0.796 0.789 0.822 0.801
24  0.886 0.769 0.780 0.764 0.876 0.774 0.726 0.782 0.865 0.756 0.784 0.824
25  0.822 0.747 0.764 0.768 0.810 0.791 0.741 0.770 0.834 0.780 0.811 0.804
26  0.782 0.858 0.867 0.843 0.803 0.814 0.814 0.826 0.785 0.760 0.827 0.750
27  0.774 0.813 0.815 0.819 0.808 0.829 0.759 0.805 0.782 0.803 0.837 0.835
28  0.854 0.810 0.812 0.788 0.798 0.843 0.786 0.807 0.856 0.761 0.843 0.799
29  0.768 0.869 0.806 0.772 0.799 0.810 0.712 0.705 0.740 0.752 0.788 0.807
30  0.786 0.874 0.879 0.865 0.792 0.839 0.778 0.780 0.791 0.786 0.868 0.800
31  0.869 0.796 0.796 0.770 0.842 0.831 0.738 0.809 0.852 0.802 0.814 0.836
32  0.743 0.756 0.840 0.852 0.739 0.763 0.766 0.804 0.746 0.828 0.784 0.837
33  0.724 0.781 0.846 0.853 0.771 0.767 0.787 0.833 0.751 0.761 0.829 0.782

OBS  S73   S74   S75   S76   S77   S78   S79   S80   S81   S82   S83   S84

23  0.800 0.848 0.841 0.833 0.832 0.802 0.795 0.827 0.771 0.860 0.771 0.782
24  0.815 0.869 0.839 0.849 0.874 0.770 0.758 0.790 0.734 0.809 0.752 0.793
25  0.828 0.836 0.798 0.856 0.804 0.749 0.774 0.788 0.772 0.791 0.760 0.774
26  0.864 0.796 0.821 0.772 0.814 0.819 0.829 0.776 0.790 0.797 0.760 0.853
27  0.747 0.809 0.843 0.910 0.820 0.823 0.805 0.791 0.766 0.820 0.732 0.787
28  0.922 0.851 0.858 0.803 0.842 0.798 0.824 0.846 0.820 0.831 0.807 0.857
29  0.726 0.702 0.823 0.796 0.849 0.854 0.873 0.820 0.828 0.832 0.818 0.855
30  0.824 0.758 0.862 0.792 0.817 0.871 0.882 0.832 0.831 0.851 0.786 0.864
31  0.817 0.822 0.841 0.840 0.794 0.778 0.787 0.733 0.750 0.752 0.717 0.814
32  0.784 0.801 0.806 0.802 0.732 0.786 0.762 0.750 0.739 0.767 0.747 0.773
33  0.764 0.792 0.825 0.854 0.778 0.788 0.772 0.757 0.715 0.769 0.693 0.779

OBS  S85   S86   S87   S88   S89   S90   S91   S92   S93   S94   S95   S96

23  0.831 0.864 0.806 0.798 0.790 0.900 0.866 0.882 0.813 0.847 0.750 0.760
24  0.808 0.844 0.783 0.790 0.843 0.857 0.853 0.855 0.801 0.775 0.721 0.758
25  0.816 0.804 0.783 0.776 0.787 0.853 0.816 0.854 0.776 0.841 0.760 0.763
26  0.814 0.785 0.852 0.771 0.767 0.789 0.849 0.803 0.856 0.774 0.802 0.850
27  0.846 0.827 0.827 0.833 0.783 0.862 0.816 0.849 0.836 0.840 0.772 0.787
28  0.800 0.786 0.817 0.764 0.841 0.821 0.867 0.831 0.820 0.811 0.811 0.858
29  0.825 0.798 0.873 0.818 0.844 0.801 0.828 0.785 0.859 0.776 0.834 0.840
30  0.840 0.799 0.885 0.791 0.776 0.817 0.848 0.832 0.885 0.821 0.869 0.856
31  0.826 0.795 0.818 0.784 0.761 0.806 0.802 0.829 0.828 0.809 0.770 0.801
32  0.855 0.786 0.844 0.782 0.672 0.787 0.767 0.789 0.780 0.854 0.801 0.781
33  0.798 0.802 0.785 0.798 0.725 0.832 0.795 0.818 0.833 0.794 0.720 0.754
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                                   SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

23  0.786 0.840 0.860 0.827 0.810 0.744 0.794 0.776 0.819 0.785 0.762 0.814
24  0.776 0.837 0.840 0.810 0.776 0.707 0.775 0.750 0.756 0.826 0.800 0.812
25  0.767 0.805 0.801 0.757 0.820 0.715 0.733 0.768 0.727 0.788 0.733 0.810
26  0.837 0.831 0.842 0.805 0.795 0.753 0.755 0.840 0.811 0.792 0.831 0.769
27  0.823 0.817 0.844 0.790 0.788 0.764 0.758 0.789 0.806 0.827 0.796 0.853
28  0.831 0.862 0.849 0.822 0.852 0.746 0.778 0.835 0.784 0.801 0.801 0.800
29  0.838 0.833 0.819 0.822 0.801 0.836 0.815 0.851 0.773 0.761 0.757 0.762
30  0.854 0.856 0.835 0.824 0.829 0.793 0.785 0.859 0.817 0.765 0.793 0.766
31  0.794 0.800 0.792 0.757 0.757 0.714 0.701 0.796 0.765 0.857 0.821 0.765
32  0.765 0.756 0.768 0.732 0.788 0.733 0.717 0.776 0.779 0.753 0.751 0.734
33  0.789 0.812 0.805 0.761 0.739 0.726 0.745 0.748 0.800 0.777 0.775 0.826

OBS S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

23  0.738 0.819 0.748 0.712 0.672 0.742 0.852 0.833 0.750 0.788 0.725 0.776
24  0.813 0.809 0.754 0.760 0.773 0.732 0.834 0.819 0.713 0.776 0.741 0.780
25  0.784 0.819 0.769 0.722 0.757 0.731 0.817 0.786 0.713 0.760 0.689 0.813
26  0.878 0.854 0.761 0.716 0.845 0.778 0.792 0.751 0.782 0.706 0.719 0.761
27  0.795 0.786 0.755 0.717 0.750 0.758 0.797 0.771 0.775 0.831 0.762 0.784
28  0.827 0.829 0.817 0.793 0.836 0.768 0.844 0.821 0.780 0.709 0.675 0.813
29  0.871 0.713 0.743 0.692 0.832 0.797 0.692 0.673 0.822 0.791 0.862 0.708
30  0.868 0.813 0.766 0.703 0.832 0.771 0.784 0.746 0.846 0.779 0.802 0.752
31  0.873 0.850 0.783 0.762 0.845 0.730 0.811 0.768 0.744 0.785 0.708 0.746
32  0.744 0.836 0.742 0.697 0.678 0.744 0.806 0.783 0.725 0.846 0.743 0.707
33  0.728 0.796 0.724 0.688 0.700 0.766 0.826 0.804 0.772 0.770 0.724 0.748

OBS    S121       S122       S123       S124       S125       S126       S127       S128       S129

23     0.730      0.796      0.773      0.754      0.801      0.794      0.822      0.832      0.755
24     0.767      0.830      0.845      0.782      0.780      0.785      0.815      0.827      0.837
25     0.800      0.801      0.817      0.733      0.771      0.804      0.844      0.796      0.769
26     0.757      0.720      0.835      0.836      0.877      0.817      0.775      0.837      0.827
27     0.717      0.786      0.805      0.817      0.818      0.809      0.788      0.790      0.768
28     0.859      0.791      0.885      0.762      0.798      0.849      0.872      0.864      0.840
29     0.699      0.669      0.735      0.784      0.787      0.761      0.742      0.790      0.775
30     0.783      0.719      0.818      0.810      0.843      0.819      0.815      0.852      0.801
31     0.788      0.787      0.895      0.794      0.798      0.799      0.782      0.787      0.842
32     0.691      0.703      0.754      0.734      0.803      0.780      0.761      0.767      0.704
33     0.714      0.758      0.760      0.798      0.854      0.802      0.771      0.779      0.730
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                                          SAS

OBS  S1    S2    S3    S4    S5    S6    S7    S8    S9    S10   S11   S12

34  0.794 0.816 0.791 0.753 0.727 0.747 0.781 0.833 0.755 0.861 0.808 0.774
35  0.800 0.777 0.945 0.743 0.803 0.721 0.796 0.752 0.767 0.794 0.722 0.738
36  0.795 0.736 0.781 0.756 0.722 0.746 0.829 0.752 0.752 0.792 0.787 0.756
37  0.946 0.830 0.836 0.882 0.913 0.730 0.803 0.814 0.762 0.839 0.754 0.786
38  0.911 0.790 0.753 0.919 0.943 0.698 0.723 0.777 0.719 0.754 0.719 0.771
39  0.901 0.817 0.743 0.910 0.935 0.761 0.739 0.837 0.732 0.822 0.742 0.781
40  0.885 0.823 0.809 0.831 0.957 0.742 0.758 0.794 0.770 0.791 0.776 0.761
41  0.714 0.806 0.720 0.679 0.751 0.748 0.672 0.816 0.750 0.762 0.849 0.696
42  0.746 0.728 0.782 0.700 0.692 0.743 0.709 0.787 0.689 0.820 0.743 0.660
43  0.822 0.768 0.767 0.772 0.737 0.738 0.837 0.761 0.766 0.798 0.780 0.763
44  0.872 0.761 0.745 0.877 0.926 0.671 0.679 0.750 0.706 0.715 0.710 0.765

OBS  S13   S14   S15   S16   S17   S18   S19   S20   S21   S22   S23   S24

34  0.671 0.715 0.679 0.716 0.852 0.844 0.898 0.807 0.858 0.735 0.879 0.796
35  0.748 0.740 0.678 0.715 0.873 0.873 0.809 0.787 0.825 0.755 0.817 0.831
36  0.671 0.797 0.678 0.690 0.758 0.764 0.752 0.747 0.800 0.834 0.806 0.837
37  0.682 0.755 0.716 0.713 0.816 0.816 0.808 0.887 0.865 0.767 0.853 0.810
38  0.702 0.690 0.732 0.648 0.698 0.705 0.710 0.832 0.787 0.756 0.729 0.722
39  0.657 0.756 0.724 0.675 0.729 0.732 0.752 0.881 0.813 0.778 0.742 0.733
40  0.703 0.743 0.720 0.709 0.766 0.773 0.746 0.886 0.817 0.779 0.782 0.753
41  0.620 0.714 0.667 0.709 0.784 0.789 0.721 0.789 0.770 0.752 0.826 0.741
42  0.689 0.688 0.580 0.694 0.854 0.841 0.812 0.764 0.760 0.675 0.809 0.719
43  0.653 0.791 0.661 0.675 0.760 0.760 0.756 0.758 0.812 0.861 0.812 0.864
44  0.686 0.676 0.678 0.637 0.771 0.769 0.715 0.828 0.737 0.706 0.758 0.688

OBS  S25   S26   S27   S28   S29   S30   S31   S32   S33   S34   S35   S36

34  0.813 0.832 0.889 0.773 0.740 0.825 0.796 0.865 0.973 1.000 0.808 0.762
35  0.789 0.738 0.869 0.766 0.807 0.820 0.845 0.849 0.800 0.808 1.000 0.799
36  0.843 0.798 0.788 0.831 0.752 0.803 0.867 0.760 0.751 0.762 0.799 1.000
37  0.802 0.837 0.855 0.800 0.886 0.873 0.856 0.816 0.817 0.836 0.847 0.816
38  0.707 0.791 0.762 0.754 0.935 0.825 0.770 0.708 0.721 0.731 0.756 0.736
39  0.738 0.839 0.786 0.814 0.894 0.826 0.801 0.704 0.736 0.751 0.754 0.747
40  0.752 0.842 0.805 0.785 0.922 0.888 0.812 0.776 0.759 0.780 0.824 0.764
41  0.754 0.805 0.749 0.778 0.745 0.829 0.711 0.798 0.758 0.780 0.747 0.734
42  0.804 0.758 0.790 0.732 0.679 0.814 0.737 0.942 0.811 0.829 0.816 0.719
43  0.830 0.811 0.789 0.838 0.749 0.785 0.881 0.752 0.744 0.758 0.783 0.931
44  0.702 0.757 0.764 0.723 0.882 0.807 0.718 0.743 0.725 0.728 0.760 0.668

OBS  S37   S38   S39   S40   S41   S42   S43   S44   S45   S46   S47   S48

34  0.836 0.731 0.751 0.780 0.780 0.829 0.758 0.728 0.818 0.794 0.772 0.788
35  0.847 0.756 0.754 0.824 0.747 0.816 0.783 0.760 0.818 0.924 0.779 0.798
36  0.816 0.736 0.747 0.764 0.734 0.719 0.931 0.668 0.740 0.791 0.774 0.929
37  1.000 0.881 0.899 0.923 0.771 0.779 0.836 0.825 0.888 0.834 0.910 0.820
38  0.881 1.000 0.946 0.900 0.723 0.668 0.743 0.903 0.772 0.755 0.963 0.739
39  0.899 0.946 1.000 0.932 0.727 0.694 0.767 0.878 0.824 0.756 0.935 0.761
40  0.923 0.900 0.932 1.000 0.793 0.740 0.772 0.833 0.840 0.809 0.947 0.763
41  0.771 0.723 0.727 0.793 1.000 0.763 0.715 0.739 0.794 0.692 0.747 0.763
42  0.779 0.668 0.694 0.740 0.763 1.000 0.710 0.724 0.810 0.777 0.692 0.725
43  0.836 0.743 0.767 0.772 0.715 0.710 1.000 0.681 0.739 0.779 0.755 0.885
44  0.825 0.903 0.878 0.833 0.739 0.724 0.681 1.000 0.805 0.736 0.879 0.657
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                                          SAS

OBS  S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

34  0.864  0.789  0.836  0.790  0.750  0.745  0.807  0.803  0.754  0.820  0.833  0.836
35  0.893  0.804  0.790  0.786  0.742  0.769  0.826  0.807  0.772  0.768  0.920  0.912
36  0.806  0.769  0.775  0.783  0.747  0.766  0.815  0.799  0.755  0.813  0.801  0.809
37  0.848  0.902  0.870  0.933  0.886  0.919  0.950  0.937  0.899  0.769  0.865  0.828
38  0.757  0.887  0.856  0.896  0.912  0.950  0.858  0.901  0.932  0.751  0.778  0.750
39  0.774  0.922  0.875  0.930  0.906  0.934  0.902  0.929  0.925  0.767  0.774  0.748
40  0.794  0.921  0.892  0.946  0.846  0.950  0.915  0.937  0.925  0.794  0.840  0.797
41  0.764  0.801  0.823  0.788  0.689  0.772  0.772  0.793  0.759  0.766  0.747  0.755
42  0.803  0.739  0.760  0.734  0.694  0.710  0.795  0.759  0.727  0.758  0.793  0.800
43  0.792  0.763  0.781  0.807  0.763  0.774  0.815  0.818  0.782  0.800  0.798  0.793
44  0.743  0.827  0.820  0.821  0.877  0.892  0.796  0.841  0.913  0.695  0.758  0.717

OBS  S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

34  0.745  0.799  0.861  0.863  0.783  0.777  0.808  0.853  0.764  0.784  0.829  0.799
35  0.818  0.767  0.805  0.794  0.782  0.811  0.751  0.749  0.789  0.810  0.778  0.857
36  0.912  0.782  0.770  0.747  0.908  0.781  0.713  0.758  0.928  0.772  0.765  0.781
37  0.810  0.881  0.836  0.792  0.844  0.840  0.740  0.805  0.802  0.840  0.832  0.845
38  0.743  0.925  0.787  0.758  0.780  0.814  0.706  0.715  0.740  0.749  0.788  0.773
39  0.778  0.904  0.789  0.757  0.791  0.868  0.724  0.784  0.746  0.761  0.834  0.807
40  0.780  0.900  0.837  0.803  0.805  0.844  0.738  0.745  0.757  0.798  0.828  0.805
41  0.718  0.802  0.854  0.849  0.773  0.736  0.781  0.776  0.728  0.781  0.779  0.735
42  0.705  0.714  0.808  0.826  0.703  0.757  0.739  0.797  0.708  0.797  0.772  0.820
43  0.903  0.782  0.760  0.734  0.902  0.787  0.706  0.768  0.902  0.778  0.767  0.783
44  0.644  0.847  0.763  0.763  0.691  0.748  0.693  0.684  0.666  0.719  0.767  0.703

OBS  S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

34  0.782  0.808  0.839  0.874  0.805  0.801  0.789  0.773  0.728  0.788  0.703  0.797
35  0.734  0.773  0.859  0.835  0.778  0.798  0.781  0.767  0.783  0.765  0.728  0.795
36  0.822  0.830  0.770  0.807  0.804  0.751  0.773  0.784  0.742  0.782  0.741  0.799
37  0.789  0.807  0.839  0.864  0.841  0.881  0.885  0.835  0.851  0.853  0.810  0.902
38  0.740  0.709  0.786  0.764  0.809  0.877  0.898  0.831  0.848  0.849  0.842  0.854
39  0.799  0.758  0.835  0.809  0.831  0.874  0.892  0.842  0.862  0.833  0.848  0.911
40  0.772  0.734  0.842  0.809  0.842  0.872  0.896  0.827  0.844  0.846  0.791  0.885
41  0.786  0.776  0.794  0.750  0.826  0.818  0.815  0.840  0.790  0.859  0.765  0.759
42  0.774  0.800  0.800  0.797  0.699  0.761  0.750  0.738  0.727  0.725  0.743  0.771
43  0.840  0.848  0.769  0.824  0.821  0.760  0.766  0.782  0.756  0.799  0.767  0.808
44  0.722  0.693  0.785  0.749  0.750  0.889  0.865  0.847  0.860  0.865  0.844  0.809

OBS  S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

34  0.815  0.808  0.804  0.800  0.743  0.847  0.812  0.831  0.833  0.821  0.739  0.768
35  0.843  0.790  0.824  0.786  0.724  0.801  0.770  0.783  0.784  0.817  0.770  0.765
36  0.792  0.805  0.781  0.759  0.775  0.820  0.820  0.840  0.785  0.791  0.735  0.777
37  0.916  0.878  0.900  0.863  0.807  0.902  0.860  0.895  0.881  0.857  0.860  0.879
38  0.800  0.801  0.845  0.845  0.848  0.805  0.816  0.798  0.846  0.771  0.874  0.890
39  0.851  0.798  0.873  0.860  0.858  0.837  0.837  0.831  0.873  0.815  0.867  0.909
40  0.847  0.811  0.892  0.791  0.815  0.835  0.856  0.838  0.875  0.805  0.864  0.857
41  0.766  0.810  0.812  0.738  0.793  0.806  0.850  0.807  0.810  0.758  0.764  0.751
42  0.852  0.749  0.805  0.767  0.662  0.766  0.734  0.768  0.748  0.848  0.791  0.769
43  0.818  0.838  0.796  0.781  0.798  0.844  0.844  0.865  0.790  0.791  0.739  0.793
44  0.797  0.797  0.834  0.838  0.792  0.766  0.796  0.753  0.812  0.736  0.850  0.853
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                                        SAS

OBS  S97    S98    S99    S100   S101   S102   S103   S104   S105   S106   S107   S108

34  0.797  0.816  0.816  0.777  0.766  0.735  0.753  0.764  0.818  0.792  0.791  0.828
35  0.772  0.765  0.792  0.748  0.767  0.729  0.711  0.765  0.778  0.782  0.770  0.761
36  0.764  0.825  0.798  0.771  0.783  0.676  0.724  0.762  0.723  0.857  0.776  0.762
37  0.869  0.867  0.852  0.843  0.834  0.798  0.790  0.883  0.825  0.835  0.768  0.764
38  0.864  0.831  0.813  0.840  0.785  0.866  0.847  0.895  0.759  0.743  0.744  0.728
39  0.897  0.851  0.849  0.820  0.845  0.870  0.815  0.906  0.781  0.822  0.757  0.758
40  0.855  0.866  0.860  0.836  0.826  0.796  0.774  0.873  0.810  0.773  0.778  0.767
41  0.789  0.840  0.843  0.849  0.824  0.746  0.779  0.759  0.784  0.721  0.751  0.825
42  0.757  0.717  0.731  0.690  0.782  0.726  0.681  0.778  0.769  0.739  0.728  0.715
43  0.777  0.831  0.813  0.779  0.788  0.694  0.746  0.782  0.739  0.864  0.772  0.769
44  0.822  0.784  0.812  0.845  0.754  0.880  0.860  0.876  0.768  0.675  0.712  0.706

OBS S109   S110   S111   S112   S113   S114   S115   S116   S117   S118   S119   S120

34  0.749  0.809  0.736  0.701  0.705  0.772  0.842  0.813  0.765  0.782  0.723  0.750
35  0.787  0.787  0.726  0.692  0.737  0.721  0.806  0.786  0.746  0.847  0.767  0.748
36  0.869  0.838  0.763  0.726  0.824  0.698  0.804  0.765  0.734  0.805  0.697  0.769
37  0.843  0.818  0.787  0.732  0.775  0.743  0.804  0.762  0.838  0.829  0.746  0.735
38  0.838  0.726  0.774  0.719  0.833  0.834  0.691  0.710  0.835  0.774  0.846  0.692
39  0.860  0.736  0.785  0.746  0.849  0.817  0.760  0.740  0.845  0.756  0.798  0.763
40  0.864  0.763  0.755  0.699  0.807  0.744  0.767  0.723  0.833  0.757  0.774  0.746
41  0.740  0.755  0.698  0.638  0.698  0.734  0.811  0.768  0.820  0.690  0.732  0.724
42  0.710  0.820  0.732  0.699  0.666  0.742  0.794  0.807  0.713  0.816  0.715  0.711
43  0.870  0.839  0.770  0.739  0.810  0.701  0.806  0.768  0.722  0.807  0.687  0.774
44  0.753  0.711  0.751  0.719  0.773  0.848  0.684  0.753  0.820  0.796  0.870  0.705

OBS    S121     S122     S123     S124     S125     S126     S127     S128     S129

34     0.714    0.767    0.782    0.790    0.866    0.811    0.776    0.791    0.740
35     0.744    0.731    0.804    0.753    0.761    0.758    0.792    0.821    0.757
36     0.788    0.768    0.797    0.757    0.754    0.748    0.789    0.813    0.791
37     0.711    0.754    0.808    0.801    0.792    0.798    0.773    0.827    0.767
38     0.683    0.654    0.737    0.765    0.770    0.760    0.730    0.783    0.743
39     0.720    0.722    0.791    0.814    0.794    0.833    0.785    0.830    0.773
40     0.736    0.717    0.783    0.814    0.815    0.806    0.795    0.831    0.787
41     0.767    0.710    0.691    0.814    0.811    0.764    0.793    0.803    0.715
42     0.664    0.694    0.739    0.697    0.767    0.797    0.779    0.740    0.670
43     0.758    0.772    0.809    0.755    0.753    0.743    0.762    0.811    0.804
44     0.653    0.642    0.724    0.751    0.729    0.744    0.727    0.778    0.704
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                                        SAS

OBS  S1    S2    S3    S4    S5    S6    S7    S8    S9    S10   S11   S12

45  0.829 0.797 0.797 0.780 0.844 0.733 0.754 0.808 0.721 0.802 0.737 0.748
46  0.807 0.760 0.952 0.750 0.762 0.768 0.838 0.748 0.748 0.793 0.723 0.718
47  0.910 0.822 0.770 0.924 0.929 0.730 0.726 0.794 0.721 0.758 0.745 0.759
48  0.824 0.783 0.781 0.753 0.734 0.719 0.777 0.784 0.783 0.820 0.800 0.723
49  0.841 0.856 0.875 0.758 0.780 0.762 0.803 0.815 0.780 0.838 0.777 0.756
50  0.909 0.870 0.790 0.831 0.925 0.802 0.758 0.833 0.772 0.803 0.795 0.768
51  0.876 0.864 0.783 0.831 0.865 0.790 0.792 0.867 0.805 0.861 0.838 0.763
52  0.929 0.847 0.775 0.864 0.926 0.772 0.777 0.834 0.785 0.811 0.800 0.768
53  0.965 0.757 0.735 0.971 0.899 0.675 0.743 0.743 0.680 0.775 0.697 0.780
54  0.930 0.816 0.755 0.930 0.942 0.750 0.723 0.809 0.735 0.775 0.758 0.745
55  0.948 0.806 0.821 0.879 0.889 0.767 0.793 0.814 0.742 0.848 0.768 0.756

OBS  S13   S14   S15   S16   S17   S18   S19   S20   S21   S22   S23   S24

45  0.632 0.760 0.657 0.700 0.829 0.836 0.821 0.864 0.826 0.711 0.835 0.748
46  0.711 0.758 0.686 0.706 0.834 0.831 0.800 0.746 0.800 0.747 0.788 0.810
47  0.696 0.713 0.751 0.640 0.716 0.720 0.727 0.876 0.801 0.755 0.742 0.717
48  0.678 0.752 0.715 0.725 0.778 0.771 0.740 0.753 0.846 0.800 0.827 0.871
49  0.698 0.751 0.697 0.740 0.885 0.880 0.804 0.792 0.868 0.772 0.854 0.834
50  0.649 0.760 0.709 0.699 0.758 0.765 0.760 0.859 0.828 0.793 0.793 0.752
51  0.661 0.775 0.741 0.750 0.811 0.816 0.787 0.876 0.877 0.809 0.817 0.809
52  0.681 0.770 0.737 0.707 0.769 0.771 0.755 0.904 0.849 0.801 0.788 0.781
53  0.675 0.721 0.756 0.620 0.741 0.756 0.743 0.816 0.794 0.703 0.741 0.729
54  0.694 0.718 0.726 0.672 0.743 0.744 0.713 0.900 0.806 0.764 0.753 0.725
55  0.693 0.774 0.717 0.731 0.813 0.817 0.788 0.892 0.859 0.760 0.816 0.783

OBS  S25   S26   S27   S28   S29   S30   S31   S32   S33   S34   S35   S36

45  0.799 0.778 0.832 0.773 0.806 0.833 0.798 0.816 0.812 0.818 0.818 0.740
46  0.779 0.736 0.845 0.757 0.769 0.806 0.844 0.797 0.782 0.794 0.924 0.791
47  0.720 0.833 0.770 0.773 0.912 0.875 0.772 0.737 0.763 0.772 0.779 0.774
48  0.809 0.753 0.805 0.819 0.750 0.773 0.811 0.760 0.765 0.788 0.798 0.929
49  0.811 0.764 0.894 0.800 0.789 0.828 0.846 0.831 0.847 0.864 0.893 0.806
50  0.773 0.849 0.820 0.823 0.879 0.870 0.806 0.772 0.766 0.789 0.804 0.769
51  0.791 0.880 0.829 0.843 0.840 0.895 0.818 0.797 0.824 0.836 0.790 0.775
52  0.773 0.878 0.805 0.827 0.893 0.881 0.833 0.769 0.769 0.790 0.786 0.783
53  0.728 0.779 0.769 0.728 0.862 0.794 0.787 0.732 0.749 0.750 0.742 0.747
54  0.735 0.846 0.764 0.791 0.909 0.875 0.785 0.755 0.731 0.745 0.769 0.766
55  0.817 0.831 0.822 0.804 0.870 0.866 0.842 0.816 0.788 0.807 0.826 0.815

OBS  S37   S38   S39   S40   S41   S42   S43   S44   S45   S46   S47   S48

45  0.888 0.772 0.824 0.840 0.794 0.810 0.739 0.805 1.000 0.769 0.802 0.738
46  0.834 0.755 0.756 0.809 0.692 0.777 0.779 0.736 0.769 1.000 0.774 0.789
47  0.910 0.963 0.935 0.947 0.747 0.692 0.755 0.879 0.802 0.774 1.000 0.787
48  0.820 0.739 0.761 0.763 0.763 0.725 0.885 0.657 0.738 0.789 0.787 1.000
49  0.848 0.757 0.774 0.794 0.764 0.803 0.792 0.743 0.821 0.880 0.809 0.859
50  0.902 0.887 0.922 0.921 0.801 0.739 0.763 0.827 0.841 0.803 0.942 0.792
51  0.870 0.856 0.875 0.892 0.823 0.760 0.781 0.820 0.798 0.794 0.898 0.804
52  0.933 0.896 0.930 0.946 0.788 0.734 0.807 0.821 0.830 0.780 0.948 0.791
53  0.886 0.912 0.906 0.846 0.689 0.694 0.763 0.877 0.794 0.746 0.920 0.747
54  0.919 0.950 0.934 0.950 0.772 0.710 0.774 0.892 0.803 0.753 0.954 0.791
55  0.950 0.858 0.902 0.915 0.772 0.795 0.815 0.796 0.867 0.812 0.904 0.822
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                                   SAS

OBS   S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

45   0.821  0.841  0.798  0.830  0.794  0.803  0.867  0.836  0.803  0.737  0.819  0.796
46   0.880  0.803  0.794  0.780  0.746  0.753  0.812  0.791  0.779  0.766  0.896  0.871
47   0.809  0.942  0.898  0.948  0.920  0.954  0.904  0.938  0.933  0.774  0.783  0.768
48   0.859  0.792  0.804  0.791  0.747  0.791  0.822  0.799  0.777  0.761  0.816  0.827
49   1.000  0.837  0.842  0.800  0.758  0.790  0.836  0.804  0.797  0.801  0.918  0.905
50   0.837  1.000  0.906  0.929  0.844  0.949  0.908  0.905  0.927  0.789  0.811  0.789
51   0.842  0.906  1.000  0.916  0.838  0.914  0.887  0.906  0.903  0.818  0.838  0.832
52   0.800  0.929  0.916  1.000  0.876  0.960  0.928  0.956  0.958  0.800  0.803  0.794
53   0.758  0.844  0.838  0.876  1.000  0.925  0.888  0.862  0.922  0.700  0.760  0.756
54   0.790  0.949  0.914  0.960  0.925  1.000  0.937  0.963  0.955  0.765  0.787  0.766
55   0.836  0.908  0.887  0.928  0.888  0.937  1.000  0.926  0.907  0.772  0.840  0.827

OBS   S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

45   0.719  0.772  0.795  0.797  0.752  0.795  0.735  0.792  0.740  0.796  0.831  0.799
46   0.811  0.768  0.781  0.783  0.775  0.807  0.782  0.744  0.780  0.760  0.770  0.826
47   0.784  0.929  0.813  0.780  0.811  0.820  0.724  0.738  0.759  0.776  0.815  0.791
48   0.911  0.834  0.790  0.772  0.907  0.781  0.727  0.805  0.912  0.785  0.776  0.808
49   0.838  0.836  0.844  0.842  0.816  0.806  0.748  0.831  0.806  0.821  0.833  0.868
50   0.784  0.920  0.842  0.816  0.787  0.844  0.786  0.791  0.783  0.800  0.833  0.821
51   0.778  0.953  0.884  0.861  0.837  0.844  0.789  0.813  0.800  0.812  0.898  0.802
52   0.796  0.933  0.843  0.813  0.827  0.866  0.765  0.785  0.780  0.824  0.862  0.813
53   0.745  0.904  0.750  0.722  0.782  0.779  0.663  0.748  0.743  0.776  0.777  0.779
54   0.790  0.948  0.837  0.791  0.807  0.836  0.745  0.753  0.766  0.792  0.820  0.813
55   0.823  0.896  0.833  0.796  0.850  0.852  0.740  0.822  0.813  0.839  0.831  0.864

OBS   S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

45   0.747  0.765  0.818  0.822  0.761  0.818  0.819  0.794  0.806  0.797  0.762  0.831
46   0.730  0.769  0.827  0.806  0.761  0.751  0.756  0.712  0.736  0.712  0.689  0.792
47   0.751  0.712  0.812  0.785  0.816  0.878  0.885  0.834  0.836  0.838  0.820  0.898
48   0.793  0.862  0.788  0.826  0.846  0.805  0.806  0.825  0.756  0.835  0.743  0.799
49   0.761  0.826  0.870  0.859  0.799  0.833  0.828  0.799  0.755  0.816  0.709  0.808
50   0.791  0.770  0.819  0.795  0.840  0.872  0.882  0.821  0.838  0.847  0.786  0.886
51   0.832  0.816  0.876  0.860  0.883  0.909  0.928  0.865  0.848  0.889  0.811  0.885
52   0.810  0.778  0.847  0.840  0.871  0.897  0.902  0.851  0.867  0.871  0.818  0.923
53   0.712  0.738  0.748  0.803  0.766  0.866  0.873  0.825  0.840  0.846  0.820  0.825
54   0.770  0.733  0.824  0.796  0.842  0.899  0.913  0.846  0.867  0.872  0.860  0.902
55   0.786  0.813  0.829  0.865  0.826  0.881  0.901  0.840  0.854  0.846  0.802  0.897

OBS   S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

45   0.868  0.803  0.824  0.814  0.749  0.838  0.787  0.825  0.821  0.854  0.831  0.803
46   0.802  0.755  0.787  0.759  0.702  0.789  0.756  0.784  0.782  0.786  0.731  0.756
47   0.821  0.798  0.876  0.836  0.816  0.822  0.840  0.817  0.884  0.801  0.859  0.874
48   0.797  0.832  0.790  0.787  0.826  0.856  0.846  0.862  0.805  0.815  0.762  0.793
49   0.827  0.805  0.816  0.813  0.758  0.843  0.806  0.835  0.833  0.866  0.800  0.797
50   0.828  0.800  0.880  0.800  0.808  0.834  0.841  0.820  0.866  0.830  0.872  0.882
51   0.853  0.855  0.900  0.856  0.863  0.862  0.908  0.879  0.928  0.834  0.878  0.887
52   0.869  0.839  0.915  0.831  0.847  0.856  0.891  0.873  0.906  0.834  0.880  0.907
53   0.830  0.832  0.826  0.884  0.808  0.814  0.794  0.834  0.838  0.793  0.847  0.877
54   0.858  0.838  0.911  0.858  0.835  0.825  0.856  0.833  0.889  0.818  0.898  0.892
55   0.907  0.859  0.893  0.860  0.799  0.877  0.841  0.890  0.869  0.880  0.878  0.878
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                                         SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

45  0.814 0.776 0.794 0.787 0.811 0.766 0.728 0.810 0.761 0.784 0.707 0.735
46  0.760 0.770 0.771 0.694 0.719 0.674 0.670 0.764 0.822 0.776 0.824 0.742
47  0.880 0.864 0.855 0.834 0.824 0.847 0.817 0.878 0.782 0.777 0.742 0.734
48  0.792 0.843 0.825 0.822 0.798 0.706 0.756 0.771 0.755 0.882 0.778 0.781
49  0.810 0.806 0.821 0.781 0.784 0.738 0.738 0.804 0.834 0.847 0.812 0.782
50  0.861 0.854 0.872 0.834 0.836 0.783 0.778 0.880 0.824 0.795 0.789 0.763
51  0.915 0.928 0.912 0.874 0.837 0.841 0.841 0.893 0.846 0.807 0.854 0.796
52  0.895 0.896 0.877 0.862 0.868 0.819 0.805 0.915 0.819 0.806 0.789 0.767
53  0.848 0.822 0.794 0.842 0.768 0.864 0.831 0.882 0.714 0.771 0.694 0.685
54  0.893 0.870 0.847 0.859 0.836 0.884 0.857 0.894 0.797 0.795 0.759 0.720
55  0.864 0.855 0.836 0.827 0.835 0.798 0.778 0.882 0.796 0.842 0.773 0.743

OBS S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

45  0.743 0.766 0.746 0.702 0.743 0.720 0.807 0.761 0.794 0.776 0.714 0.722
46  0.785 0.791 0.722 0.695 0.728 0.708 0.794 0.792 0.721 0.782 0.730 0.778
47  0.851 0.735 0.764 0.699 0.813 0.806 0.748 0.729 0.845 0.777 0.815 0.714
48  0.824 0.804 0.776 0.736 0.778 0.716 0.835 0.810 0.766 0.815 0.714 0.758
49  0.783 0.811 0.762 0.734 0.750 0.757 0.864 0.849 0.791 0.851 0.758 0.734
50  0.843 0.775 0.775 0.719 0.820 0.762 0.774 0.747 0.825 0.755 0.747 0.758
51  0.870 0.806 0.793 0.753 0.845 0.831 0.810 0.798 0.868 0.766 0.811 0.783
52  0.872 0.785 0.790 0.732 0.810 0.764 0.792 0.746 0.855 0.781 0.753 0.766
53  0.782 0.741 0.805 0.738 0.794 0.815 0.737 0.785 0.839 0.818 0.810 0.689
54  0.864 0.753 0.769 0.713 0.820 0.818 0.746 0.732 0.850 0.795 0.833 0.723
55  0.845 0.814 0.790 0.739 0.796 0.756 0.813 0.788 0.843 0.820 0.745 0.744

OBS    S121     S122     S123     S124     S125     S126     S127     S128     S129

45     0.692    0.748    0.769    0.753    0.753    0.794    0.759    0.780    0.726
46     0.760    0.745    0.803    0.748    0.748    0.746    0.771    0.811    0.737
47     0.721    0.673    0.756    0.801    0.800    0.790    0.770    0.829    0.758
48     0.748    0.781    0.775    0.770    0.776    0.769    0.800    0.808    0.752
49     0.756    0.766    0.823    0.771    0.795    0.797    0.808    0.798    0.753
50     0.750    0.719    0.806    0.825    0.823    0.828    0.793    0.851    0.775
51     0.785    0.787    0.840    0.869    0.878    0.884    0.848    0.881    0.817
52     0.750    0.744    0.819    0.834    0.831    0.835    0.793    0.860    0.808
53     0.665    0.700    0.748    0.766    0.752    0.753    0.707    0.770    0.706
54     0.708    0.679    0.773    0.805    0.801    0.793    0.778    0.826    0.756
55     0.744    0.772    0.819    0.797    0.805    0.816    0.796    0.826    0.760
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                                        SAS

OBS   S1    S2    S3    S4    S5    S6    S7    S8    S9    S10   S11   S12

56  0.926 0.837 0.793 0.870 0.944 0.757 0.782 0.837 0.780 0.814 0.779 0.764
57  0.951 0.821 0.751 0.937 0.949 0.749 0.741 0.818 0.754 0.777 0.770 0.741
58  0.729 0.768 0.753 0.698 0.728 0.830 0.834 0.821 0.760 0.829 0.827 0.765
59  0.817 0.816 0.894 0.762 0.804 0.741 0.808 0.796 0.784 0.834 0.769 0.743
60  0.800 0.799 0.881 0.754 0.758 0.739 0.801 0.792 0.785 0.835 0.756 0.732
61  0.818 0.736 0.803 0.753 0.745 0.760 0.801 0.739 0.754 0.791 0.769 0.743
62  0.906 0.866 0.758 0.913 0.896 0.767 0.749 0.855 0.778 0.817 0.802 0.757
63  0.796 0.841 0.782 0.746 0.802 0.815 0.783 0.894 0.786 0.849 0.881 0.741
64  0.776 0.826 0.777 0.723 0.769 0.804 0.777 0.910 0.771 0.831 0.900 0.728
65  0.834 0.759 0.765 0.791 0.759 0.710 0.809 0.770 0.763 0.820 0.806 0.722
66  0.825 0.832 0.798 0.775 0.832 0.784 0.817 0.876 0.777 0.849 0.812 0.772

OBS   S13   S14   S15   S16   S17   S18   S19   S20   S21   S22   S23   S24

56  0.712 0.759 0.735 0.718 0.798 0.800 0.768 0.931 0.839 0.800 0.801 0.779
57  0.699 0.736 0.723 0.657 0.769 0.765 0.717 0.889 0.809 0.787 0.758 0.743
58  0.647 0.739 0.643 0.703 0.755 0.768 0.809 0.776 0.823 0.855 0.790 0.761
59  0.721 0.752 0.693 0.732 0.887 0.892 0.798 0.770 0.861 0.767 0.860 0.860
60  0.753 0.748 0.715 0.718 0.880 0.884 0.786 0.767 0.874 0.757 0.824 0.855
61  0.688 0.806 0.701 0.678 0.757 0.752 0.725 0.737 0.813 0.840 0.785 0.886
62  0.693 0.735 0.776 0.695 0.784 0.777 0.734 0.871 0.854 0.770 0.784 0.769
63  0.684 0.753 0.689 0.753 0.827 0.827 0.799 0.829 0.822 0.793 0.879 0.780
64  0.673 0.721 0.674 0.718 0.842 0.839 0.807 0.802 0.822 0.791 0.842 0.764
65  0.685 0.759 0.738 0.704 0.783 0.786 0.752 0.791 0.870 0.821 0.817 0.876
66  0.674 0.777 0.681 0.717 0.779 0.793 0.822 0.832 0.823 0.830 0.779 0.774

OBS   S25   S26   S27   S28   S29   S30   S31   S32   S33   S34   S35   S36

56  0.777 0.862 0.814 0.823 0.923 0.899 0.825 0.792 0.784 0.803 0.807 0.799
57  0.725 0.842 0.776 0.795 0.885 0.861 0.783 0.751 0.739 0.754 0.772 0.755
58  0.772 0.889 0.771 0.820 0.772 0.866 0.860 0.795 0.810 0.820 0.768 0.813
59  0.804 0.756 0.897 0.774 0.828 0.837 0.862 0.823 0.827 0.833 0.920 0.801
60  0.806 0.751 0.878 0.777 0.796 0.828 0.860 0.856 0.831 0.836 0.912 0.809
61  0.822 0.782 0.774 0.854 0.768 0.786 0.869 0.743 0.724 0.745 0.818 0.912
62  0.747 0.858 0.813 0.810 0.869 0.874 0.796 0.756 0.781 0.799 0.767 0.782
63  0.764 0.867 0.815 0.812 0.806 0.879 0.796 0.840 0.846 0.861 0.805 0.770
64  0.768 0.843 0.819 0.788 0.772 0.865 0.770 0.852 0.853 0.863 0.794 0.747
65  0.810 0.803 0.808 0.798 0.799 0.792 0.842 0.739 0.771 0.783 0.782 0.908
66  0.791 0.814 0.829 0.843 0.810 0.839 0.831 0.763 0.767 0.777 0.811 0.781

OBS   S37   S38   S39   S40   S41   S42   S43   S44   S45   S46   S47   S48

56  0.937 0.901 0.929 0.937 0.793 0.759 0.818 0.841 0.836 0.791 0.938 0.799
57  0.899 0.932 0.925 0.925 0.759 0.727 0.782 0.913 0.803 0.779 0.933 0.777
58  0.769 0.751 0.767 0.794 0.766 0.758 0.800 0.695 0.737 0.766 0.774 0.761
59  0.865 0.778 0.774 0.840 0.747 0.793 0.798 0.758 0.819 0.896 0.783 0.816
60  0.828 0.750 0.748 0.797 0.755 0.800 0.793 0.717 0.796 0.871 0.768 0.827
61  0.810 0.743 0.778 0.780 0.718 0.705 0.903 0.644 0.719 0.811 0.784 0.911
62  0.881 0.925 0.904 0.900 0.802 0.714 0.782 0.847 0.772 0.768 0.929 0.834
63  0.836 0.787 0.789 0.837 0.854 0.808 0.760 0.763 0.795 0.781 0.813 0.790
64  0.792 0.758 0.757 0.803 0.849 0.826 0.734 0.763 0.797 0.783 0.780 0.772
65  0.844 0.780 0.791 0.805 0.773 0.703 0.902 0.691 0.752 0.775 0.811 0.907
66  0.840 0.814 0.868 0.844 0.736 0.757 0.787 0.748 0.795 0.807 0.820 0.781
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                                        SAS

OBS   S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

56   0.804  0.905  0.906  0.956  0.862  0.963  0.926  1.000  0.953  0.797  0.823  0.801
57   0.797  0.927  0.903  0.958  0.922  0.955  0.907  0.953  1.000  0.760  0.790  0.775
58   0.801  0.789  0.818  0.800  0.700  0.765  0.772  0.797  0.760  1.000  0.780  0.791
59   0.918  0.811  0.838  0.803  0.760  0.787  0.840  0.823  0.790  0.780  1.000  0.940
60   0.905  0.789  0.832  0.794  0.756  0.766  0.827  0.801  0.775  0.791  0.940  1.000
61   0.838  0.784  0.778  0.796  0.745  0.790  0.823  0.786  0.778  0.791  0.813  0.826
62   0.836  0.920  0.953  0.933  0.904  0.948  0.896  0.925  0.926  0.775  0.815  0.811
63   0.844  0.842  0.884  0.843  0.750  0.837  0.833  0.861  0.820  0.884  0.845  0.828
64   0.842  0.816  0.861  0.813  0.722  0.791  0.796  0.821  0.813  0.843  0.838  0.841
65   0.816  0.787  0.837  0.827  0.782  0.807  0.850  0.845  0.802  0.776  0.826  0.819
66   0.806  0.844  0.844  0.866  0.779  0.836  0.852  0.870  0.847  0.819  0.810  0.809

OBS   S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

56   0.786  0.925  0.861  0.821  0.845  0.870  0.762  0.784  0.791  0.808  0.864  0.815
57   0.778  0.926  0.820  0.813  0.802  0.847  0.743  0.767  0.755  0.779  0.828  0.808
58   0.791  0.775  0.884  0.843  0.776  0.819  0.811  0.800  0.798  0.741  0.807  0.765
59   0.813  0.815  0.845  0.838  0.826  0.810  0.716  0.787  0.802  0.783  0.835  0.850
60   0.826  0.811  0.828  0.841  0.819  0.809  0.720  0.785  0.799  0.807  0.833  0.873
61   1.000  0.798  0.750  0.721  0.867  0.778  0.707  0.758  0.888  0.773  0.736  0.846
62   0.798  1.000  0.869  0.843  0.853  0.848  0.756  0.802  0.782  0.804  0.863  0.820
63   0.750  0.869  1.000  0.917  0.795  0.834  0.829  0.852  0.774  0.790  0.877  0.793
64   0.721  0.843  0.917  1.000  0.766  0.851  0.829  0.855  0.749  0.798  0.887  0.793
65   0.867  0.853  0.795  0.766  1.000  0.783  0.697  0.787  0.887  0.769  0.794  0.780
66   0.778  0.848  0.834  0.851  0.783  1.000  0.787  0.835  0.772  0.811  0.907  0.844

OBS   S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

56   0.816  0.777  0.865  0.843  0.867  0.908  0.925  0.878  0.884  0.893  0.837  0.924
57   0.780  0.758  0.821  0.812  0.845  0.884  0.884  0.840  0.848  0.858  0.852  0.917
58   0.842  0.781  0.814  0.771  0.780  0.757  0.772  0.719  0.713  0.731  0.683  0.816
59   0.751  0.814  0.876  0.853  0.801  0.799  0.831  0.767  0.741  0.798  0.718  0.794
60   0.746  0.810  0.875  0.856  0.811  0.810  0.812  0.782  0.735  0.795  0.713  0.799
61   0.806  0.822  0.790  0.786  0.835  0.755  0.755  0.769  0.735  0.776  0.733  0.787
62   0.782  0.775  0.852  0.838  0.879  0.916  0.939  0.877  0.858  0.898  0.853  0.877
63   0.828  0.824  0.885  0.824  0.816  0.849  0.887  0.820  0.793  0.832  0.753  0.833
64   0.808  0.799  0.864  0.812  0.801  0.821  0.842  0.796  0.765  0.824  0.728  0.811
65   0.794  0.855  0.782  0.835  0.857  0.800  0.838  0.835  0.776  0.849  0.769  0.811
66   0.834  0.802  0.867  0.846  0.823  0.847  0.877  0.833  0.871  0.828  0.788  0.887

OBS   S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

56   0.893  0.852  0.932  0.839  0.847  0.856  0.892  0.874  0.923  0.830  0.894  0.912
57   0.853  0.831  0.904  0.864  0.831  0.829  0.869  0.839  0.897  0.808  0.869  0.897
58   0.744  0.709  0.784  0.698  0.737  0.734  0.788  0.754  0.799  0.791  0.749  0.772
59   0.829  0.811  0.810  0.806  0.760  0.841  0.799  0.844  0.825  0.816  0.784  0.779
60   0.820  0.804  0.807  0.814  0.771  0.829  0.805  0.836  0.817  0.828  0.767  0.778
61   0.786  0.796  0.775  0.748  0.805  0.820  0.808  0.823  0.761  0.795  0.737  0.770
62   0.850  0.860  0.904  0.899  0.878  0.863  0.895  0.872  0.938  0.832  0.889  0.908
63   0.813  0.793  0.849  0.783  0.775  0.795  0.849  0.814  0.877  0.837  0.817  0.827
64   0.789  0.768  0.831  0.777  0.763  0.796  0.838  0.803  0.856  0.807  0.791  0.807
65   0.824  0.864  0.818  0.811  0.841  0.881  0.883  0.900  0.850  0.790  0.770  0.806
66   0.845  0.780  0.863  0.808  0.816  0.818  0.844  0.835  0.862  0.849  0.860  0.883
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                                         SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

 56  0.899 0.905 0.872 0.877 0.861 0.833 0.826 0.919 0.833 0.815 0.796 0.784
 57  0.892 0.878 0.859 0.843 0.845 0.868 0.853 0.912 0.800 0.792 0.769 0.733
 58  0.757 0.787 0.763 0.704 0.744 0.687 0.697 0.768 0.779 0.778 0.858 0.779
 59  0.803 0.807 0.808 0.763 0.748 0.748 0.744 0.791 0.823 0.819 0.814 0.800
 60  0.799 0.801 0.798 0.762 0.776 0.757 0.738 0.773 0.781 0.820 0.807 0.790
 61  0.746 0.800 0.796 0.761 0.782 0.663 0.712 0.752 0.715 0.838 0.750 0.752
 62  0.945 0.917 0.893 0.895 0.851 0.906 0.882 0.902 0.820 0.838 0.807 0.775
 63  0.843 0.849 0.829 0.819 0.786 0.770 0.767 0.838 0.880 0.802 0.861 0.808
 64  0.822 0.828 0.822 0.796 0.787 0.760 0.759 0.814 0.884 0.775 0.872 0.810
 65  0.820 0.886 0.861 0.837 0.816 0.737 0.786 0.795 0.741 0.874 0.799 0.795
 66  0.866 0.844 0.821 0.797 0.848 0.797 0.768 0.893 0.831 0.830 0.837 0.808

OBS  S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

 56  0.893 0.791 0.792 0.743 0.829 0.781 0.775 0.742 0.882 0.821 0.780 0.767
 57  0.860 0.760 0.771 0.737 0.804 0.820 0.768 0.775 0.843 0.803 0.837 0.745
 58  0.856 0.828 0.733 0.714 0.839 0.751 0.770 0.716 0.735 0.725 0.727 0.740
 59  0.799 0.806 0.743 0.714 0.752 0.753 0.831 0.819 0.777 0.818 0.791 0.733
 60  0.795 0.792 0.740 0.698 0.752 0.754 0.842 0.820 0.777 0.837 0.800 0.718
 61  0.862 0.820 0.754 0.716 0.812 0.673 0.837 0.802 0.708 0.793 0.703 0.758
 62  0.877 0.766 0.786 0.728 0.840 0.870 0.792 0.773 0.883 0.786 0.860 0.743
 63  0.808 0.836 0.762 0.724 0.774 0.829 0.833 0.809 0.837 0.761 0.774 0.760
 64  0.786 0.820 0.739 0.708 0.747 0.847 0.822 0.811 0.792 0.758 0.779 0.757
 65  0.878 0.813 0.763 0.729 0.827 0.728 0.812 0.786 0.784 0.792 0.740 0.766
 66  0.845 0.787 0.815 0.777 0.825 0.822 0.782 0.756 0.845 0.785 0.745 0.804

OBS    S121     S122     S123     S124     S125     S126     S127     S128     S129

 56    0.740    0.738    0.809    0.831    0.823    0.827    0.803    0.853    0.794
 57    0.704    0.695    0.793    0.804    0.793    0.802    0.756    0.848    0.769
 58    0.783    0.713    0.818    0.765    0.850    0.794    0.756    0.800    0.829
 59    0.735    0.766    0.820    0.789    0.807    0.790    0.815    0.788    0.767
 60    0.758    0.769    0.805    0.787    0.808    0.796    0.812    0.792    0.766
 61    0.807    0.762    0.828    0.741    0.751    0.735    0.800    0.806    0.808
 62    0.732    0.729    0.791    0.859    0.853    0.845    0.818    0.843    0.771
 63    0.745    0.743    0.788    0.815    0.897    0.838    0.827    0.826    0.788
 64    0.728    0.749    0.769    0.800    0.879    0.831    0.800    0.811    0.794
 65    0.748    0.802    0.771    0.806    0.786    0.768    0.799    0.822    0.778
 66    0.742    0.772    0.816    0.784    0.814    0.840    0.797    0.844    0.829
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                                    SAS

OBS  S1    S2    S3    S4    S5    S6    S7    S8    S9    S10   S11   S12

67  0.715 0.746 0.778 0.658 0.689 0.850 0.780 0.831 0.712 0.783 0.811 0.732
68  0.802 0.800 0.740 0.740 0.710 0.813 0.824 0.903 0.738 0.895 0.839 0.746
69  0.792 0.750 0.777 0.745 0.703 0.740 0.855 0.758 0.750 0.814 0.782 0.752
70  0.813 0.820 0.778 0.758 0.748 0.712 0.787 0.795 0.729 0.794 0.762 0.769
71  0.799 0.863 0.757 0.766 0.814 0.777 0.808 0.911 0.797 0.863 0.844 0.771
72  0.849 0.791 0.825 0.769 0.779 0.753 0.774 0.792 0.727 0.822 0.721 0.750
73  0.754 0.771 0.722 0.714 0.734 0.817 0.809 0.864 0.776 0.886 0.846 0.772
74  0.790 0.775 0.757 0.740 0.694 0.767 0.811 0.855 0.787 0.916 0.840 0.735
75  0.799 0.832 0.834 0.750 0.817 0.792 0.784 0.879 0.809 0.863 0.808 0.775
76  0.849 0.824 0.820 0.798 0.785 0.729 0.812 0.840 0.781 0.876 0.763 0.802
77  0.818 0.819 0.759 0.764 0.820 0.711 0.762 0.808 0.836 0.811 0.817 0.729

OBS  S13   S14   S15   S16   S17   S18   S19   S20   S21   S22   S23   S24

67  0.644 0.709 0.607 0.689 0.729 0.723 0.815 0.761 0.772 0.767 0.758 0.726
68  0.610 0.745 0.647 0.723 0.808 0.808 0.828 0.767 0.843 0.788 0.821 0.782
69  0.662 0.786 0.657 0.718 0.747 0.751 0.764 0.746 0.842 0.861 0.796 0.865
70  0.697 0.720 0.674 0.687 0.792 0.790 0.750 0.802 0.809 0.756 0.789 0.756
71  0.638 0.808 0.701 0.738 0.825 0.839 0.810 0.841 0.837 0.814 0.822 0.784
72  0.740 0.757 0.686 0.706 0.839 0.838 0.782 0.803 0.833 0.766 0.801 0.824
73  0.592 0.824 0.599 0.719 0.743 0.743 0.792 0.804 0.794 0.873 0.800 0.815
74  0.607 0.795 0.642 0.733 0.806 0.808 0.811 0.751 0.850 0.826 0.848 0.869
75  0.694 0.802 0.712 0.773 0.872 0.871 0.792 0.861 0.838 0.800 0.841 0.839
76  0.728 0.767 0.719 0.765 0.867 0.868 0.860 0.845 0.869 0.774 0.833 0.849
77  0.666 0.761 0.746 0.742 0.778 0.777 0.746 0.848 0.867 0.854 0.832 0.874

OBS  S25   S26   S27   S28   S29   S30   S31   S32   S33   S34   S35   S36

67  0.741 0.814 0.759 0.786 0.712 0.778 0.738 0.766 0.787 0.808 0.751 0.713
68  0.770 0.826 0.805 0.807 0.705 0.780 0.809 0.804 0.833 0.853 0.749 0.758
69  0.834 0.785 0.782 0.856 0.740 0.791 0.852 0.746 0.751 0.764 0.789 0.928
70  0.780 0.760 0.803 0.761 0.752 0.786 0.802 0.828 0.761 0.784 0.810 0.772
71  0.811 0.827 0.837 0.843 0.788 0.868 0.814 0.784 0.829 0.829 0.778 0.765
72  0.804 0.750 0.835 0.799 0.807 0.800 0.836 0.837 0.782 0.799 0.857 0.781
73  0.828 0.864 0.747 0.922 0.726 0.824 0.817 0.784 0.764 0.782 0.734 0.822
74  0.836 0.796 0.809 0.851 0.702 0.758 0.822 0.801 0.792 0.808 0.773 0.830
75  0.798 0.821 0.843 0.858 0.823 0.862 0.841 0.806 0.825 0.839 0.859 0.770
76  0.856 0.772 0.910 0.803 0.796 0.792 0.840 0.802 0.854 0.874 0.835 0.807
77  0.804 0.814 0.820 0.842 0.849 0.817 0.794 0.732 0.778 0.805 0.778 0.804

OBS  S37   S38   S39   S40   S41   S42   S43   S44   S45   S46   S47   S48

67  0.740 0.706 0.724 0.738 0.781 0.739 0.706 0.693 0.735 0.782 0.724 0.727
68  0.805 0.715 0.784 0.745 0.776 0.797 0.768 0.684 0.792 0.744 0.738 0.805
69  0.802 0.740 0.746 0.757 0.728 0.708 0.902 0.666 0.740 0.780 0.759 0.912
70  0.840 0.749 0.761 0.798 0.781 0.797 0.778 0.719 0.796 0.760 0.776 0.785
71  0.832 0.788 0.834 0.828 0.779 0.772 0.767 0.767 0.831 0.770 0.815 0.776
72  0.845 0.773 0.807 0.805 0.735 0.820 0.783 0.703 0.799 0.826 0.791 0.808
73  0.789 0.740 0.799 0.772 0.786 0.774 0.840 0.722 0.747 0.730 0.751 0.793
74  0.807 0.709 0.758 0.734 0.776 0.800 0.848 0.693 0.765 0.769 0.712 0.862
75  0.839 0.786 0.835 0.842 0.794 0.800 0.769 0.785 0.818 0.827 0.812 0.788
76  0.864 0.764 0.809 0.809 0.750 0.797 0.824 0.749 0.822 0.806 0.785 0.826
77  0.841 0.809 0.831 0.842 0.826 0.699 0.821 0.750 0.761 0.761 0.816 0.846
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                                        SAS

OBS   S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

 67  0.748  0.786  0.789  0.765  0.663  0.745  0.740  0.762  0.743  0.811  0.716  0.720
 68  0.831  0.791  0.813  0.785  0.748  0.753  0.822  0.784  0.767  0.800  0.787  0.785
 69  0.806  0.783  0.800  0.780  0.743  0.766  0.813  0.791  0.755  0.798  0.802  0.799
 70  0.821  0.800  0.812  0.824  0.776  0.792  0.839  0.808  0.779  0.741  0.783  0.807
 71  0.833  0.833  0.898  0.862  0.777  0.820  0.831  0.864  0.828  0.807  0.835  0.833
 72  0.868  0.821  0.802  0.813  0.779  0.813  0.864  0.815  0.808  0.765  0.850  0.873
 73  0.761  0.791  0.832  0.810  0.712  0.770  0.786  0.816  0.780  0.842  0.751  0.746
 74  0.826  0.770  0.816  0.778  0.738  0.733  0.813  0.777  0.758  0.781  0.814  0.810
 75  0.870  0.819  0.876  0.847  0.748  0.824  0.829  0.865  0.821  0.814  0.876  0.875
 76  0.859  0.795  0.860  0.840  0.803  0.796  0.865  0.843  0.812  0.771  0.853  0.856
 77  0.799  0.840  0.883  0.871  0.766  0.842  0.826  0.867  0.845  0.780  0.801  0.811

OBS   S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

 67  0.707  0.756  0.829  0.829  0.697  0.787  1.000  0.808  0.726  0.742  0.754  0.755
 68  0.758  0.802  0.852  0.855  0.787  0.835  0.808  1.000  0.790  0.809  0.851  0.808
 69  0.888  0.782  0.774  0.749  0.887  0.772  0.726  0.790  1.000  0.760  0.762  0.775
 70  0.773  0.804  0.790  0.798  0.769  0.811  0.742  0.809  0.760  1.000  0.817  0.868
 71  0.736  0.863  0.877  0.887  0.794  0.907  0.754  0.851  0.762  0.817  1.000  0.801
 72  0.846  0.820  0.793  0.793  0.780  0.844  0.755  0.808  0.775  0.868  0.801  1.000
 73  0.806  0.782  0.828  0.808  0.794  0.834  0.792  0.823  0.854  0.738  0.837  0.758
 74  0.822  0.775  0.824  0.799  0.855  0.802  0.744  0.876  0.852  0.763  0.829  0.780
 75  0.790  0.852  0.885  0.864  0.782  0.867  0.770  0.814  0.748  0.788  0.904  0.842
 76  0.786  0.838  0.824  0.812  0.835  0.846  0.764  0.834  0.802  0.836  0.866  0.840
 77  0.835  0.879  0.816  0.801  0.857  0.823  0.747  0.757  0.803  0.777  0.828  0.810

OBS   S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

 67  0.792  0.744  0.770  0.764  0.747  0.745  0.753  0.705  0.742  0.721  0.680  0.787
 68  0.823  0.876  0.814  0.834  0.757  0.793  0.819  0.776  0.751  0.759  0.700  0.798
 69  0.854  0.852  0.748  0.802  0.803  0.727  0.751  0.753  0.730  0.777  0.731  0.784
 70  0.738  0.763  0.788  0.836  0.777  0.804  0.798  0.762  0.775  0.782  0.759  0.789
 71  0.837  0.829  0.904  0.866  0.828  0.866  0.904  0.851  0.826  0.849  0.786  0.864
 72  0.758  0.780  0.842  0.840  0.810  0.828  0.827  0.782  0.794  0.801  0.769  0.817
 73  1.000  0.911  0.834  0.803  0.826  0.786  0.813  0.829  0.803  0.813  0.800  0.862
 74  0.911  1.000  0.821  0.857  0.828  0.781  0.802  0.820  0.761  0.804  0.773  0.814
 75  0.834  0.821  1.000  0.868  0.845  0.904  0.908  0.887  0.844  0.851  0.802  0.883
 76  0.803  0.857  0.868  1.000  0.853  0.873  0.877  0.860  0.833  0.840  0.789  0.860
 77  0.826  0.828  0.845  0.853  1.000  0.882  0.870  0.901  0.849  0.924  0.836  0.859

OBS   S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

 67  0.743  0.691  0.771  0.689  0.699  0.710  0.775  0.707  0.762  0.756  0.728  0.765
 68  0.808  0.773  0.776  0.801  0.748  0.802  0.796  0.815  0.809  0.836  0.761  0.818
 69  0.777  0.795  0.773  0.746  0.779  0.808  0.802  0.824  0.765  0.789  0.729  0.763
 70  0.868  0.806  0.856  0.795  0.742  0.809  0.809  0.820  0.808  0.897  0.820  0.819
 71  0.839  0.799  0.861  0.825  0.824  0.841  0.870  0.867  0.903  0.845  0.853  0.867
 72  0.883  0.794  0.856  0.812  0.788  0.840  0.797  0.835  0.805  0.907  0.855  0.857
 73  0.803  0.785  0.812  0.759  0.821  0.811  0.864  0.828  0.813  0.784  0.782  0.835
 74  0.821  0.837  0.777  0.809  0.818  0.859  0.856  0.871  0.803  0.813  0.751  0.800
 75  0.867  0.816  0.869  0.833  0.848  0.834  0.876  0.837  0.885  0.831  0.836  0.863
 76  0.901  0.860  0.859  0.886  0.854  0.874  0.853  0.886  0.860  0.880  0.825  0.844
 77  0.833  0.890  0.874  0.820  0.958  0.900  0.928  0.891  0.881  0.799  0.822  0.850
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                                        SAS

OBS  S97    S98    S99    S100   S101   S102   S103   S104   S105   S106   S107   S108

67   0.732  0.745  0.748  0.705  0.729  0.664  0.676  0.756  0.820  0.733  0.839  0.743
68   0.804  0.781  0.784  0.746  0.762  0.723  0.692  0.802  0.825  0.859  0.822  0.757
69   0.755  0.822  0.802  0.758  0.765  0.669  0.731  0.745  0.725  0.830  0.776  0.761
70   0.792  0.784  0.779  0.774  0.834  0.747  0.713  0.827  0.777  0.794  0.762  0.724
71   0.893  0.877  0.851  0.825  0.845  0.827  0.786  0.875  0.866  0.825  0.850  0.822
72   0.796  0.787  0.771  0.766  0.848  0.755  0.729  0.861  0.757  0.829  0.752  0.752
73   0.814  0.856  0.842  0.793  0.829  0.731  0.771  0.831  0.809  0.786  0.821  0.822
74   0.811  0.833  0.834  0.791  0.802  0.732  0.758  0.790  0.800  0.851  0.823  0.826
75   0.876  0.857  0.849  0.838  0.829  0.816  0.785  0.879  0.859  0.819  0.833  0.826
76   0.878  0.860  0.838  0.826  0.832  0.819  0.792  0.861  0.796  0.872  0.807  0.822
77   0.866  0.934  0.903  0.925  0.883  0.801  0.879  0.852  0.796  0.802  0.810  0.841

OBS  S109   S110   S111   S112   S113   S114   S115   S116   S117   S118   S119   S120

67   0.753  0.780  0.694  0.681  0.722  0.739  0.732  0.688  0.690  0.678  0.657  0.783
68   0.756  0.820  0.786  0.752  0.751  0.807  0.852  0.834  0.782  0.739  0.668  0.728
69   0.835  0.841  0.764  0.746  0.830  0.705  0.785  0.763  0.701  0.779  0.687  0.762
70   0.777  0.784  0.771  0.715  0.708  0.745  0.777  0.719  0.765  0.839  0.688  0.687
71   0.819  0.792  0.812  0.755  0.810  0.852  0.824  0.801  0.879  0.769  0.765  0.786
72   0.804  0.784  0.801  0.755  0.766  0.734  0.809  0.786  0.770  0.866  0.739  0.716
73   0.818  0.887  0.801  0.789  0.817  0.796  0.836  0.814  0.768  0.701  0.686  0.808
74   0.775  0.874  0.804  0.777  0.746  0.789  0.877  0.877  0.757  0.753  0.698  0.788
75   0.815  0.793  0.798  0.761  0.802  0.834  0.870  0.846  0.881  0.798  0.800  0.800
76   0.815  0.793  0.802  0.775  0.788  0.794  0.827  0.810  0.835  0.849  0.745  0.792
77   0.862  0.758  0.773  0.736  0.814  0.750  0.806  0.771  0.824  0.761  0.787  0.784

OBS     S121     S122     S123     S124     S125     S126     S127     S128     S129

67      0.717    0.684    0.755    0.722    0.838    0.768    0.724    0.796    0.743
68      0.687    0.797    0.792    0.752    0.842    0.815    0.766    0.756    0.759
69      0.789    0.781    0.812    0.754    0.763    0.760    0.771    0.822    0.823
70      0.711    0.738    0.756    0.748    0.761    0.760    0.725    0.755    0.746
71      0.766    0.818    0.814    0.825    0.851    0.903    0.843    0.824    0.816
72      0.729    0.728    0.801    0.729    0.758    0.774    0.771    0.765    0.747
73      0.810    0.782    0.836    0.762    0.816    0.859    0.828    0.860    0.843
74      0.752    0.831    0.814    0.766    0.808    0.837    0.816    0.816    0.779
75      0.794    0.784    0.840    0.815    0.841    0.878    0.896    0.848    0.805
76      0.736    0.822    0.826    0.795    0.827    0.847    0.793    0.796    0.775
77      0.781    0.792    0.788    0.834    0.796    0.821    0.817    0.875    0.818
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                                          SAS

OBS   S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

 78  0.860  0.855  0.782  0.860  0.883  0.729  0.715  0.856  0.790  0.817  0.758  0.770
 79  0.860  0.849  0.762  0.871  0.878  0.772  0.740  0.885  0.773  0.838  0.793  0.766
 80  0.817  0.818  0.750  0.826  0.843  0.716  0.695  0.837  0.776  0.790  0.790  0.727
 81  0.827  0.797  0.771  0.834  0.849  0.715  0.691  0.812  0.748  0.774  0.730  0.742
 82  0.836  0.856  0.749  0.839  0.857  0.697  0.702  0.819  0.791  0.780  0.802  0.735
 83  0.826  0.746  0.713  0.832  0.849  0.690  0.676  0.765  0.729  0.731  0.729  0.729
 84  0.895  0.811  0.772  0.823  0.881  0.780  0.788  0.848  0.794  0.844  0.786  0.763
 85  0.894  0.793  0.821  0.832  0.847  0.737  0.783  0.821  0.757  0.840  0.735  0.766
 86  0.868  0.788  0.781  0.838  0.819  0.675  0.738  0.777  0.784  0.801  0.794  0.730
 87  0.881  0.849  0.814  0.820  0.902  0.755  0.766  0.829  0.792  0.811  0.776  0.773
 88  0.908  0.789  0.778  0.896  0.844  0.703  0.744  0.807  0.735  0.830  0.715  0.774

OBS   S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

 78  0.702  0.716  0.755  0.722  0.820  0.819  0.741  0.905  0.839  0.759  0.802  0.770
 79  0.688  0.754  0.735  0.731  0.807  0.805  0.755  0.897  0.833  0.768  0.795  0.758
 80  0.674  0.770  0.717  0.724  0.793  0.788  0.722  0.880  0.806  0.784  0.827  0.790
 81  0.661  0.740  0.682  0.737  0.764  0.762  0.765  0.880  0.780  0.756  0.771  0.734
 82  0.669  0.749  0.720  0.710  0.807  0.800  0.722  0.875  0.840  0.799  0.860  0.809
 83  0.682  0.739  0.664  0.679  0.739  0.735  0.712  0.834  0.747  0.752  0.771  0.752
 84  0.663  0.764  0.696  0.725  0.778  0.777  0.792  0.906  0.838  0.818  0.782  0.793
 85  0.724  0.759  0.699  0.741  0.849  0.843  0.811  0.886  0.848  0.753  0.831  0.808
 86  0.662  0.755  0.706  0.724  0.818  0.821  0.751  0.828  0.834  0.766  0.864  0.844
 87  0.745  0.754  0.728  0.726  0.815  0.815  0.773  0.910  0.837  0.788  0.806  0.783
 88  0.686  0.729  0.746  0.706  0.824  0.822  0.784  0.834  0.839  0.706  0.798  0.790

OBS   S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

 78  0.749  0.819  0.823  0.798  0.854  0.871  0.778  0.786  0.788  0.801  0.798  0.751
 79  0.774  0.829  0.805  0.824  0.873  0.882  0.787  0.762  0.772  0.789  0.781  0.773
 80  0.788  0.776  0.791  0.846  0.820  0.832  0.733  0.750  0.757  0.773  0.767  0.784
 81  0.772  0.790  0.766  0.820  0.828  0.831  0.750  0.739  0.715  0.728  0.783  0.742
 82  0.791  0.797  0.820  0.831  0.832  0.851  0.752  0.767  0.769  0.788  0.765  0.782
 83  0.760  0.760  0.732  0.807  0.818  0.786  0.717  0.747  0.693  0.703  0.728  0.741
 84  0.774  0.853  0.787  0.857  0.855  0.864  0.814  0.773  0.779  0.797  0.795  0.799
 85  0.816  0.814  0.846  0.800  0.825  0.840  0.826  0.855  0.798  0.815  0.843  0.792
 86  0.804  0.785  0.827  0.786  0.798  0.799  0.795  0.786  0.802  0.808  0.790  0.805
 87  0.783  0.852  0.827  0.817  0.873  0.885  0.818  0.844  0.785  0.804  0.824  0.781
 88  0.776  0.771  0.833  0.764  0.818  0.791  0.784  0.782  0.798  0.800  0.786  0.759

OBS   S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

 78  0.881  0.877  0.874  0.872  0.818  0.761  0.760  0.889  0.818  0.751  0.878  0.805
 79  0.885  0.898  0.892  0.896  0.815  0.750  0.766  0.865  0.819  0.756  0.885  0.806
 80  0.835  0.831  0.842  0.827  0.840  0.738  0.782  0.847  0.794  0.712  0.834  0.825
 81  0.851  0.848  0.862  0.844  0.790  0.727  0.756  0.860  0.806  0.736  0.836  0.756
 82  0.853  0.849  0.833  0.846  0.859  0.725  0.799  0.865  0.797  0.712  0.838  0.835
 83  0.810  0.842  0.848  0.791  0.765  0.743  0.767  0.844  0.762  0.689  0.820  0.743
 84  0.902  0.854  0.911  0.885  0.759  0.771  0.808  0.809  0.831  0.792  0.898  0.799
 85  0.916  0.800  0.851  0.847  0.766  0.852  0.818  0.797  0.868  0.802  0.821  0.797
 86  0.878  0.801  0.798  0.811  0.810  0.749  0.838  0.797  0.803  0.755  0.798  0.832
 87  0.900  0.845  0.873  0.892  0.812  0.805  0.796  0.834  0.824  0.787  0.876  0.790
 88  0.863  0.845  0.860  0.791  0.738  0.767  0.781  0.838  0.814  0.759  0.836  0.787
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                                        SAS

OBS   S49   S50   S51   S52   S53   S54   S55   S56   S57   S58   S59   S60

78  0.833 0.872 0.909 0.897 0.866 0.899 0.881 0.908 0.884 0.757 0.799 0.810
79  0.828 0.882 0.928 0.902 0.873 0.913 0.901 0.925 0.884 0.772 0.831 0.812
80  0.799 0.821 0.865 0.851 0.825 0.846 0.840 0.878 0.840 0.719 0.767 0.782
81  0.755 0.838 0.848 0.867 0.840 0.867 0.854 0.884 0.848 0.713 0.741 0.735
82  0.816 0.847 0.889 0.871 0.846 0.872 0.846 0.893 0.858 0.731 0.798 0.795
83  0.709 0.786 0.811 0.818 0.820 0.860 0.802 0.837 0.852 0.683 0.718 0.713
84  0.808 0.886 0.885 0.923 0.825 0.902 0.897 0.924 0.917 0.816 0.794 0.799
85  0.827 0.828 0.853 0.869 0.830 0.858 0.907 0.893 0.853 0.744 0.829 0.820
86  0.805 0.800 0.855 0.839 0.832 0.838 0.859 0.852 0.831 0.709 0.811 0.804
87  0.816 0.880 0.900 0.915 0.826 0.911 0.893 0.932 0.904 0.784 0.810 0.807
88  0.813 0.800 0.856 0.831 0.884 0.858 0.860 0.839 0.864 0.698 0.806 0.814

OBS   S61   S62   S63   S64   S65   S66   S67   S68   S69   S70   S71   S72

78  0.755 0.916 0.849 0.821 0.800 0.847 0.745 0.793 0.727 0.804 0.866 0.828
79  0.755 0.939 0.887 0.842 0.838 0.877 0.753 0.819 0.751 0.798 0.904 0.827
80  0.769 0.877 0.820 0.796 0.835 0.833 0.705 0.776 0.753 0.762 0.851 0.782
81  0.735 0.858 0.793 0.765 0.776 0.871 0.742 0.751 0.730 0.775 0.826 0.794
82  0.776 0.898 0.832 0.824 0.849 0.828 0.721 0.759 0.777 0.782 0.849 0.801
83  0.733 0.853 0.753 0.728 0.769 0.788 0.680 0.700 0.731 0.759 0.786 0.769
84  0.787 0.877 0.833 0.811 0.811 0.887 0.787 0.798 0.784 0.789 0.864 0.817
85  0.786 0.850 0.813 0.789 0.824 0.845 0.743 0.808 0.777 0.868 0.839 0.883
86  0.796 0.860 0.793 0.768 0.864 0.780 0.691 0.773 0.795 0.806 0.799 0.794
87  0.775 0.904 0.849 0.831 0.818 0.863 0.771 0.776 0.773 0.856 0.861 0.856
88  0.748 0.899 0.783 0.777 0.811 0.808 0.689 0.801 0.746 0.795 0.825 0.812

OBS   S73   S74   S75   S76   S77   S78   S79   S80   S81   S82   S83   S84

78  0.786 0.781 0.904 0.873 0.882 1.000 0.943 0.940 0.911 0.933 0.908 0.904
79  0.813 0.802 0.908 0.877 0.870 0.943 1.000 0.929 0.901 0.908 0.896 0.912
80  0.829 0.820 0.887 0.860 0.901 0.940 0.929 1.000 0.915 0.958 0.943 0.880
81  0.803 0.761 0.844 0.833 0.849 0.911 0.901 0.915 1.000 0.905 0.916 0.869
82  0.813 0.804 0.851 0.840 0.924 0.933 0.908 0.958 0.905 1.000 0.927 0.848
83  0.800 0.773 0.802 0.789 0.836 0.908 0.896 0.943 0.916 0.927 1.000 0.833
84  0.862 0.814 0.883 0.860 0.859 0.904 0.912 0.880 0.869 0.848 0.833 1.000
85  0.803 0.821 0.867 0.901 0.833 0.906 0.898 0.881 0.886 0.865 0.881 0.894
86  0.785 0.837 0.816 0.860 0.890 0.896 0.868 0.916 0.862 0.934 0.879 0.816
87  0.812 0.777 0.869 0.859 0.874 0.941 0.913 0.899 0.911 0.922 0.881 0.897
88  0.759 0.809 0.833 0.886 0.820 0.929 0.921 0.907 0.884 0.894 0.895 0.842

OBS   S85   S86   S87   S88   S89   S90   S91   S92   S93   S94   S95   S96

78  0.906 0.896 0.941 0.929 0.879 0.884 0.905 0.881 0.919 0.845 0.907 0.901
79  0.898 0.868 0.913 0.921 0.885 0.869 0.901 0.893 0.941 0.851 0.928 0.932
80  0.881 0.916 0.899 0.907 0.915 0.899 0.936 0.907 0.891 0.821 0.883 0.889
81  0.886 0.862 0.911 0.884 0.865 0.850 0.874 0.853 0.863 0.833 0.891 0.891
82  0.865 0.934 0.922 0.894 0.905 0.922 0.946 0.925 0.906 0.830 0.887 0.869
83  0.881 0.879 0.881 0.895 0.894 0.846 0.862 0.841 0.824 0.806 0.927 0.923
84  0.894 0.816 0.897 0.842 0.857 0.845 0.888 0.858 0.885 0.831 0.887 0.919
85  1.000 0.891 0.938 0.903 0.829 0.894 0.868 0.892 0.868 0.910 0.922 0.923
86  0.891 1.000 0.870 0.907 0.875 0.932 0.904 0.929 0.863 0.821 0.831 0.834
87  0.938 0.870 1.000 0.856 0.843 0.861 0.900 0.864 0.911 0.877 0.941 0.936
88  0.903 0.907 0.856 1.000 0.872 0.885 0.844 0.879 0.867 0.849 0.886 0.909
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                                          SAS

OBS   S97    S98    S99   S100   S101   S102   S103   S104   S105   S106   S107   S108

78   0.947  0.900  0.892  0.914  0.877  0.952  0.913  0.910  0.828  0.826  0.773  0.782
79   0.964  0.917  0.871  0.898  0.879  0.946  0.888  0.938  0.838  0.846  0.807  0.788
80   0.930  0.932  0.921  0.946  0.927  0.930  0.939  0.890  0.790  0.797  0.747  0.822
81   0.905  0.876  0.866  0.888  0.899  0.909  0.881  0.898  0.764  0.782  0.714  0.758
82   0.916  0.948  0.939  0.964  0.926  0.935  0.974  0.873  0.807  0.789  0.757  0.833
83   0.885  0.855  0.849  0.914  0.888  0.894  0.909  0.924  0.733  0.727  0.699  0.763
84   0.898  0.885  0.855  0.830  0.862  0.815  0.801  0.937  0.814  0.826  0.816  0.778
85   0.892  0.849  0.846  0.849  0.889  0.836  0.806  0.934  0.793  0.835  0.755  0.762
86   0.891  0.899  0.893  0.935  0.847  0.840  0.903  0.838  0.772  0.793  0.734  0.789
87   0.902  0.900  0.893  0.904  0.913  0.852  0.846  0.943  0.827  0.801  0.790  0.782
88   0.926  0.846  0.840  0.879  0.821  0.911  0.873  0.904  0.764  0.830  0.739  0.754

OBS  S109   S110   S111   S112   S113   S114   S115   S116   S117   S118   S119   S120

78   0.833  0.737  0.783  0.727  0.803  0.865  0.794  0.782  0.912  0.827  0.879  0.728
79   0.866  0.769  0.811  0.761  0.853  0.900  0.812  0.791  0.934  0.796  0.875  0.751
80   0.805  0.738  0.795  0.748  0.787  0.856  0.842  0.827  0.903  0.797  0.843  0.778
81   0.809  0.771  0.805  0.751  0.795  0.824  0.766  0.749  0.856  0.782  0.803  0.784
82   0.820  0.748  0.784  0.730  0.773  0.835  0.805  0.796  0.867  0.811  0.859  0.757
83   0.774  0.724  0.825  0.774  0.781  0.823  0.750  0.780  0.846  0.812  0.800  0.754
84   0.864  0.801  0.807  0.786  0.845  0.798  0.798  0.774  0.881  0.793  0.764  0.774
85   0.830  0.811  0.828  0.784  0.783  0.775  0.811  0.788  0.851  0.886  0.753  0.757
86   0.786  0.788  0.768  0.720  0.724  0.769  0.824  0.818  0.824  0.819  0.776  0.742
87   0.874  0.786  0.821  0.770  0.810  0.780  0.765  0.739  0.874  0.866  0.784  0.765
88   0.788  0.760  0.808  0.760  0.796  0.858  0.794  0.825  0.880  0.842  0.823  0.720

OBS     S121      S122      S123      S124      S125      S126      S127      S128      S129

78      0.714     0.713     0.765     0.827     0.804     0.833     0.818     0.832     0.741
79      0.721     0.738     0.776     0.829     0.830     0.862     0.843     0.820     0.750
80      0.746     0.763     0.733     0.789     0.774     0.822     0.868     0.866     0.741
81      0.706     0.704     0.738     0.770     0.748     0.793     0.794     0.852     0.778
82      0.730     0.743     0.734     0.808     0.791     0.803     0.834     0.867     0.752
83      0.706     0.710     0.720     0.743     0.721     0.756     0.792     0.813     0.724
84      0.758     0.741     0.827     0.799     0.801     0.844     0.802     0.869     0.803
85      0.705     0.765     0.803     0.787     0.770     0.809     0.787     0.815     0.752
86      0.709     0.782     0.750     0.796     0.763     0.768     0.804     0.825     0.737
87      0.747     0.730     0.803     0.830     0.820     0.834     0.803     0.855     0.785
88      0.669     0.756     0.765     0.788     0.764     0.797     0.769     0.777     0.710
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                                        SAS

OBS  S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

 89 0.807  0.790  0.709  0.813  0.811  0.686  0.711  0.814  0.780  0.802  0.770  0.733
 90 0.868  0.825  0.783  0.817  0.806  0.702  0.750  0.803  0.772  0.835  0.789  0.765
 91 0.841  0.830  0.752  0.792  0.832  0.751  0.768  0.842  0.827  0.825  0.863  0.764
 92 0.874  0.822  0.770  0.827  0.800  0.710  0.770  0.819  0.789  0.849  0.818  0.748
 93 0.876  0.854  0.763  0.838  0.878  0.757  0.784  0.861  0.797  0.841  0.811  0.781
 94 0.846  0.828  0.804  0.784  0.778  0.768  0.783  0.818  0.738  0.842  0.740  0.761
 95 0.845  0.828  0.749  0.844  0.867  0.756  0.707  0.822  0.734  0.782  0.723  0.732
 96 0.881  0.830  0.750  0.885  0.870  0.792  0.766  0.877  0.753  0.826  0.760  0.777
 97 0.874  0.856  0.762  0.850  0.882  0.762  0.756  0.864  0.796  0.834  0.775  0.769
 98 0.854  0.843  0.749  0.816  0.849  0.730  0.773  0.832  0.810  0.831  0.843  0.750
 99 0.836  0.859  0.779  0.794  0.858  0.746  0.750  0.820  0.823  0.812  0.850  0.765

OBS  S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

 89 0.661  0.745  0.747  0.713  0.753  0.746  0.731  0.832  0.839  0.829  0.790  0.843
 90 0.629  0.776  0.709  0.731  0.835  0.837  0.811  0.837  0.868  0.777  0.900  0.857
 91 0.645  0.793  0.717  0.737  0.803  0.802  0.765  0.869  0.861  0.844  0.866  0.853
 92 0.634  0.800  0.713  0.731  0.835  0.838  0.796  0.837  0.865  0.793  0.882  0.855
 93 0.675  0.772  0.763  0.732  0.827  0.833  0.792  0.911  0.854  0.788  0.813  0.801
 94 0.710  0.766  0.665  0.734  0.828  0.827  0.810  0.836  0.845  0.749  0.847  0.775
 95 0.701  0.718  0.672  0.704  0.774  0.768  0.738  0.894  0.803  0.741  0.750  0.721
 96 0.697  0.771  0.707  0.679  0.774  0.765  0.764  0.887  0.835  0.790  0.760  0.758
 97 0.675  0.764  0.745  0.723  0.819  0.817  0.783  0.889  0.838  0.762  0.786  0.776
 98 0.653  0.801  0.737  0.734  0.792  0.805  0.775  0.877  0.842  0.830  0.840  0.837
 99 0.638  0.785  0.716  0.728  0.802  0.807  0.780  0.852  0.843  0.816  0.860  0.840

OBS  S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

 89 0.787  0.767  0.783  0.841  0.844  0.776  0.761  0.672  0.725  0.743  0.724  0.775
 90 0.853  0.789  0.862  0.821  0.801  0.817  0.806  0.787  0.832  0.847  0.801  0.820
 91 0.816  0.849  0.816  0.867  0.828  0.848  0.802  0.767  0.795  0.812  0.770  0.820
 92 0.854  0.803  0.849  0.831  0.785  0.832  0.829  0.789  0.818  0.831  0.783  0.840
 93 0.776  0.856  0.836  0.820  0.859  0.885  0.828  0.780  0.833  0.833  0.784  0.785
 94 0.841  0.774  0.840  0.811  0.776  0.821  0.809  0.854  0.794  0.821  0.817  0.791
 95 0.760  0.802  0.772  0.811  0.834  0.869  0.770  0.801  0.720  0.739  0.770  0.735
 96 0.763  0.850  0.787  0.858  0.840  0.856  0.801  0.781  0.754  0.768  0.765  0.777
 97 0.767  0.837  0.823  0.831  0.838  0.854  0.794  0.765  0.789  0.797  0.772  0.764
 98 0.805  0.831  0.817  0.862  0.833  0.856  0.800  0.756  0.812  0.816  0.765  0.825
 99 0.801  0.842  0.844  0.849  0.819  0.835  0.792  0.768  0.805  0.816  0.792  0.798

OBS  S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

 89 0.807  0.848  0.858  0.815  0.793  0.662  0.798  0.792  0.749  0.702  0.816  0.826
 90 0.902  0.805  0.837  0.835  0.806  0.766  0.844  0.766  0.838  0.789  0.822  0.856
 91 0.860  0.816  0.837  0.856  0.850  0.734  0.844  0.796  0.787  0.756  0.840  0.846
 92 0.895  0.798  0.831  0.838  0.807  0.768  0.865  0.753  0.825  0.784  0.817  0.862
 93 0.881  0.846  0.873  0.875  0.810  0.748  0.790  0.812  0.821  0.782  0.884  0.805
 94 0.857  0.771  0.815  0.805  0.758  0.848  0.791  0.736  0.854  0.786  0.801  0.815
 95 0.860  0.874  0.867  0.864  0.764  0.791  0.739  0.850  0.831  0.731  0.859  0.762
 96 0.879  0.890  0.909  0.857  0.751  0.769  0.793  0.853  0.803  0.756  0.874  0.793
 97 0.869  0.864  0.897  0.855  0.789  0.757  0.777  0.822  0.814  0.760  0.880  0.792
 98 0.867  0.831  0.851  0.866  0.840  0.717  0.831  0.784  0.776  0.770  0.864  0.843
 99 0.852  0.813  0.849  0.860  0.843  0.731  0.813  0.812  0.794  0.771  0.855  0.825
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OBS  S49   S50   S51   S52   S53   S54   S55   S56   S57   S58   S59   S60

 89 0.758 0.808 0.863 0.847 0.808 0.835 0.799 0.847 0.831 0.737 0.760 0.771
 90 0.843 0.834 0.862 0.856 0.814 0.825 0.877 0.856 0.829 0.734 0.841 0.829
 91 0.806 0.841 0.908 0.891 0.794 0.856 0.841 0.892 0.869 0.788 0.799 0.805
 92 0.835 0.820 0.879 0.873 0.834 0.833 0.890 0.874 0.839 0.754 0.844 0.805
 93 0.833 0.866 0.928 0.906 0.838 0.889 0.869 0.923 0.897 0.799 0.825 0.836
 94 0.866 0.830 0.834 0.834 0.793 0.818 0.880 0.830 0.808 0.791 0.816 0.817
 95 0.800 0.872 0.878 0.880 0.847 0.898 0.878 0.894 0.869 0.749 0.784 0.828
 96 0.797 0.882 0.887 0.907 0.877 0.892 0.878 0.912 0.897 0.772 0.779 0.767
 97 0.810 0.861 0.915 0.895 0.848 0.893 0.864 0.899 0.892 0.757 0.803 0.778
 98 0.806 0.854 0.928 0.896 0.822 0.870 0.855 0.905 0.878 0.787 0.807 0.799
 99 0.821 0.872 0.912 0.877 0.794 0.847 0.836 0.872 0.859 0.763 0.808 0.801
                                                                     0.798

OBS  S61   S62   S63   S64   S65   S66   S67   S68   S69   S70   S71   S72

 89 0.805 0.878 0.775 0.763 0.841 0.816 0.699 0.748 0.779 0.742 0.824 0.788
 90 0.820 0.863 0.795 0.796 0.881 0.818 0.710 0.802 0.808 0.809 0.841 0.840
 91 0.808 0.895 0.849 0.838 0.883 0.844 0.775 0.796 0.802 0.809 0.870 0.797
 92 0.823 0.872 0.814 0.803 0.900 0.835 0.707 0.815 0.824 0.820 0.867 0.835
 93 0.761 0.938 0.877 0.856 0.850 0.862 0.762 0.809 0.765 0.808 0.903 0.805
 94 0.795 0.832 0.837 0.807 0.790 0.849 0.756 0.836 0.789 0.897 0.845 0.907
 95 0.737 0.889 0.817 0.791 0.770 0.860 0.728 0.761 0.729 0.820 0.853 0.855
 96 0.770 0.908 0.827 0.807 0.806 0.883 0.765 0.818 0.763 0.819 0.867 0.857
 97 0.746 0.945 0.843 0.822 0.820 0.866 0.732 0.804 0.755 0.792 0.893 0.796
 98 0.800 0.917 0.849 0.828 0.886 0.844 0.745 0.781 0.822 0.784 0.877 0.787
 99 0.796 0.893 0.829 0.822 0.861 0.821 0.748 0.784 0.802 0.779 0.851 0.771

OBS  S73   S74   S75   S76   S77   S78   S79   S80   S81   S82   S83   S84

 89 0.821 0.818 0.848 0.854 0.958 0.879 0.885 0.915 0.865 0.905 0.894 0.857
 90 0.811 0.859 0.834 0.874 0.900 0.884 0.869 0.899 0.850 0.922 0.846 0.845
 91 0.864 0.856 0.876 0.853 0.928 0.905 0.901 0.936 0.874 0.946 0.862 0.888
 92 0.828 0.871 0.837 0.886 0.891 0.881 0.893 0.907 0.853 0.925 0.841 0.858
 93 0.813 0.803 0.885 0.860 0.881 0.919 0.941 0.891 0.863 0.906 0.824 0.885
 94 0.784 0.813 0.831 0.880 0.799 0.845 0.851 0.821 0.833 0.830 0.806 0.831
 95 0.782 0.751 0.836 0.825 0.822 0.907 0.928 0.883 0.891 0.887 0.927 0.887
 96 0.835 0.800 0.863 0.844 0.850 0.901 0.932 0.889 0.891 0.869 0.923 0.919
 97 0.814 0.811 0.876 0.878 0.866 0.947 0.964 0.930 0.905 0.916 0.885 0.898
 98 0.856 0.833 0.857 0.860 0.934 0.900 0.917 0.932 0.876 0.948 0.855 0.885
 99 0.842 0.834 0.849 0.838 0.903 0.892 0.871 0.921 0.866 0.939 0.849 0.855

OBS  S85   S86   S87   S88   S89   S90   S91   S92   S93   S94   S95   S96

 89 0.829 0.875 0.843 0.872 1.000 0.890 0.914 0.893 0.861 0.787 0.833 0.864
 90 0.894 0.932 0.861 0.885 0.890 1.000 0.919 0.968 0.876 0.855 0.835 0.848
 91 0.868 0.904 0.900 0.844 0.914 0.919 1.000 0.927 0.919 0.817 0.842 0.874
 92 0.892 0.929 0.864 0.879 0.893 0.968 0.927 1.000 0.892 0.852 0.846 0.860
 93 0.868 0.863 0.911 0.867 0.861 0.876 0.919 0.892 1.000 0.828 0.889 0.911
 94 0.910 0.821 0.877 0.849 0.787 0.855 0.817 0.852 0.828 1.000 0.897 0.880
 95 0.922 0.831 0.941 0.886 0.833 0.835 0.842 0.846 0.889 0.897 1.000 0.943
 96 0.923 0.834 0.936 0.909 0.864 0.848 0.874 0.860 0.911 0.880 0.943 1.000
 97 0.892 0.891 0.902 0.926 0.896 0.874 0.889 0.886 0.931 0.844 0.925 0.945
 98 0.849 0.899 0.900 0.846 0.920 0.915 0.951 0.936 0.934 0.803 0.851 0.885
 99 0.846 0.893 0.893 0.840 0.881 0.916 0.949 0.902 0.893 0.798 0.827 0.850
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                                        SAS

OBS  S97    S98    S99    S100   S101   S102   S103   S104   S105   S106   S107   S108

 89 0.896  0.920  0.881  0.898  0.889  0.885  0.903  0.868  0.748  0.814  0.766  0.827
 90 0.874  0.915  0.916  0.891  0.885  0.822  0.856  0.852  0.792  0.828  0.747  0.850
 91 0.889  0.951  0.949  0.933  0.899  0.828  0.873  0.886  0.823  0.805  0.817  0.852
 92 0.886  0.936  0.902  0.892  0.885  0.825  0.852  0.874  0.790  0.840  0.765  0.834
 93 0.931  0.934  0.893  0.913  0.855  0.847  0.837  0.914  0.844  0.820  0.826  0.819
 94 0.844  0.803  0.798  0.798  0.882  0.791  0.754  0.881  0.771  0.846  0.758  0.746
 95 0.925  0.851  0.827  0.874  0.918  0.930  0.872  0.939  0.778  0.791  0.748  0.736
 96 0.945  0.885  0.850  0.862  0.918  0.906  0.857  0.977  0.802  0.838  0.785  0.765
 97 1.000  0.912  0.886  0.914  0.875  0.909  0.866  0.938  0.814  0.829  0.797  0.803
 98 0.912  1.000  0.940  0.940  0.895  0.830  0.885  0.890  0.815  0.808  0.810  0.846
 99 0.886  0.940  1.000  0.925  0.886  0.822  0.865  0.852  0.819  0.784  0.793  0.869

OBS  S109   S110   S111   S112   S113   S114   S115   S116   S117   S118   S119   S120

 89 0.842  0.710  0.790  0.750  0.849  0.823  0.806  0.779  0.838  0.752  0.836  0.773
 90 0.805  0.801  0.787  0.734  0.742  0.759  0.851  0.832  0.822  0.803  0.753  0.771
 91 0.864  0.817  0.804  0.758  0.786  0.807  0.837  0.811  0.854  0.771  0.777  0.804
 92 0.826  0.819  0.807  0.757  0.766  0.766  0.871  0.852  0.846  0.806  0.754  0.780
 93 0.871  0.794  0.807  0.768  0.826  0.823  0.808  0.789  0.914  0.791  0.804  0.780
 94 0.794  0.798  0.832  0.777  0.765  0.769  0.817  0.783  0.794  0.866  0.711  0.735
 95 0.838  0.739  0.818  0.778  0.822  0.835  0.743  0.733  0.866  0.832  0.829  0.715
 96 0.871  0.775  0.852  0.818  0.855  0.861  0.788  0.767  0.892  0.819  0.819  0.777
 97 0.851  0.763  0.825  0.764  0.845  0.849  0.795  0.792  0.922  0.794  0.806  0.774
 98 0.859  0.791  0.808  0.770  0.818  0.789  0.829  0.814  0.883  0.767  0.776  0.808
 99 0.841  0.787  0.793  0.742  0.787  0.796  0.824  0.809  0.831  0.754  0.765  0.811

OBS     S121      S122      S123      S124      S125      S126      S127      S128      S129

 89     0.746     0.777     0.755     0.796     0.753     0.814     0.812     0.841     0.787
 90     0.743     0.812     0.780     0.797     0.776     0.799     0.820     0.840     0.747
 91     0.775     0.791     0.798     0.824     0.836     0.835     0.851     0.891     0.813
 92     0.749     0.819     0.789     0.804     0.788     0.811     0.830     0.847     0.758
 93     0.754     0.778     0.822     0.864     0.858     0.866     0.827     0.856     0.801
 94     0.721     0.760     0.795     0.738     0.785     0.808     0.775     0.782     0.734
 95     0.688     0.687     0.773     0.766     0.765     0.796     0.776     0.792     0.728
 96     0.728     0.727     0.813     0.819     0.802     0.848     0.802     0.848     0.770
 97     0.728     0.754     0.797     0.848     0.825     0.859     0.824     0.826     0.761
 98     0.798     0.804     0.793     0.848     0.827     0.851     0.857     0.897     0.804
 99     0.782     0.791     0.798     0.846     0.839     0.837     0.861     0.890     0.805
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                                        SAS

OBS  S1    S2    S3    S4    S5    S6    S7    S8    S9    S10   S11   S12

100 0.823 0.836 0.732 0.836 0.844 0.686 0.696 0.804 0.791 0.764 0.804 0.729
101 0.818 0.826 0.735 0.762 0.822 0.742 0.719 0.801 0.766 0.777 0.776 0.729
102 0.842 0.792 0.703 0.863 0.866 0.680 0.665 0.780 0.713 0.758 0.697 0.752
103 0.826 0.777 0.699 0.840 0.844 0.648 0.669 0.757 0.746 0.736 0.758 0.710
104 0.888 0.829 0.746 0.883 0.872 0.769 0.750 0.870 0.754 0.816 0.768 0.774
105 0.777 0.830 0.816 0.716 0.787 0.805 0.816 0.885 0.761 0.824 0.836 0.727
106 0.836 0.802 0.767 0.766 0.753 0.761 0.812 0.832 0.759 0.876 0.754 0.774
107 0.740 0.786 0.806 0.695 0.731 0.837 0.894 0.871 0.781 0.856 0.853 0.723
108 0.709 0.816 0.736 0.694 0.733 0.707 0.729 0.803 0.777 0.804 0.805 0.800
109 0.833 0.791 0.769 0.789 0.841 0.794 0.829 0.798 0.779 0.802 0.772 0.783
110 0.795 0.744 0.762 0.743 0.705 0.789 0.819 0.818 0.746 0.873 0.832 0.767

OBS  S13   S14   S15   S16   S17   S18   S19   S20   S21   S22   S23   S24

100 0.657 0.739 0.717 0.706 0.779 0.775 0.697 0.885 0.814 0.781 0.827 0.810
101 0.685 0.785 0.671 0.713 0.789 0.782 0.752 0.867 0.806 0.785 0.810 0.776
102 0.687 0.684 0.724 0.666 0.784 0.784 0.719 0.825 0.780 0.684 0.744 0.707
103 0.650 0.701 0.694 0.678 0.748 0.748 0.692 0.814 0.785 0.753 0.794 0.775
104 0.710 0.762 0.708 0.689 0.783 0.776 0.761 0.885 0.811 0.791 0.776 0.750
105 0.659 0.734 0.673 0.730 0.789 0.778 0.756 0.796 0.791 0.791 0.819 0.756
106 0.675 0.743 0.731 0.704 0.799 0.802 0.794 0.777 0.853 0.780 0.785 0.826
107 0.670 0.737 0.684 0.733 0.768 0.765 0.765 0.774 0.840 0.855 0.762 0.800
108 0.645 0.734 0.691 0.687 0.783 0.783 0.827 0.775 0.798 0.784 0.814 0.812
109 0.716 0.758 0.744 0.679 0.754 0.754 0.749 0.833 0.839 0.858 0.738 0.813
110 0.624 0.773 0.606 0.721 0.775 0.768 0.793 0.754 0.809 0.811 0.819 0.809

OBS  S25   S26   S27   S28   S29   S30   S31   S32   S33   S34   S35   S36

100 0.757 0.805 0.790 0.822 0.822 0.824 0.757 0.732 0.761 0.777 0.748 0.771
101 0.820 0.795 0.788 0.852 0.801 0.829 0.757 0.788 0.739 0.766 0.767 0.783
102 0.715 0.753 0.764 0.746 0.836 0.793 0.714 0.733 0.726 0.735 0.729 0.676
103 0.733 0.755 0.758 0.778 0.815 0.785 0.701 0.717 0.745 0.753 0.711 0.724
104 0.768 0.840 0.789 0.835 0.851 0.859 0.796 0.776 0.748 0.764 0.765 0.762
105 0.727 0.811 0.806 0.784 0.773 0.817 0.765 0.779 0.800 0.818 0.778 0.723
106 0.788 0.792 0.827 0.801 0.761 0.765 0.857 0.753 0.777 0.792 0.782 0.857
107 0.733 0.831 0.796 0.801 0.757 0.793 0.821 0.751 0.775 0.791 0.770 0.776
108 0.810 0.769 0.853 0.800 0.762 0.766 0.765 0.734 0.826 0.828 0.761 0.762
109 0.784 0.878 0.795 0.827 0.871 0.868 0.873 0.744 0.728 0.749 0.787 0.869
110 0.819 0.854 0.786 0.829 0.713 0.813 0.850 0.836 0.796 0.809 0.787 0.838

OBS  S37   S38   S39   S40   S41   S42   S43   S44   S45   S46   S47   S48

100 0.843 0.840 0.820 0.836 0.849 0.690 0.779 0.845 0.787 0.694 0.834 0.822
101 0.834 0.785 0.845 0.826 0.824 0.782 0.788 0.754 0.811 0.719 0.824 0.798
102 0.798 0.866 0.870 0.796 0.746 0.726 0.694 0.880 0.766 0.674 0.847 0.706
103 0.790 0.847 0.815 0.774 0.779 0.681 0.746 0.860 0.728 0.670 0.817 0.756
104 0.883 0.895 0.906 0.873 0.759 0.778 0.782 0.876 0.810 0.764 0.878 0.771
105 0.825 0.759 0.781 0.810 0.784 0.769 0.739 0.768 0.761 0.822 0.782 0.755
106 0.835 0.743 0.822 0.773 0.721 0.739 0.864 0.675 0.784 0.776 0.777 0.882
107 0.768 0.744 0.757 0.778 0.751 0.728 0.772 0.712 0.707 0.824 0.742 0.778
108 0.764 0.728 0.758 0.767 0.825 0.715 0.769 0.706 0.735 0.742 0.734 0.781
109 0.843 0.838 0.860 0.864 0.740 0.710 0.870 0.753 0.743 0.785 0.851 0.824
110 0.818 0.726 0.736 0.763 0.755 0.820 0.839 0.711 0.766 0.791 0.735 0.804
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                                                 SAS

OBS  S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

100 0.781 0.834 0.874 0.862 0.842 0.859 0.827 0.877 0.843 0.704 0.763 0.762
101 0.784 0.836 0.837 0.868 0.768 0.836 0.835 0.861 0.845 0.744 0.748 0.776
102 0.738 0.783 0.841 0.819 0.864 0.884 0.798 0.833 0.868 0.687 0.748 0.757
103 0.738 0.778 0.841 0.805 0.831 0.857 0.778 0.826 0.853 0.697 0.744 0.738
104 0.804 0.880 0.893 0.915 0.882 0.894 0.882 0.919 0.912 0.768 0.791 0.773
105 0.834 0.824 0.846 0.819 0.714 0.797 0.796 0.833 0.800 0.779 0.823 0.781
106 0.847 0.795 0.807 0.806 0.771 0.795 0.842 0.815 0.792 0.778 0.819 0.820
107 0.812 0.789 0.854 0.789 0.694 0.759 0.773 0.796 0.769 0.858 0.814 0.807
108 0.782 0.763 0.796 0.767 0.685 0.720 0.743 0.784 0.733 0.779 0.800 0.790
109 0.783 0.843 0.870 0.872 0.782 0.864 0.845 0.893 0.860 0.856 0.799 0.795
110 0.811 0.775 0.806 0.785 0.741 0.753 0.814 0.791 0.760 0.828 0.806 0.792

OBS  S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

100 0.761 0.895 0.819 0.796 0.837 0.797 0.705 0.746 0.758 0.774 0.825 0.766
101 0.782 0.851 0.786 0.787 0.816 0.848 0.729 0.762 0.765 0.834 0.845 0.848
102 0.663 0.906 0.770 0.760 0.737 0.797 0.664 0.723 0.669 0.747 0.827 0.755
103 0.712 0.882 0.767 0.759 0.786 0.768 0.676 0.692 0.731 0.713 0.786 0.729
104 0.752 0.902 0.838 0.814 0.795 0.893 0.756 0.802 0.745 0.827 0.875 0.861
105 0.715 0.820 0.880 0.884 0.741 0.831 0.820 0.825 0.725 0.777 0.866 0.757
106 0.838 0.838 0.802 0.775 0.874 0.830 0.733 0.859 0.830 0.794 0.825 0.829
107 0.750 0.807 0.861 0.872 0.799 0.837 0.839 0.822 0.776 0.762 0.850 0.752
108 0.752 0.775 0.808 0.810 0.795 0.808 0.743 0.757 0.761 0.724 0.822 0.752
109 0.862 0.877 0.808 0.786 0.878 0.845 0.753 0.756 0.835 0.777 0.819 0.804
110 0.820 0.766 0.836 0.820 0.813 0.787 0.780 0.820 0.841 0.784 0.792 0.784

OBS  S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

100 0.793 0.791 0.838 0.826 0.925 0.914 0.898 0.946 0.888 0.964 0.914 0.830
101 0.829 0.802 0.829 0.832 0.883 0.877 0.879 0.927 0.899 0.926 0.888 0.862
102 0.731 0.732 0.816 0.819 0.801 0.952 0.946 0.930 0.909 0.935 0.894 0.815
103 0.771 0.758 0.785 0.792 0.879 0.913 0.888 0.939 0.881 0.974 0.909 0.801
104 0.831 0.790 0.879 0.861 0.852 0.910 0.938 0.890 0.898 0.873 0.924 0.937
105 0.809 0.800 0.859 0.796 0.796 0.828 0.838 0.790 0.764 0.807 0.733 0.814
106 0.786 0.851 0.819 0.872 0.802 0.826 0.846 0.797 0.782 0.789 0.727 0.826
107 0.821 0.823 0.833 0.807 0.810 0.773 0.807 0.747 0.714 0.757 0.699 0.816
108 0.822 0.826 0.826 0.822 0.841 0.782 0.788 0.822 0.758 0.833 0.763 0.778
109 0.818 0.775 0.815 0.815 0.862 0.833 0.866 0.805 0.809 0.820 0.774 0.864
110 0.887 0.874 0.793 0.793 0.758 0.737 0.769 0.738 0.771 0.748 0.724 0.801

OBS  S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

100 0.849 0.935 0.904 0.879 0.898 0.891 0.933 0.892 0.913 0.798 0.874 0.862
101 0.889 0.847 0.913 0.821 0.889 0.885 0.899 0.885 0.855 0.882 0.918 0.918
102 0.836 0.840 0.852 0.911 0.885 0.822 0.828 0.825 0.847 0.791 0.930 0.906
103 0.806 0.903 0.846 0.873 0.903 0.856 0.873 0.852 0.837 0.754 0.872 0.857
104 0.934 0.838 0.943 0.904 0.868 0.852 0.886 0.874 0.914 0.881 0.939 0.977
105 0.793 0.772 0.827 0.764 0.748 0.792 0.823 0.790 0.844 0.771 0.778 0.802
106 0.835 0.793 0.801 0.830 0.814 0.828 0.805 0.840 0.820 0.846 0.791 0.838
107 0.755 0.734 0.790 0.739 0.766 0.747 0.817 0.765 0.826 0.758 0.748 0.785
108 0.762 0.789 0.782 0.754 0.827 0.850 0.852 0.834 0.819 0.746 0.736 0.765
109 0.830 0.786 0.874 0.788 0.842 0.805 0.864 0.826 0.871 0.794 0.838 0.871
110 0.811 0.788 0.786 0.760 0.710 0.801 0.817 0.819 0.794 0.798 0.739 0.775
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                                          SAS

OBS  S97    S98    S99   S100   S101   S102   S103   S104   S105   S106   S107   S108

100 0.914 0.940 0.925 1.000 0.905 0.911 0.959 0.856 0.787 0.774 0.741 0.807
101 0.875 0.895 0.886 0.905 1.000 0.836 0.836 0.918 0.759 0.782 0.733 0.809
102 0.909 0.830 0.822 0.911 0.836 1.000 0.920 0.908 0.745 0.749 0.714 0.741
103 0.866 0.885 0.865 0.959 0.836 0.920 1.000 0.856 0.746 0.711 0.722 0.774
104 0.938 0.890 0.852 0.856 0.918 0.908 0.856 1.000 0.816 0.824 0.780 0.764
105 0.814 0.815 0.819 0.787 0.759 0.745 0.746 0.816 1.000 0.779 0.908 0.790
106 0.829 0.808 0.784 0.774 0.782 0.749 0.711 0.824 0.779 1.000 0.810 0.763
107 0.797 0.810 0.793 0.741 0.733 0.714 0.722 0.780 0.908 0.810 1.000 0.799
108 0.803 0.846 0.869 0.807 0.809 0.741 0.774 0.764 0.790 0.763 0.799 1.000
109 0.851 0.859 0.841 0.806 0.818 0.774 0.759 0.861 0.768 0.842 0.837 0.777
110 0.763 0.791 0.787 0.732 0.750 0.681 0.702 0.776 0.797 0.789 0.815 0.764

OBS S109   S110   S111   S112   S113   S114   S115   S116   S117   S118   S119   S120

100 0.806 0.732 0.777 0.731 0.770 0.820 0.791 0.775 0.858 0.777 0.823 0.748
101 0.818 0.750 0.832 0.775 0.788 0.746 0.813 0.773 0.835 0.823 0.730 0.785
102 0.774 0.681 0.787 0.732 0.810 0.876 0.710 0.762 0.900 0.830 0.883 0.692
103 0.759 0.702 0.759 0.727 0.763 0.835 0.731 0.779 0.847 0.795 0.854 0.710
104 0.861 0.776 0.852 0.817 0.842 0.869 0.792 0.783 0.894 0.834 0.834 0.771
105 0.768 0.797 0.730 0.700 0.715 0.814 0.796 0.795 0.794 0.741 0.736 0.753
106 0.842 0.789 0.798 0.764 0.840 0.754 0.822 0.789 0.805 0.825 0.716 0.747
107 0.837 0.815 0.731 0.735 0.810 0.823 0.765 0.746 0.751 0.717 0.750 0.768
108 0.777 0.764 0.761 0.713 0.749 0.785 0.802 0.778 0.823 0.710 0.737 0.806
109 1.000 0.809 0.768 0.733 0.946 0.756 0.722 0.683 0.806 0.790 0.790 0.771
110 0.809 1.000 0.769 0.757 0.760 0.762 0.826 0.823 0.711 0.752 0.688 0.750

OBS     S121     S122     S123     S124     S125     S126     S127     S128     S129

100     0.722    0.749    0.739    0.820    0.782    0.797    0.823    0.848    0.755
101     0.758    0.754    0.759    0.768    0.764    0.804    0.809    0.850    0.755
102     0.649    0.678    0.715    0.767    0.746    0.780    0.756    0.748    0.683
103     0.694    0.712    0.710    0.765    0.737    0.759    0.774    0.814    0.720
104     0.711    0.714    0.799    0.802    0.787    0.832    0.785    0.844    0.766
105     0.720    0.764    0.767    0.779    0.822    0.812    0.779    0.796    0.782
106     0.699    0.778    0.797    0.799    0.783    0.805    0.764    0.754    0.743
107     0.764    0.792    0.805    0.796    0.847    0.821    0.778    0.809    0.828
108     0.801    0.765    0.756    0.848    0.828    0.783    0.811    0.800    0.773
109     0.767    0.714    0.835    0.833    0.813    0.797    0.773    0.819    0.830
110     0.746    0.750    0.816    0.741    0.818    0.791    0.767    0.805    0.834
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                                   SAS

OBS  S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

111 0.783 0.759 0.714 0.797 0.741 0.720 0.745 0.796 0.740 0.808 0.731 0.814
112 0.747 0.702 0.671 0.741 0.685 0.687 0.731 0.764 0.687 0.790 0.716 0.768
113 0.784 0.758 0.716 0.798 0.794 0.788 0.816 0.792 0.720 0.807 0.725 0.781
114 0.797 0.759 0.706 0.817 0.776 0.746 0.735 0.857 0.719 0.810 0.801 0.777
115 0.792 0.775 0.785 0.736 0.731 0.783 0.750 0.843 0.768 0.855 0.840 0.713
116 0.798 0.737 0.755 0.786 0.717 0.755 0.712 0.831 0.715 0.840 0.821 0.688
117 0.823 0.841 0.725 0.837 0.843 0.716 0.708 0.840 0.730 0.797 0.741 0.763
118 0.841 0.763 0.803 0.831 0.784 0.647 0.747 0.738 0.702 0.760 0.673 0.725
119 0.796 0.724 0.735 0.811 0.826 0.634 0.676 0.731 0.712 0.716 0.697 0.732
120 0.723 0.720 0.756 0.695 0.700 0.749 0.746 0.789 0.726 0.754 0.787 0.718
121 0.679 0.735 0.757 0.662 0.672 0.773 0.768 0.740 0.710 0.742 0.768 0.733

OBS  S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

111 0.694 0.799 0.688 0.716 0.744 0.745 0.769 0.774 0.778 0.765 0.748 0.754
112 0.662 0.761 0.628 0.723 0.708 0.704 0.728 0.752 0.754 0.760 0.712 0.760
113 0.680 0.741 0.722 0.651 0.712 0.716 0.748 0.807 0.818 0.845 0.672 0.773
114 0.672 0.696 0.691 0.674 0.761 0.760 0.770 0.776 0.762 0.746 0.742 0.732
115 0.624 0.819 0.666 0.721 0.828 0.824 0.789 0.763 0.797 0.763 0.852 0.834
116 0.622 0.797 0.652 0.673 0.827 0.817 0.765 0.722 0.765 0.746 0.833 0.819
117 0.660 0.736 0.766 0.671 0.770 0.778 0.727 0.857 0.789 0.721 0.750 0.713
118 0.786 0.671 0.705 0.643 0.838 0.834 0.756 0.792 0.804 0.719 0.788 0.776
119 0.770 0.632 0.768 0.639 0.770 0.774 0.689 0.754 0.768 0.706 0.725 0.741
120 0.687 0.829 0.679 0.722 0.749 0.759 0.812 0.761 0.738 0.779 0.776 0.780
121 0.639 0.873 0.698 0.713 0.735 0.750 0.716 0.743 0.737 0.798 0.730 0.767

OBS  S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

111 0.769 0.761 0.755 0.817 0.743 0.766 0.783 0.742 0.724 0.736 0.726 0.763
112 0.722 0.716 0.717 0.793 0.692 0.703 0.762 0.697 0.688 0.701 0.692 0.726
113 0.757 0.845 0.750 0.836 0.832 0.832 0.845 0.678 0.700 0.705 0.737 0.824
114 0.731 0.778 0.758 0.768 0.797 0.771 0.730 0.744 0.766 0.772 0.721 0.698
115 0.817 0.792 0.797 0.844 0.692 0.784 0.811 0.806 0.826 0.842 0.806 0.804
116 0.786 0.751 0.771 0.821 0.673 0.746 0.768 0.783 0.804 0.813 0.786 0.765
117 0.713 0.782 0.775 0.780 0.822 0.846 0.744 0.725 0.772 0.765 0.746 0.734
118 0.760 0.706 0.831 0.709 0.791 0.779 0.785 0.846 0.770 0.782 0.847 0.805
119 0.689 0.719 0.762 0.675 0.862 0.802 0.708 0.743 0.724 0.723 0.767 0.697
120 0.813 0.761 0.784 0.813 0.708 0.752 0.746 0.707 0.748 0.750 0.748 0.769
121 0.800 0.757 0.717 0.859 0.699 0.783 0.788 0.691 0.714 0.714 0.744 0.788

OBS  S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

111 0.787 0.774 0.785 0.755 0.698 0.732 0.770 0.751 0.746 0.722 0.764 0.776
112 0.732 0.719 0.746 0.699 0.638 0.699 0.739 0.719 0.702 0.695 0.699 0.736
113 0.775 0.833 0.849 0.807 0.698 0.666 0.810 0.773 0.743 0.728 0.813 0.778
114 0.743 0.834 0.817 0.744 0.734 0.742 0.701 0.848 0.720 0.708 0.806 0.716
115 0.804 0.691 0.760 0.767 0.811 0.794 0.806 0.684 0.807 0.794 0.748 0.835
116 0.762 0.710 0.740 0.723 0.768 0.807 0.768 0.753 0.761 0.792 0.729 0.810
117 0.838 0.835 0.845 0.833 0.820 0.713 0.722 0.820 0.794 0.721 0.845 0.766
118 0.829 0.774 0.756 0.757 0.690 0.816 0.807 0.796 0.776 0.782 0.777 0.815
119 0.746 0.846 0.798 0.774 0.732 0.715 0.687 0.870 0.714 0.730 0.815 0.714
120 0.735 0.692 0.763 0.746 0.724 0.711 0.774 0.705 0.722 0.778 0.714 0.758
121 0.711 0.683 0.720 0.736 0.767 0.664 0.758 0.653 0.692 0.760 0.721 0.748
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OBS  S49   S50   S51   S52   S53   S54   S55   S56   S57   S58   S59   S60

111 0.762 0.775 0.793 0.790 0.805 0.769 0.790 0.792 0.771 0.733 0.743 0.740
112 0.734 0.719 0.753 0.732 0.738 0.713 0.739 0.743 0.737 0.714 0.714 0.698
113 0.750 0.820 0.845 0.810 0.794 0.820 0.796 0.829 0.804 0.839 0.752 0.752
114 0.757 0.762 0.831 0.764 0.815 0.818 0.756 0.781 0.820 0.751 0.753 0.754
115 0.864 0.774 0.810 0.792 0.737 0.746 0.813 0.775 0.768 0.770 0.831 0.842
116 0.849 0.747 0.798 0.746 0.785 0.732 0.788 0.742 0.775 0.716 0.819 0.820
117 0.791 0.825 0.868 0.855 0.839 0.850 0.843 0.882 0.843 0.735 0.777 0.777
118 0.851 0.755 0.766 0.781 0.818 0.795 0.820 0.821 0.803 0.725 0.818 0.837
119 0.758 0.747 0.811 0.753 0.810 0.833 0.745 0.780 0.837 0.727 0.791 0.800
120 0.734 0.758 0.783 0.766 0.689 0.723 0.744 0.767 0.745 0.740 0.733 0.718
121 0.756 0.750 0.785 0.750 0.665 0.708 0.744 0.740 0.704 0.783 0.735 0.758

OBS  S61   S62   S63   S64   S65   S66   S67   S68   S69   S70   S71   S72

111 0.754 0.786 0.762 0.739 0.763 0.815 0.694 0.786 0.764 0.771 0.812 0.801
112 0.716 0.728 0.724 0.708 0.729 0.777 0.681 0.752 0.746 0.715 0.755 0.755
113 0.812 0.840 0.774 0.747 0.827 0.825 0.722 0.751 0.830 0.708 0.810 0.766
114 0.673 0.870 0.829 0.847 0.728 0.822 0.739 0.807 0.705 0.745 0.852 0.734
115 0.837 0.792 0.833 0.822 0.812 0.782 0.732 0.852 0.785 0.777 0.824 0.809
116 0.802 0.773 0.809 0.811 0.786 0.756 0.688 0.834 0.763 0.719 0.801 0.786
117 0.708 0.883 0.837 0.792 0.784 0.845 0.690 0.782 0.701 0.765 0.879 0.770
118 0.793 0.786 0.761 0.758 0.792 0.785 0.678 0.739 0.779 0.839 0.769 0.866
119 0.703 0.860 0.774 0.779 0.740 0.745 0.657 0.668 0.687 0.688 0.765 0.739
120 0.758 0.743 0.760 0.757 0.766 0.804 0.783 0.728 0.762 0.687 0.786 0.716
121 0.807 0.732 0.745 0.728 0.748 0.742 0.717 0.687 0.789 0.711 0.766 0.729

OBS  S73   S74   S75   S76   S77   S78   S79   S80   S81   S82   S83   S84

111 0.801 0.804 0.798 0.802 0.773 0.783 0.811 0.795 0.805 0.784 0.825 0.807
112 0.789 0.777 0.761 0.775 0.736 0.727 0.761 0.748 0.751 0.730 0.774 0.786
113 0.817 0.746 0.802 0.788 0.814 0.803 0.853 0.787 0.795 0.773 0.781 0.845
114 0.796 0.789 0.834 0.794 0.750 0.865 0.900 0.856 0.824 0.835 0.823 0.798
115 0.836 0.877 0.870 0.827 0.806 0.794 0.812 0.842 0.766 0.805 0.750 0.798
116 0.814 0.877 0.846 0.810 0.771 0.782 0.791 0.827 0.749 0.796 0.780 0.774
117 0.768 0.757 0.881 0.835 0.824 0.912 0.934 0.903 0.856 0.867 0.846 0.881
118 0.701 0.753 0.798 0.849 0.761 0.827 0.796 0.797 0.782 0.811 0.812 0.793
119 0.686 0.698 0.800 0.745 0.787 0.879 0.875 0.843 0.803 0.859 0.800 0.764
120 0.808 0.788 0.800 0.792 0.784 0.728 0.751 0.778 0.784 0.757 0.754 0.774
121 0.810 0.752 0.794 0.736 0.781 0.714 0.721 0.746 0.706 0.730 0.706 0.758

OBS  S85   S86   S87   S88   S89   S90   S91   S92   S93   S94   S95   S96

111 0.828 0.768 0.821 0.808 0.790 0.787 0.804 0.807 0.807 0.832 0.818 0.852
112 0.784 0.720 0.770 0.760 0.750 0.734 0.758 0.757 0.768 0.777 0.778 0.818
113 0.783 0.724 0.810 0.796 0.849 0.742 0.786 0.766 0.826 0.765 0.822 0.855
114 0.775 0.769 0.780 0.858 0.823 0.759 0.807 0.766 0.823 0.769 0.835 0.861
115 0.811 0.824 0.765 0.794 0.806 0.851 0.837 0.871 0.808 0.817 0.743 0.788
116 0.788 0.818 0.739 0.825 0.779 0.832 0.811 0.852 0.789 0.783 0.733 0.767
117 0.851 0.824 0.874 0.880 0.838 0.822 0.854 0.846 0.914 0.794 0.866 0.892
118 0.886 0.819 0.866 0.842 0.752 0.803 0.771 0.806 0.791 0.866 0.832 0.819
119 0.753 0.776 0.784 0.823 0.836 0.753 0.777 0.754 0.804 0.711 0.829 0.819
120 0.757 0.742 0.765 0.720 0.773 0.771 0.804 0.780 0.780 0.735 0.715 0.777
121 0.705 0.709 0.747 0.669 0.746 0.743 0.775 0.749 0.754 0.721 0.688 0.728
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                                   SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

111 0.825 0.808 0.793 0.777 0.832 0.787 0.759 0.852 0.730 0.798 0.731 0.761
112 0.764 0.770 0.742 0.731 0.775 0.732 0.727 0.817 0.700 0.764 0.735 0.713
113 0.845 0.818 0.787 0.770 0.788 0.810 0.763 0.842 0.715 0.840 0.810 0.749
114 0.849 0.789 0.796 0.820 0.746 0.876 0.835 0.869 0.814 0.754 0.823 0.785
115 0.795 0.829 0.824 0.791 0.813 0.710 0.731 0.792 0.796 0.822 0.765 0.802
116 0.792 0.814 0.809 0.775 0.773 0.762 0.779 0.783 0.795 0.789 0.746 0.778
117 0.922 0.883 0.831 0.858 0.835 0.900 0.847 0.894 0.794 0.805 0.751 0.823
118 0.794 0.767 0.754 0.777 0.823 0.830 0.795 0.834 0.741 0.825 0.717 0.710
119 0.806 0.776 0.765 0.823 0.730 0.883 0.854 0.834 0.736 0.716 0.750 0.737
120 0.774 0.808 0.811 0.748 0.785 0.692 0.710 0.771 0.753 0.747 0.768 0.806
121 0.728 0.798 0.782 0.722 0.758 0.649 0.694 0.711 0.720 0.699 0.764 0.801

OBS S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

111 0.768 0.769 1.000 0.933 0.777 0.811 0.782 0.767 0.778 0.799 0.735 0.741
112 0.733 0.757 0.933 1.000 0.752 0.774 0.739 0.740 0.725 0.772 0.706 0.721
113 0.946 0.760 0.777 0.752 1.000 0.814 0.708 0.694 0.808 0.742 0.827 0.749
114 0.756 0.762 0.811 0.774 0.814 1.000 0.762 0.826 0.845 0.760 0.855 0.725
115 0.722 0.826 0.782 0.739 0.708 0.762 1.000 0.967 0.787 0.743 0.693 0.775
116 0.683 0.823 0.767 0.740 0.694 0.826 0.967 1.000 0.773 0.747 0.758 0.759
117 0.806 0.711 0.778 0.725 0.808 0.845 0.787 0.773 1.000 0.770 0.837 0.715
118 0.790 0.752 0.799 0.772 0.742 0.760 0.743 0.747 0.770 1.000 0.836 0.701
119 0.790 0.688 0.735 0.706 0.827 0.855 0.693 0.758 0.837 0.836 1.000 0.692
120 0.771 0.750 0.741 0.721 0.749 0.725 0.775 0.759 0.715 0.701 0.692 1.000
121 0.767 0.746 0.703 0.676 0.758 0.681 0.772 0.738 0.763 0.651 0.658 0.829

OBS    S121     S122     S123     S124     S125     S126     S127     S128     S129

111    0.703    0.725    0.786    0.729    0.759    0.781    0.756    0.766    0.747
112    0.676    0.724    0.792    0.687    0.715    0.753    0.723    0.767    0.771
113    0.758    0.704    0.816    0.814    0.773    0.805    0.755    0.797    0.815
114    0.681    0.726    0.747    0.762    0.819    0.797    0.781    0.752    0.753
115    0.772    0.815    0.791    0.749    0.800    0.801    0.857    0.820    0.745
116    0.738    0.787    0.770    0.719    0.774    0.773    0.844    0.810    0.705
117    0.763    0.708    0.739    0.866    0.783    0.833    0.810    0.806    0.712
118    0.651    0.686    0.742    0.732    0.704    0.719    0.703    0.750    0.700
119    0.658    0.650    0.692    0.781    0.736    0.722    0.739    0.757    0.711
120    0.829    0.824    0.779    0.790    0.794    0.803    0.829    0.860    0.774
121    1.000    0.810    0.826    0.804    0.758    0.791    0.850    0.830    0.797
```

```
                                        SAS

OBS   S1     S2     S3     S4     S5     S6     S7     S8     S9     S10    S11    S12

122 0.727 0.716 0.740 0.705 0.648 0.700 0.805 0.793 0.708 0.818 0.787 0.678
123 0.803 0.774 0.789 0.756 0.748 0.820 0.835 0.814 0.756 0.836 0.772 0.795
124 0.787 0.819 0.737 0.764 0.794 0.723 0.745 0.816 0.774 0.799 0.797 0.770
125 0.771 0.810 0.749 0.746 0.765 0.832 0.770 0.863 0.766 0.850 0.867 0.788
126 0.780 0.823 0.749 0.747 0.788 0.789 0.778 0.875 0.778 0.894 0.811 0.758
127 0.735 0.773 0.774 0.713 0.745 0.778 0.724 0.828 0.765 0.805 0.839 0.705
128 0.829 0.789 0.799 0.770 0.816 0.755 0.789 0.816 0.779 0.805 0.844 0.733
129 0.740 0.745 0.743 0.707 0.740 0.745 0.848 0.808 0.770 0.790 0.817 0.758

OBS   S13    S14    S15    S16    S17    S18    S19    S20    S21    S22    S23    S24

122 0.620 0.823 0.676 0.799 0.762 0.773 0.753 0.748 0.804 0.785 0.796 0.830
123 0.627 0.829 0.649 0.719 0.828 0.826 0.796 0.809 0.836 0.825 0.773 0.845
124 0.654 0.740 0.812 0.659 0.779 0.789 0.761 0.802 0.822 0.741 0.754 0.782
125 0.680 0.749 0.687 0.716 0.781 0.791 0.830 0.793 0.823 0.778 0.801 0.780
126 0.607 0.804 0.690 0.732 0.796 0.807 0.791 0.829 0.836 0.789 0.794 0.785
127 0.617 0.836 0.653 0.729 0.818 0.823 0.746 0.795 0.773 0.778 0.822 0.815
128 0.643 0.815 0.696 0.714 0.763 0.766 0.774 0.840 0.835 0.854 0.832 0.827
129 0.641 0.770 0.658 0.753 0.727 0.731 0.740 0.788 0.822 0.907 0.755 0.837

OBS   S25    S26    S27    S28    S29    S30    S31    S32    S33    S34    S35    S36

122 0.801 0.720 0.786 0.791 0.669 0.719 0.787 0.703 0.758 0.767 0.731 0.768
123 0.817 0.835 0.805 0.885 0.735 0.818 0.895 0.754 0.760 0.782 0.804 0.797
124 0.733 0.836 0.817 0.762 0.784 0.810 0.794 0.734 0.798 0.790 0.753 0.757
125 0.771 0.877 0.818 0.798 0.787 0.843 0.798 0.803 0.854 0.866 0.761 0.754
126 0.804 0.817 0.809 0.849 0.761 0.819 0.799 0.780 0.802 0.811 0.758 0.748
127 0.844 0.775 0.788 0.872 0.742 0.815 0.782 0.761 0.771 0.776 0.792 0.789
128 0.796 0.837 0.790 0.864 0.790 0.852 0.787 0.767 0.779 0.791 0.821 0.813
129 0.769 0.827 0.768 0.840 0.775 0.801 0.842 0.704 0.730 0.740 0.757 0.791

OBS   S37    S38    S39    S40    S41    S42    S43    S44    S45    S46    S47    S48

122 0.754 0.654 0.722 0.717 0.710 0.694 0.772 0.642 0.748 0.745 0.673 0.781
123 0.808 0.737 0.791 0.783 0.691 0.739 0.809 0.724 0.769 0.803 0.756 0.775
124 0.801 0.765 0.814 0.814 0.814 0.697 0.755 0.751 0.753 0.748 0.801 0.770
125 0.792 0.770 0.794 0.815 0.811 0.767 0.753 0.729 0.753 0.748 0.800 0.776
126 0.798 0.760 0.833 0.806 0.764 0.797 0.743 0.744 0.794 0.746 0.790 0.769
127 0.773 0.730 0.785 0.795 0.793 0.779 0.762 0.727 0.759 0.771 0.770 0.800
128 0.827 0.783 0.830 0.831 0.803 0.740 0.811 0.778 0.780 0.811 0.829 0.808
129 0.767 0.743 0.773 0.787 0.715 0.670 0.804 0.704 0.726 0.737 0.758 0.752
```

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                                        SAS

OBS  S49    S50    S51    S52    S53    S54    S55    S56    S57    S58    S59    S60

122 0.766 0.719 0.787 0.744 0.700 0.679 0.772 0.738 0.695 0.713 0.766 0.769
123 0.823 0.806 0.840 0.819 0.748 0.773 0.819 0.809 0.793 0.818 0.820 0.805
124 0.771 0.825 0.869 0.834 0.766 0.805 0.797 0.831 0.804 0.765 0.789 0.787
125 0.795 0.823 0.878 0.831 0.752 0.801 0.805 0.823 0.793 0.850 0.807 0.808
126 0.797 0.828 0.884 0.835 0.753 0.793 0.816 0.827 0.802 0.794 0.790 0.796
127 0.808 0.793 0.848 0.793 0.707 0.778 0.796 0.803 0.756 0.756 0.815 0.812
128 0.798 0.851 0.881 0.860 0.770 0.826 0.826 0.853 0.848 0.800 0.788 0.792
129 0.753 0.775 0.817 0.808 0.706 0.756 0.760 0.794 0.769 0.829 0.767 0.766

OBS  S61    S62    S63    S64    S65    S66    S67    S68    S69    S70    S71    S72

122 0.762 0.729 0.743 0.749 0.802 0.772 0.684 0.797 0.781 0.738 0.818 0.728
123 0.828 0.791 0.788 0.769 0.771 0.816 0.755 0.792 0.812 0.756 0.814 0.801
124 0.741 0.859 0.815 0.800 0.806 0.784 0.722 0.752 0.754 0.748 0.825 0.729
125 0.751 0.853 0.897 0.879 0.786 0.814 0.838 0.842 0.763 0.761 0.851 0.758
126 0.735 0.845 0.838 0.831 0.768 0.840 0.768 0.815 0.760 0.760 0.903 0.774
127 0.800 0.818 0.827 0.800 0.799 0.797 0.724 0.766 0.771 0.725 0.843 0.771
128 0.806 0.843 0.826 0.811 0.822 0.844 0.796 0.756 0.822 0.755 0.824 0.765
129 0.808 0.771 0.788 0.794 0.778 0.829 0.743 0.759 0.823 0.746 0.816 0.747

OBS  S73    S74    S75    S76    S77    S78    S79    S80    S81    S82    S83    S84

122 0.782 0.831 0.784 0.822 0.792 0.713 0.738 0.763 0.704 0.743 0.710 0.741
123 0.836 0.814 0.840 0.826 0.788 0.765 0.776 0.733 0.738 0.734 0.720 0.827
124 0.762 0.766 0.815 0.795 0.834 0.827 0.829 0.789 0.770 0.808 0.743 0.799
125 0.816 0.808 0.841 0.827 0.796 0.804 0.830 0.774 0.748 0.791 0.721 0.801
126 0.859 0.837 0.878 0.847 0.821 0.833 0.862 0.822 0.793 0.803 0.756 0.844
127 0.828 0.816 0.896 0.793 0.817 0.818 0.843 0.868 0.794 0.834 0.792 0.802
128 0.860 0.816 0.848 0.796 0.875 0.832 0.820 0.866 0.852 0.867 0.813 0.869
129 0.843 0.779 0.805 0.775 0.818 0.741 0.750 0.741 0.778 0.752 0.724 0.803

OBS  S85    S86    S87    S88    S89    S90    S91    S92    S93    S94    S95    S96

122 0.765 0.782 0.730 0.756 0.777 0.812 0.791 0.819 0.778 0.760 0.687 0.727
123 0.803 0.750 0.803 0.765 0.755 0.780 0.798 0.789 0.822 0.795 0.773 0.813
124 0.787 0.796 0.830 0.788 0.796 0.797 0.824 0.804 0.864 0.738 0.766 0.819
125 0.770 0.763 0.820 0.764 0.753 0.776 0.836 0.788 0.858 0.785 0.765 0.802
126 0.809 0.768 0.834 0.797 0.814 0.799 0.835 0.811 0.866 0.808 0.796 0.848
127 0.787 0.804 0.803 0.769 0.812 0.820 0.851 0.830 0.827 0.775 0.776 0.802
128 0.815 0.825 0.855 0.777 0.841 0.840 0.891 0.847 0.856 0.782 0.792 0.848
129 0.752 0.737 0.785 0.710 0.787 0.747 0.813 0.758 0.801 0.734 0.728 0.770
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                                        SAS

OBS  S97   S98   S99   S100  S101  S102  S103  S104  S105  S106  S107  S108

122 0.754 0.804 0.791 0.749 0.754 0.678 0.712 0.714 0.764 0.778 0.792 0.765
123 0.797 0.793 0.798 0.739 0.759 0.715 0.710 0.799 0.767 0.797 0.805 0.756
124 0.848 0.848 0.846 0.820 0.768 0.767 0.765 0.802 0.779 0.799 0.796 0.848
125 0.825 0.827 0.839 0.782 0.764 0.746 0.737 0.787 0.822 0.783 0.847 0.828
126 0.859 0.851 0.837 0.797 0.804 0.780 0.759 0.832 0.812 0.805 0.821 0.783
127 0.824 0.857 0.861 0.823 0.809 0.756 0.774 0.785 0.779 0.764 0.778 0.811
128 0.826 0.897 0.890 0.848 0.850 0.748 0.814 0.844 0.796 0.754 0.809 0.800
129 0.761 0.804 0.805 0.755 0.755 0.683 0.720 0.766 0.782 0.743 0.828 0.773

OBS S109  S110  S111  S112  S113  S114  S115  S116  S117  S118  S119  S120

122 0.714 0.750 0.725 0.724 0.704 0.726 0.815 0.787 0.708 0.686 0.650 0.824
123 0.835 0.816 0.786 0.792 0.816 0.747 0.791 0.770 0.739 0.742 0.692 0.779
124 0.833 0.741 0.729 0.687 0.814 0.762 0.749 0.719 0.866 0.732 0.781 0.790
125 0.813 0.818 0.759 0.715 0.773 0.819 0.800 0.774 0.783 0.704 0.736 0.794
126 0.797 0.791 0.781 0.753 0.805 0.797 0.801 0.773 0.833 0.719 0.722 0.803
127 0.773 0.767 0.756 0.723 0.755 0.781 0.857 0.844 0.810 0.703 0.739 0.829
128 0.819 0.805 0.766 0.767 0.797 0.752 0.820 0.810 0.806 0.750 0.757 0.860
129 0.830 0.834 0.747 0.771 0.815 0.753 0.745 0.705 0.712 0.700 0.711 0.774

OBS    S121     S122     S123     S124     S125     S126     S127     S128     S129

122    0.810    1.000    0.791    0.749    0.753    0.803    0.807    0.800    0.799
123    0.826    0.791    1.000    0.785    0.804    0.835    0.820    0.820    0.845
124    0.804    0.749    0.785    1.000    0.827    0.834    0.808    0.827    0.774
125    0.758    0.753    0.804    0.827    1.000    0.861    0.820    0.823    0.796
126    0.791    0.803    0.835    0.834    0.861    1.000    0.881    0.847    0.809
127    0.850    0.807    0.820    0.808    0.820    0.881    1.000    0.868    0.782
128    0.830    0.800    0.820    0.827    0.823    0.847    0.868    1.000    0.844
129    0.797    0.799    0.845    0.774    0.796    0.809    0.782    0.844    1.000
```

Appendix 5

STIMULUS COORDINATES FOR EACH OPERATIONAL TAXONOMIC UNIT (OTU) AS DETERMINED BY NON-METRIC MULTIDIMENSIONAL SCALING

SAS
CONFIGURATION DERIVED IN 2 DIMENSIONS

STIMULUS COORDINATES

CODE NUMBER*	Dimension 1	Dimension 2
1	-0.7501	-0.9405
2	0.5918	1.6758
3	-1.8131	0.4361
4	-1.7635	0.0818
5	1.9739	-1.2187
6	1.8525	0.1948
7	0.4386	-0.9087
8	0.8185	-1.8420
9	0.9493	-0.0159
10	1.2714	-1.2875
11	-0.9511	-1.7887
12	-1.8806	3.1546
13	1.4138	-1.4258
14	-3.1747	0.4725
15	2.6218	1.0664
16	0.5809	1.3024
17	0.5086	1.2828
18	1.4055	0.9797
19	-0.9191	0.0778
20	0.1853	0.5225
21	0.8943	-1.4613
22	1.1074	0.6308
23	1.3110	0.2597
24	1.5270	0.2602
25	0.1941	-1.2382
26	0.1918	1.0655
27	0.8174	-1.0895
28	-1.5982	0.1969
29	-0.2543	0.2782
30	1.0625	0.1476
31	0.6111	1.6827

32	0.7408	1.3720
33	0.7906	1.1099
34	0.3806	1.4543
35	1.4588	-0.0658
36	-0.4073	0.5712
37	-1.7538	-0.2218
38	-1.1295	-0.6441
39	-0.9527	0.1816
40	0.2831	-1.6893
41	0.9709	2.0068
42	1.1530	-0.7477
43	-2.1195	0.2216
44	-0.1432	1.3840
45	0.8642	1.5128
46	-1.4233	-0.0523
47	0.9424	0.6824
48	0.4780	0.9655
49	-0.6434	-0.4161
50	-0.2245	-0.2535
51	-0.6208	-0.2361
52	-1.7430	0.3732
53	-1.2576	-0.0816
54	-0.3386	0.5743
55	-0.6134	0.0666
56	-1.1768	-0.0610
57	1.5194	-0.6722
58	0.3341	1.1221
59	0.3895	1.2077
60	1.3862	0.4788
61	-0.8233	-0.0967
62	0.328	0.4061
63	0.5679	0.7877
64	0.2238	0.6257
65	-0.0883	-0.3893
66	2.1224	-0.4908
67	1.4439	0.1979
68	1.5608	-0.3005
69	0.0179	1.4767
70	0.0645	-0.4337
71	0.0740	1.2274
72	0.9541	-1.1227
73	1.2988	-0.2644
74	0.0770	0.1689
75	0.0645	0.5935
76	-0.3060	-0.6299
77	-0.8968	0.2194
78	-0.7063	-0.0335
79	-0.8861	-0.2997
80	-1.1879	-0.4065
81	-0.8676	-0.1728
82	-1.5470	-0.5565
83	-0.3392	-0.3410
84	-0.3881	0.6353
85	-0.6595	0.5605

86	-0.5691	0.1892
87	-0.9754	0.6362
88	-0.8920	-0.9139
89	-0.2095	0.3210
90	-0.1322	-0.5198
91	-0.0802	0.0476
92	-0.4278	-0.1098
93	0.9040	0.9553
94	-1.2127	0.1587
95	-0.7366	-0.2350
96	-0.6766	-0.1493
97	-0.2547	-0.4995
98	-0.2181	-0.5292
99	-1.0825	-0.4893
100	-0.6843	-0.4474
101	-1.9239	0.1662
102	-1.6800	-0.5872
103	-0.8237	-0.0950
104	0.7321	0.7873
105	0.4265	0.8725
106	1.2623	-0.5755
107	0.5876	-1.3258
108	-0.5474	-0.6354
109	1.5151	0.1123
110	-0.8044	-1.1646
111	-0.0678	-2.1904
112	-0.8307	-1.3149
113	-1.2821	-0.7519
114	1.2447	0.2802
115	1.0409	1.0686
116	-1.2920	-0.3392
117	-0.9668	1.5102
118	-2.0739	0.6247
119	1.1666	-1.3776
120	1.5971	-1.6297
121	2.0533	-0.2839
122	1.1594	-0.5165
123	-0.7111	-1.0780
124	0.6644	-0.6537
125	0.3197	-0.8927
126	0.8161	-0.8784
127	0.1577	-0.7722
128	0.8779	-0.4861

* Code number = code numbers as listed in appendix 3.

Appendix 6

PRELIMINARY EXPERIMENTS ON ROOTING OF SOFTWOOD CUTTINGS OF Potentilla fruticosa

A series of exploratory experiments were conducted to help delineate cultural requirements for rooting of softwood cuttings. Cuttings of 'Coronation Triumph' and 'Moonlight' were collected in late June. Three replicates with 6 cuttings per replicate were used for each treatment combination. Cuttings were rated approximately 30 days after treatment initiation. The treatments were:

1) Media Study: The media used were turface, vermiculite, peatmoss, peatmoss and vermiculite (50/50 vol.) and peatmoss and turface (50/50 vol.). Cuttings were placed in plastic pots with the appropriate media and enclosed in a plastic bag to maintain a high relative humidity. Pots were placed on a growth room bench (20°C/15°C day/night) with a 16 hour daylength.

2) Rooting Hormone: Cuttings were dipped in Stimroot #1 (0.1% IBA in talc, Plant Products, Bramlea, Ontario), (Freeland 1977) and placed in a peat/vermiculite media (50/50 vol.) in a plastic pot. Pots were then placed on a growth room bench (20°C/15°C day/night) with a 16 hour daylength. An untreated control was also completed for comparitive purposes. Pots were enclosed in plastic bags to maintain a high relative humidity.

3) Environment: Cuttings were placed in a peat/vermiculite media (50/50 vol.) in plastic pots and placed on a growth room bench, on a greenhouse bench, in a greenhouse intermittant mist chamber (10 sec. mist every 2 minutes). Pots in the first two locations were enclosed with plastic bags to maintain a high relative humidity.

4) Containers: Cuttings were placed in a peat/vermiculite media (50/50 vol.) in either plastic or clay pots and then placed on a growth room bench. Pots were enclosed in plastic bags to maintain a high relative humdity.

The results of these preliminary experiments are presented in the following table.

Treatment	Mean Rooting Percentage	Mean Main Root Rating*
A) Media effects		
turface	61.1 bc**	2.2 bc

vermiculite	55.5 c	2.2 bc
peatmoss	63.9 b	1.8 c
peatmoss & vermiculite	69.5 a	2.8 a
peatmoss & turface	63.9 b	2.3 b
B) Rooting Hormone (0.1% IBA in talc)		
hormone	69.5 a	3.3 a
no hormone	61.1 b	2.1 b
C) Rooting environment		
greenhouse bench	80.5 a	2.8 b
growthroom bench	64.9 b	2.1 c
intermittant mist	85.6 a	4.0 a
D) Type of container		
plastic pot	83.5 a	2.7 a
clay pot	52.8 b	1.4 b

---

* Main root rating: 0 = no roots, 1 = 1-3 roots, 2 = 4-7 roots, 3 = 8-11 roots, 4 = 12-15 roots, 5 = >15 roots.

** Values followed by a similar letter are not statistically different as determined by Duncan's multiple range test $\alpha = 0.05$.

Interpretation of these results indicate that cuttings placed in a medium composed of peat and vermiculite, in an intermittant mist chamber, with rooting hormone were most successful and vigorous. Success and vigour relate to overall survival and development of many new roots. There were no differences between the two cultivars tested. The results from this preliminary experiment were utilized in the selection of cultural treatments for subsequent studies.

Appendix 7

SURVEY OF ROOTING OF 64 *Potentilla fruticosa* TAXA

	Mean Main Root Rating[1]	Mean Lateral Root Rating[2]	Survival (%)[3]	New Growth Rating[4]
A. Cultivar				
Abbotswood	5.0	3.0	100	2.0
Beani	2.0	2.0	88.7	2.0
Beesi	2.3	3.0	100	2.0
Berlin Beauty	4.7	3.0	88.7	2.0
Buttercup	4.0	3.0	100	2.0
Coronation Triumph	4.7	2.0	80	2.0
Darts Golddigger	4.0	3.0	88.7	2.0
Darts Nugget	3.0	3.0	100	2.0
Daydawn	3.0	3.0	100	2.0
Elizabeth	4.0	3.0	100	2.0
Farreri	4.3	3.0	88.7	2.0
Farreri White	5.0	3.0	100	2.0
Fran Lady Danesbury	4.7	3.0	100	2.0
Friesengold	2.0	3.0	100	2.0
Goldfried	3.3	3.0	100	2.0
Gold Drop	3.7	3.0	100	2.0
Hachman's Giant	4.7	3.0	100	2.0
Hallman's Dwarf	4.3	3.0	100	2.0
Hersi	4.0	3.0	33	1.0
Hurstborne	2.0	1.0	40	1.0
Irving	2.7	3.0	88.7	2.0
Jackmani	4.7	3.0	100	2.0
Katherine Dyke	2.7	3.0	88.7	2.0
Knaphill	2.7	3.0	100	2.0
Lemondrop	4.7	3.0	100	2.0
Longacre	3.0	3.0	88.7	2.0
Mandshurian	5.0	3.0	100	2.0
Moonlight	2.3	2.0	100	2.0
Mount Everest	3.0	3.0	100	2.0
Northman	2.7	3.0	100	2.0
Nyewood Form	5.0	3.0	100	2.0
Ochroleuca	2.7	2.0	88.7	2.0

Primrose Beauty	3.7	3.0	100	2.0
Purdomi	4.0	3.0	100	2.0
Roseacre	2.0	3.0	100	2.0
Sanved	2.0	3.0	77	2.0
Subalbicans	3.3	3.0	100	2.0
Sundance	2.3	3.0	100	2.0
Sunset	2.7	3.0	100	2.0
Sutters Gold	3.7	3.0	100	2.0
Tangerine	3.0	3.0	100	2.0
Tenuloba	2.0	3.0	88.7	2.0
Veitchi	3.0	3.0	100	2.0
White Gold	4.33	3.0	100	2.0
Yellow Single	4.0	3.0	100	2.0
UM 7911	3.0	3.0	100	2.0
UM 7506	2.33	1.0	65	2.0

B. Miscellaneous Taxa

P. fruticosa arbuscula	4.3	3.0	100	2.0
Friedrichsonii	3.0	3.0	100	2.0
glabra	3.7	3.0	100	2.0
parvifolia	5.0	3.0	100	2.0
Rhederiana	3.5	3.0	65	2.0
Sulphurescens	3.7	3.0	66	2.0
native #3	0	0	0	0
native #4	0	0	0	0
native #120	3.7	3.0	100	2.0
native #19	4.3	2.0	100	2.0
native #49	0	0	0	0
native #52	3.0	2.0	100	2.0
native #1	2.3	3.0	100	2.0
native #28	2.0	1.0	22.2	0
European (2n=2x)	3.0	3.0	100	2.0
European (2n=4x)	3.0	3.0	100	2.0
Scandinavian	2.5	3.0	100	2.0

[1] Main Root Rating: 0 = none, 1 = 1-3 roots, 2 = 4-7 roots, 3 = 8-11 roots, 4 = 12-15 roots, 5 = > 15 roots.

[2] Lateral Root Rating: 0 = none, 1 = few, 2 = moderate, 3 = abundant.

[3] Survival: outplanting survival after treatment.

[4] New Growth Rating: 0 = none, 1 = weak, 2 = vigorous.

Appendix 8

MAXIMUM AND MINIMUM TEMPERATURES AND GROWING DEGREE DAY VALUES FROM MAY 8 TO OCTOBER 9, 1984

Date	Max.(°C)	Min.(°C)	Growing Degree Day Values (4.4°C base temp.)	
			daily	cumulative
May 8	13.3	1.1	5.0	5.0
9	16.7	1.7	9.3	14.3
10	20.0	6.1	13.9	27.2
11	11.1	6.7	3.8	31.0
12	15.0	0.6	7.3	38.3
13	18.3	7.2	13.4	58.7
14	20.6	4.4	12.9	71.6
15	25.6	6.7	17.8	88.4
16	31.7	16.1	26.8	115.2
17	25.6	18.9	28.7	143.9
18	20.0	13.9	20.0	164.9
19	13.9	10.0	10.9	175.8
20	17.2	9.4	14.3	190.1
21	23.3	12.2	21.7	211.8
22	16.7	8.9	13.3	225.1
23	18.9	8.3	15.0	240.1
24	14.4	6.1	8.0	248.1
25	13.3	5.0	5.5	253.6
26	18.9	3.9	11.5	265.1
27	18.9	6.7	13.5	278.6
28	22.2	4.4	14.1	292.7
29	25.6	6.7	17.8	310.5
30	32.2	14.4	25.2	335.7
31	35.6	17.3	26.6	362.3
June 1	21.1	14.4	22.3	384.6
2	25.6	12.2	22.7	407.3
3	26.7	11.7	22.6	429.9
4	21.1	3.3	13.3	443.2
5	17.8	15.6	20.5	463.7
6	20.3	16.7	23.7	487.4
7	27.2	16.1	26.7	514.1
8	20.0	13.9	21.0	535.1
9	13.3	10.0	10.0	545.1
10	18.9	6.7	13.5	558.6

11	23.3	9.4	19.2	577.8
12	17.2	13.3	17.8	595.6
13	20.6	10.6	18.5	614.1
14	22.2	8.9	18.1	632.2
15	21.7	13.9	22.2	654.4
16	27.8	17.8	28.3	682.7
17	27.2	17.8	28.2	710.9
18	24.4	16.1	25.8	736.7
19	25.6	13.9	24.3	761.0
20	26.7	12.2	23.1	784.1
21	27.2	17.8	28.2	812.3
22	27.8	17.5	28.1	840.4
23	22.8	14.2	23.2	863.6
24	24.4	12.5	22.5	886.1
25	32.8	15.3	25.9	912.0
26	23.9	16.7	26.1	938.1
27	25.6	15.3	25.5	963.6
28	26.7	17.8	28.1	991.7
29	28.3	14.2	25.2	1016.9
30	30.3	16.1	27.0	1043.9
July 1	25.0	13.9	24.0	1067.9
2	29.4	18.9	26.0	1093.9
3	26.7	15.0	25.6	1119.5
4	23.9	13.6	23.3	1142.8
5	18.9	13.9	20.0	1162.8
6	22.2	9.7	18.8	1181.6
7	23.3	10.3	20.0	1201.6
8	27.8	13.9	24.8	1226.4
9	30.0	16.1	27.0	1253.4
10	30.0	16.7	27.5	1280.9
11	30.8	16.7	27.5	1308.4
12	32.2	17.2	27.7	1336.1
13	29.2	16.7	27.5	1363.6
14	26.7	17.5	27.8	1391.4
15	26.7	16.1	26.6	1418.0
16	24.7	15.8	25.6	1443.6
17	26.7	13.9	24.6	1468.2
18	33.3	17.2	27.5	1495.7
19	28.3	13.9	24.9	1520.6
20	30.0	13.9	25.0	1545.6
21	31.1	22.8	33.0	1578.6
22	27.8	21.9	32.0	1610.6
23	27.8	14.7	25.6	1636.2
24	28.9	15.6	26.5	1662.7
25	30.3	13.9	25.0	1687.7
26	28.3	14.4	25.4	1713.1
27	30.0	15.0	26.0	1739.1
28	32.2	15.6	26.3	1765.4
29	28.3	20.3	30.7	1796.1
30	27.8	21.7	31.9	1828.0
31	29.4	20.6	31.0	1859.0
Aug. 1	31.1	20.8	31.2	1890.2
2	33.3	17.8	28.0	1918.2
3	32.8	17.8	28.2	1946.4

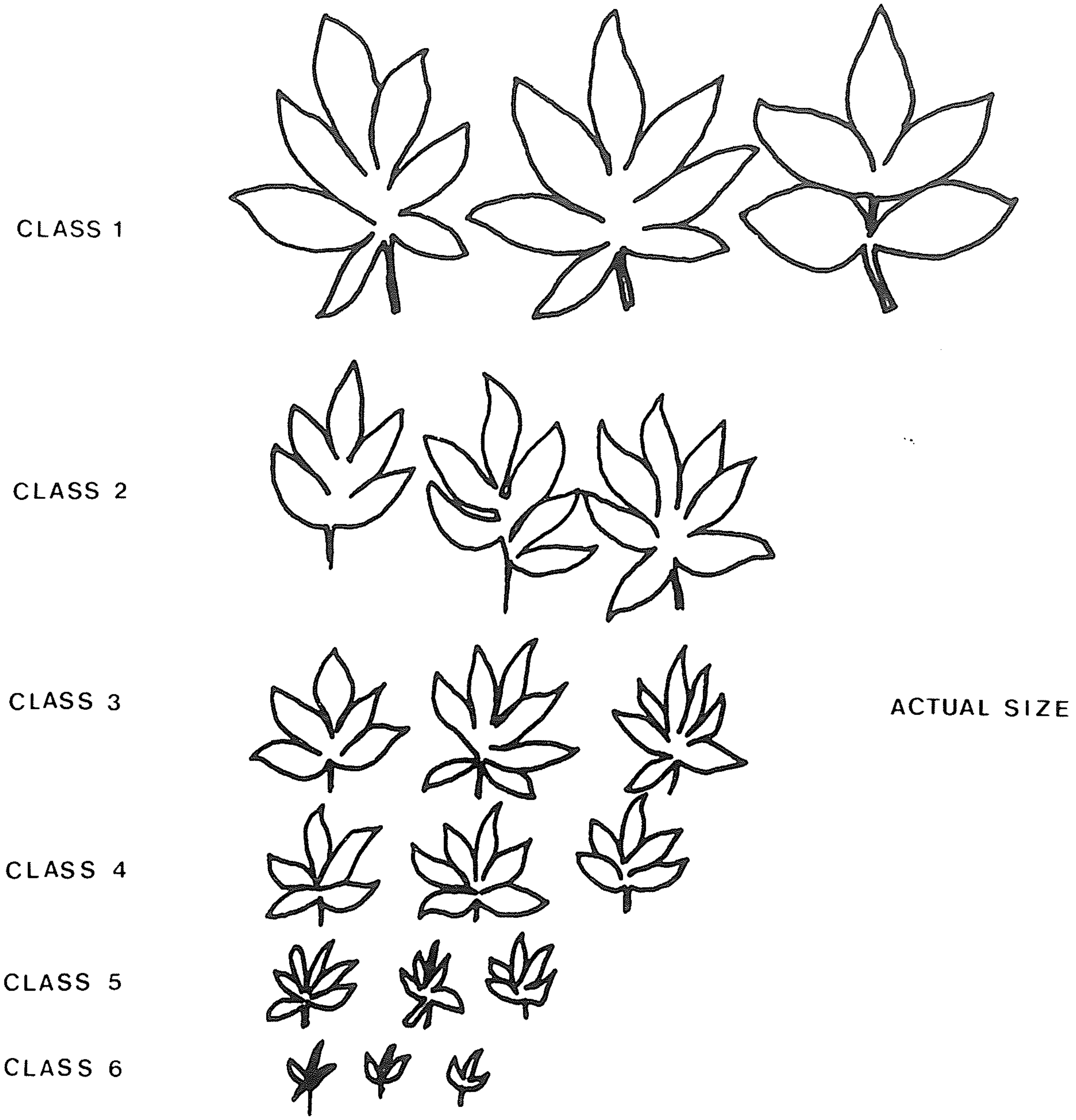
4	32.5	18.3	28.7	1975.1
5	32.2	17.8	28.3	2003.4
6	32.2	13.9	24.8	2028.2
7	30.6	14.4	25.4	2053.6
8	28.3	17.2	27.9	2081.5
9	24.4	16.1	25.8	2107.3
10	23.3	16.7	25.7	2133.0
11	30.6	13.9	25.0	2158.0
12	30.6	17.8	28.5	2186.5
13	36.1	20.0	28.8	2215.3
14	33.3	22.8	32.5	2247.8
15	25.6	15.0	25.3	2273.1
16	32.2	14.4	25.2	2298.3
17	30.0	14.4	25.5	2323.8
18	30.3	14.4	25.5	2349.3
19	32.8	18.1	28.4	2377.7
20	26.1	19.2	29.2	2406.9
21	23.3	15.0	24.2	2431.1
22	21.4	11.1	19.5	2450.6
23	26.1	8.6	19.7	2470.3
24	30.0	15.6	26.5	2496.8
25	34.4	19.2	28.9	2525.7
26	38.6	16.4	24.0	2549.7
27	38.3	15.6	23.5	2573.2
28	34.7	16.1	26.0	2599.2
29	27.8	10.0	21.3	2620.5
30	22.2	13.9	22.6	2643.1
31	19.4	8.9	16.0	2659.1
Sept.1	18.9	8.6	15.2	2674.3
2	18.1	11.7	17.3	2691.6
3	18.9	8.3	15.0	2706.6
4	20.6	7.8	16.0	2722.6
5	17.8	5.3	11.2	2733.8
6	28.9	12.8	24.0	2757.8
7	23.6	15.6	24.9	2782.7
8	17.2	11.1	15.8	2798.5
9	14.4	10.3	11.8	2810.3
10	15.8	8.3	11.7	2822.0
11	17.8	5.6	11.5	2833.5
12	15.0	11.7	13.8	2847.3
13	15.6	10.0	13.0	2860.3
14	15.6	6.4	9.8	2870.1
15	18.3	5.6	12.0	2882.1
16	17.8	3.9	10.4	2892.5
17	29.4	11.7	23.0	2915.5
18	24.4	16.4	26.0	2941.5
19	23.6	10.8	20.6	2962.1
20	21.7	7.2	16.2	2978.3
21	15.0	11.1	13.3	2991.6
22	17.8	4.4	10.4	3002.0
23	7.8	3.3	0	3002.0
24	5.6	1.7	0	3002.0
25	6.7	1.7	0	3002.0
26	10.0	1.7	0	3002.0

27	N/A	N/A	N/A	3002.0
28	14.4	1.7	6.5	3008.5
29	17.8	3.3	10.4	3018.9
30	15.0	3.0	7.3	3026.2
Oct. 1	20.6	0.0	12.9	3039.1
2	22.5	8.9	18.3	3057.4
3	18.9	2.2	11.5	3068.9
4	15.6	2.8	8.0	3076.9
5	25.6	6.7	17.8	3094.7
6	20.3	15.6	22.7	3117.4
7	16.9	6.1	11.0	3128.4
8	22.2	7.5	16.8	3145.2
9	24.4	7.8	18.3	3163.5

Appendix 9

FLOWER COLOUR CLASSES UTILIZED IN PROGENY ASSESSMENTS

Class	Royal Horticulture Colour Description
1. Dark Yellow	Aurelian Yellow 3/0
2. Bright Lemon Yellow	Canary Yellow 2/0 - Sulphur Yellow 1/0
3. Light Bright Yellow	Canary Yellow 2/1 - Sulphur Yellow 1/1
4. Creamy Yellow	Canary Yellow 2/2 - Sulphur Yellow 1/2
5. Light Creamy Yellow	Canary yellow 2/3 - Sulphur Yellow 1/3
6. Creamy White	Primrose Yellow 601/3
7. White	
8-28 Each of the above colours with the presence of orange, red or pink pigments to varying degrees but not to dominate background colour, ie. Cyanic zonation.	
29. Red	
30. Orange	
31. Salmon	
32. Pink	



APPENDIX 10 LEAF SIZE CLASSES USED IN PROGENY ASSESMENT

Appendix 11

DETAILS OF PROGENY EVALUATION

A) Flower colour and petal number crosses

B) Open-pollinated families

C) Experimental taxonomy crosses

Abbreviation		Character	Mode of Assessment
PLNUM	=	plant number	
WI	=	winter injury	1 = dead, 2 = dead to soil line ... 6 = no damage
LFCOL	=	leaf colour	1 = dark green ... 5 = light green, 6 = silver green, 7 = blue green, 8 = chlorotic
LFPUB	=	leaf vesture	1 = glabrous ... 6 = villous
LFSIZE	=	leaf size	as illustrated in appendix 10
NUMLF	=	number of leaflets	count
FLCOL	=	flower colour	as outlined in appendix 9
FLDIAM	=	flower diameter	1 = 10 mm, 2 = 10-15 mm ... 7 = 35 mm
NPET	=	number of petals	count
NLPET	=	number of large petals	count
NMPET	=	number of medium petals	count
NSPET	=	number of small petals	count
PETOV	=	petal insularity	1 = gap, 2 = touching, 3 = overlap
HGHT	=	height	cm
WDTH	=	width	cm
VIG	=	vigour	0 = dead ... 9 = very high
FLCOLG	=	flower colour - greenhouse	as outlined in appendix 9
FLDAMG	=	flower diameter - greenhouse	1 = 10 mm, 2 = 10-15 mm ... 7 = 35 mm
NPETG	=	number of petals - greenhouse	count
NLPETG	=	number of large petals - greenhouse	count
NSPETG	=	number of small petals - greenhouse	count
PETOUG	=	petal insularity - greenhouse	1 = gap, 2 = touching, 3 = overlap
LFCOLG	=	leaf colour - greenhouse	1 = dark green ... 5 = light green
LFPUBG	=	leaf vesture - greenhouse	1 = glabrous ... 4 = villous
NMLFLG	=	number of leaflets - greenhouse	count
VIGG	=	vigour - greenhouse	0 = dead ... 5 = very high

Key to Abbreviations and Codes

Code Number	Taxa
100	Arbuscula OP
101	Grandiflora OP
102	Glabra OP
103	UM 7901 OP
104	Maaneley OP
105	UM 8105 OP
106	Parvifolia OP
107	Micandra OP
108	Friedrichsenii OP
109	Beesi OP
110	Weeping OP
111	Rhederiana OP
112	UM 7904 OP
113	UM 7911 OP
114	Mandshurica OP
115	Marchand OP
116	Arborg
117	USSR OP
118	Sundance OP
119	UM 7513 OP
120	Northman OP
121	UM 7102 OP
122	UM 7522 OP
123	Coronation Triumph OP
124	Logan Form OP
125	Tangerine OP
126	UM 8102 OP
127	Sunset OP
128	Jackmani OP
129	Purdomi OP
130	Nyewoods Form OP
131	Hallman's Dwarf OP
132	Coronation Triumph x UM 7528
133	Abbotswood OP
134	Goldfinger x Roseacre
135	Goldfinger x Marchand
136	Goldfinger x Red Ace
137	Goldfinger x Davurica
138	Goldfinger x UM 7901
139	Goldfinger x UM 8102
140	Goldfinger x Grandiflora
141	Goldfinger x Hachman's Giant
142	Goldfinger (x)
144	Goldfinger x UM 7911
145	UM 8102 x UM 5722
146	UM 8102 x UM 7904
147	UM 8102 x Red Ace
148	UM 8102 x UM 7909
149	UM 8102 x UM 7911
150	UM 8102 (x)

Code Number	Taxa
151	UM 8102 x Marchand
152	UM 8102 x Davurica
153	UM 8102 x Goldfinger
154	UM 8102 x UM 7901
155	UM 8102 x Gibson Scarlet
156	UM 8102 x Sundance
157	UM 7901 x Davurica
158	UM 7901 x Goldfinger
159	UM 7901 x Sundance
160	UM 7901 x UM 8102
161	UM 7901 x Marchand
162	UM 7901 x UM 7911
163	UM 7901 x UM 7904
165	Grandiflora x Hachman's Giant
166	Hachman's x Goldfinger
167	Red Ace x UM 7908
168	Sundance x UM 8102
169	Sundance x Marchand
173	UM 7904 x UM 7901
174	UM 7904 x Sundance
175	UM 7911 x UM 8102
176	UM 7911 x UM 7904
177	UM 7911 x Marchand
178	UM 7911 x UM 7901
179	Marchand x Sundance
180	European (2n = 2x) x Davurica
181	Sulphurescens x Davurica
182	Scandinavian x Davurica
183	Coronation Triumph x UM 7901
184	Arbuscula (x)
185	Friedrichsenii x Davurica
186	Davurica x Glabra
187	Rhederiana x Davurica
188	Grandiflora x Scandinavian
189	Davurica x European (2n = 2x)
190	Glabra x European 2n = 4x
191	Arbuscula x Davurica
192	Davurica x Arbuscula
193	North American Native x Davurica
194	Arbuscula x Scandinavian
195	Glabra x Arbuscula
196	Friedrichsenii x Scandinanvian
197	Davurica x Scandinavian
198	European (2n = 2x) x Hersi
199	Parvifolia x Arbuscula
200	Glabra x Hersi
201	Arbuscula x Glabra
202	Scandinavian x Glabra
203	Glabra x European (2n = 2x)
204	Glabra x Parvifolia
205	Arbuscula x European (2n = 2x)
206	European (2n = 2x) x European (2n = 4x)

Code Number	Taxa
207	Hersi x Glabra
208	Parvifolia x North American
209	Scandinavian x European (2n = 2x)
210	European (2n = 2x) x Glabra
211	Davurica ⓧ
212	Scandinavian x North American
213	European (2n = 4x) ⓧ
214	European (2n = 2x) x Parvifolia
215	European (2n = 2x) x North American
216	Scandinavian x Arbuscula
217	Arbuscula x Hersi
218	Parvifolia x Glabra
219	European (2n = 2x) x European (2n = 4x)
220	Hersi x Scandinavian
221	Glabra x Scandianvian
222	Parvifolia x Scandinavian
223	North American x Glabra
224	Scandinavian x Parvifolia
225	Parvifolia x Hersi
226	Arbuscula x North American
227	Arbuscula x Parvifolia
228	Arbuscula ⓧ
229	European (2n = 2x) x Arbuscula
230	Davurica x Parvifolia
231	Rhederiana x Hersi
232	Glabra x Davurica
233	European (2n = 2x) x Friedrichsenii
234	Sulphenescens
235	Rhederiana x Parvifolia
237	Friedrichsenii ⓧ
238	North American x Arbuscula
239	Parvifolia x European (2n = 2x)
240	North American x Parvifolia
241	Hachman's x UM 7519
242	Coronation Triumph x UM 7528
243	Arbuscula x UM 7309
244	Glabra (Parent)
245	Hersi (Parent)
246	Scandinavian (Parent)
247	Arbuscula (Parent)
248	Parvifolia (Parent)
249	North American (Parent)
250	Rhederiana (Parent)
251	Sulphurescens (Parent)
252	European (2n = 2x) (Parent)
253	European (2n = 4x) (Parent)
254	Davurica (Parent)
255	UM 7911 (Parent)
256	UM 7911 (Parent)
257	UM 8102 (Parent)
258	Goldfinger (Parent)

Code Number	Taxa
259	UM 7901 (Parent)
260	Marchand (Parent)
261	Red Ace (Parent)
262	Sundance x UM 7904
263	Goldfinger x Sundance
264	Davurica (Parent)
265	Subalbicans x Marchand
266	Cornation Triumph x Sundance
268	Hachman's Giant OP
269	North American OP

A) Flower colour and petal number crosses.

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                                                     SAS

OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

  1   100     1    6    7      5      3       5       2      5      5      .      .      .      2     53    71    5
  2   100     2    6    3      5      4       5       5      5      5      .      .      .      3     59    67    5
  3   100     3    6    3      4      4       7       .      .      .      .      .      .      .     48    68    5
  4   100     4    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
  5   100     5    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
  6   100     6    4    4      4      4       5      11      4      5      .      .      .      3     47    65    5
  7   100     7    6    7      5      3       6       2      5      5      .      .      .      1     31    65    5
  8   100     8    4    3      4      3       7       4      5      5      .      .      .      3     60    90    6
  9   100     9    5    3      5      3       3       3      5      5      .      .      .      3     26    58    4
 10   100    10    6    2      5      3       5       1      5      5      .      .      .      3     36    74    5
 11   100    11    6    4      5      4       5       2      5      5      .      .      .      1     16    21    3
 12   100    12    6    2      5      3       6       4      6      5      .      .      .      2     34    76    5
 13   100    13    6    2      4      3       5       2      6      5      .      .      .      2     43    77    5
 14   100    14    5    4      4      4       7       2      5      5      .      .      .      2     53    77    5
 15   100    15    6    3      5      4       5       4      5      5      .      .      .      3     35    76    5
 16   100    16    6    3      5      3       6       .      .      .      .      .      .      .     46    71    5
 17   100    17    6    2      5      3       5       1      6      5      .      .      .      3     37    57    5
 18   100    18    6    3      5      2       5       3      5      5      .      .      .      3     39    73    5
 19   100    19    6    3      4      3       5       2      6      5      .      .      .      3     45    57    5
 20   100    20    5    8      4      4       5       .      .      .      .      .      .      .      7    20    2
 21   100    21    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 22   100    22    6    3      4      3       4       3      5      5      .      .      .      3     52    83    6
 23   100    23    6    3      5      3       7       3      5      5      .      .      .      3     58    71    5
 24   100    24    6    3      3      4       5       4      4      5      .      .      .      3     25    44    4
 25   100    25    6    3      5      4       5       2      5      5      .      .      .      3     33    80    5
 26   100    26    6    3      5      2       7       3      4      5      .      .      .      3     46    60    5
 27   100    27    6    2      5      4       5       4      7      5      .      .      .      3     29    60    5
 28   100    28    6    3      4      3       5       2      5      5      .      .      .      3     33    63    5
 29   100    29    3    3      5      4       5       .      .      .      .      .      .      .     10    26    2
 30   100    30    6    2      4      2       6       2      7      5      .      .      .      3     39    55    5
 31   100    31    6    3      4      3       4       4      3      5      .      .      .      3     39    48    5
 32   100    32    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 33   100    33    6    2      4      3       5       7      5      6      6      0      0      3     66    99    8
 34   100    34    6    2      5      4       5       7      5      5      5      0      0      3     38    59    4
 35   100    35    5    3      4      4       5       3      5      5      .      .      .      3     53    56    5
 36   100    36    6    3      5      4       5      30      3      5      .      .      .      3     27    45    3
 37   100    37    6    3      4      4       5       4      5      5      .      .      .      3     20    57    3
 38   100    38    6    2      4      2       7       3      6      6      6      0      0      3     65    49    6
 39   100    39    6    3      5      5       5       .      .      .      .      .      .      .     12    29    2
 40   100    40    6    3      4      2       6       4      5      5      .      .      .      1     29    75    5
 41   100    41    6    3      4      5       5       .      .      .      .      .      .      .      8    26    2
 42   100    42    6    2      4      4       7       7      4      5      .      .      .      3     42    63    5
 43   100    43    6    3      4      3       5       4      5      5      .      .      .      3     24    33    3
 44   100    44    6    3      3      3       7       2      6      5      .      .      .      3     64    92    7
 45   100    45    6    3      3      2       5       2      6      5      .      .      .      2     57    53    6
 46   100    46    6    3      4      2       5       3      6      5      .      .      .      2     61    60    6
 47   100    47    6    3      4      4       5       3      6      5      .      .      .      1     10    25    2
 48   100    48    6    3      4      3       5       5      5      5      .      .      .      3     56    76    6
 49   100    49    3    3      4      3       5       3      4      5      .      .      .      3     41    76    4
 50   100    50    6    3      4      4       5       .      .      .      .      .      .      .     35    50    3
 51   100    51    4    3      4      3       5       3      5      5      .      .      .      3     54    78    6
 52   100    52    6    3      4      3       7       3      6      5      .      .      .      2     77    74    7
 53   100    53    4    3      4      3       7       3      4      5      .      .      .      3     45    61    5
 54   100    54    6    3      4      3       5       4      5      5      .      .      .      3     34    56    4
 55   100    55    6    3      4      2       7       3      6      5      .      .      .      3     61    85    7
 56   100    56    6    3      4      4       5       4      5      5      .      .      .      3     20    38    3
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SAS

OBS	CODE	PLNUM	WI	LFCOL	LFPUB	LFSIZE	NUMLFL	FLCOL	FLDIAM	NPET	NLPET	NMPET	NSPET	PETOV	HGHT	WDTH	VIG
57	100	57	6	2	5	2	7	2	5	5	.	.	.	3	57	86	6
58	100	58	6	3	5	3	5	3	6	5	.	.	.	3	61	75	5
59	100	59	6	3	5	3	5	25	4	5	.	.	.	3	33	66	6
60	100	60	6	4	4	2	2	2	6	5	.	.	.	3	46	68	5
61	100	61	6	3	5	3	5	3	4	5	.	.	.	3	42	55	5
62	100	62	1	.	.	.	.	.	.	.	.	.	.	.	.	.	0
63	100	63	6	3	4	3	5	2	7	5	.	.	.	3	49	71	5
64	100	64	6	3	4	3	5	3	7	5	.	.	.	3	59	98	6
65	100	65	6	4	4	5	7	2	5	5	.	.	.	2	67	98	6
66	100	66	5	3	4	3	7	2	6	5	.	.	.	3	72	96	6
67	100	67	6	3	4	2	5	3	5	5	.	.	.	3	51	95	5
68	100	68	6	4	4	3	7	3	5	5	.	.	.	3	61	92	5
69	101	1	5	3	3	3	6	.	.	.	.	.	.	.	65	75	6
70	101	2	4	3	4	2	7	2	5	5	.	.	.	3	59	99	7
71	101	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	0
72	101	4	6	3	3	4	5	3	4	5	.	.	.	3	47	66	5
73	101	5	6	1	4	2	6	2	5	5	.	.	.	3	62	99	7
74	101	6	6	3	4	3	6	2	6	5	.	.	.	3	63	79	6
75	101	7	6	3	5	3	6	2	3	5	.	.	.	1	54	66	5
76	101	8	6	3	4	3	7	2	5	5	.	.	.	3	71	82	6
77	101	9	4	3	3	2	6	3	6	5	.	.	.	3	50	49	5
78	101	10	6	2	5	3	7	2	4	5	.	.	.	2	47	57	4
79	101	11	6	3	5	3	6	1	5	5	.	.	.	3	47	60	5
80	101	12	6	3	5	3	7	2	6	5	.	.	.	3	57	66	5
81	101	13	5	4	4	3	6	2	6	5	.	.	.	3	79	75	8
82	101	14	4	3	4	2	7	2	5	5	.	.	.	3	89	97	8
83	101	15	6	3	5	2	7	2	5	5	.	.	.	3	76	70	7
84	101	16	6	3	3	2	6	2	4	5	.	.	.	2	46	55	5
85	101	17	6	2	4	2	6	2	6	5	.	.	.	3	82	64	6
86	101	18	6	3	3	3	5	3	6	5	.	.	.	3	66	75	7
87	101	19	6	4	5	4	7	2	6	5	.	.	.	3	72	66	7
88	101	20	6	3	4	3	6	2	5	5	.	.	.	3	42	95	6
89	101	21	2	3	5	3	7	2	4	5	.	.	.	3	35	31	3
90	101	22	6	3	5	2	6	2	6	5	.	.	.	3	67	78	6
91	101	23	4	2	3	3	7	3	6	5	.	.	.	3	52	76	6
92	101	24	5	3	4	3	8	2	6	5	.	.	.	3	68	73	6
93	101	25	6	3	3	3	6	2	5	5	.	.	.	2	79	97	7
94	101	26	6	3	4	3	7	2	5	5	.	.	.	3	56	60	6
95	101	27	6	2	4	3	5	2	6	5	.	.	.	1	49	56	5
96	101	28	3	4	3	4	7	2	4	5	.	.	.	1	19	31	3
97	101	29	6	3	4	2	6	1	6	5	.	.	.	3	58	84	7
98	101	30	6	2	5	2	6	1	6	5	.	.	.	1	50	73	6
99	101	31	1	.	.	.	.	.	.	.	.	.	.	.	.	.	0
100	101	32	6	3	4	3	7	2	7	5	.	.	.	3	59	97	7
101	101	33	1	.	.	.	.	.	.	.	.	.	.	.	.	.	0
102	101	34	5	3	4	2	5	3	3	5	.	.	.	2	56	67	5
103	101	35	1	.	.	.	.	.	.	.	.	.	.	.	.	.	0
104	101	36	4	3	4	2	7	.	.	.	.	.	.	.	33	33	4
105	101	37	6	3	2	3	5	3	4	5	.	.	.	3	60	85	6
106	101	38	2	3	4	3	5	2	3	5	.	.	.	3	26	28	3
107	101	39	5	2	4	3	5	2	6	5	.	.	.	2	62	98	6
108	101	40	6	3	4	3	7	2	5	5	.	.	.	3	75	71	7
109	101	41	6	3	4	2	7	2	6	5	.	.	.	2	57	98	6
110	101	42	6	2	4	2	7	2	5	5	.	.	.	2	45	61	5
111	101	43	6	3	5	2	7	2	5	5	.	.	.	2	71	68	5
112	101	44	3	3	5	3	7	2	4	5	.	.	.	3	75	78	5

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                                                          SAS

OBS  CODE PLNUM   WI   LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL   FLDIAM  NPET   NLPET  NMPET  NSPET  PETOV  HGHT  WDTH   VIG

113   101    45    4     3      3       3       7       2       6      5      .      .      .      3     63    85     5
114   101    46    6     3      4       3       7       2       4      5      .      .      .      2     54    85     6
115   101    47    5     3      4       3       7       2       6      5      .      .      .      3     70    75     7
116   101    48    6     3      4       3       7       2       5      5      .      .      .      3     63    95     6
117   101    49    6     4      5       3       7       3       5      5      .      .      .      2     83    80     6
118   101    50    6     2      4       4       7       2       7      5      .      .      .      3     67    75     6
119   101    51    6     3      4       3       7       2       6      5      .      .      .      3     76    85     6
120   101    52    2     3      4       4       5       .       .      .      .      .      .      .     24    28     2
121   101    53    6     3      4       3       7       2       6      5      .      .      .      2     74    70     6
122   101    54    5     3      4       3       7       2       6      5      .      .      .      3     95    98     6
123   101    55    5     2      4       2       7       2       6      5      .      .      .      3     77    73     6
124   101    56    6     4      4       3       7      11       6      5      .      .      .      3     48    50     4
125   101    57    6     3      4       3       7       2       6      5      .      .      .      3     78    94     7
126   102     1    6     3      5       3       5       6       4      5      .      .      .      3     40    56     5
127   102     2    6     2      5       3       5       2       4      5      .      .      .      3     32    45     4
128   102     3    6     3      5       3       5       7       3      5      .      .      .      3     45    61     5
129   102     4    6     3      4       2       5       7       4      5      .      .      .      3     50    58     5
130   102     5    6     3      4       2       5       5       3      5      .      .      .      3     38    39     4
131   102     6    6     2      4       3       5       4       3      5      .      .      .      3     28    65     5
132   102     7    6     2      4       3       5       3       4      5      .      .      .      2     40    56     6
133   102     8    6     3      4       3       5       5       5      5      .      .      .      1     35    51     5
134   102     9    6     2      4       3       7       2       5      5      .      .      .      3     46    77     5
135   102    10    6     3      4       2       5       7       4      5      .      .      .      3     33    43     5
136   102    11    6     3      4       4       5       6       4      5      .      .      .      3     31    42     5
137   102    12    5     3      3       3       5       2       4      5      .      .      .      3     35    33     4
138   102    13    5     3      5       3       6       5       3      5      .      .      .      2     53    40     5
139   102    14    6     3      5       3       5       2       3      5      .      .      .      3     43    37     4
140   102    15    1     .      .       .       .       .       .      .      .      .      .      .      .     .     0
141   102    16    3     3      5       3       5       .       .      .      .      .      .      .     20    28     4
142   102    17    6     2      5       3       5       3       3      5      .      .      .      3     38    54     5
143   102    18    6     3      4       3       5       4       5      5      .      .      .      3     43    60     5
144   102    19    6     2      6       3       5       2       5      5      .      .      .      3     52    48     5
145   102    20    6     2      6       4       5       .       .      .      .      .      .      .     13    31     2
146   102    21    6     3      5       3       5       4       2      5      .      .      .      1     39    40     4
147   102    22    4     3      4       3       5       4       5      5      .      .      .      1     38    47     5
148   102    23    6     2      4       3       5       3       3      5      .      .      .      1     42    47     5
149   102    24    5     2      4       3       5       4       4      5      .      .      .      1     29    41     4
150   102    25    4     3      4       3       5       .       .      .      .      .      .      .     26    33     3
151   102    26    5     3      5       4       5       3       5      5      .      .      .      1     38    51     4
152   102    27    6     3      5       3       6       3       5      5      .      .      .      1     64    95     5
153   102    28    3     3      4       4       5       7       3      5      .      .      .      3     18    38     3
154   102    29    6     3      5       2       5       3       3      5      .      .      .      3     33    42     4
155   102    30    6     2      6       3       5       3       3      5      .      .      .      3     41    59     4
156   102    31    6     3      5       3       5       2       3      5      .      .      .      3     46    54     4
157   102    32    6     2      5       2       5       4       5      5      .      .      .      3     74    61     5
158   102    33    6     3      4       3       5       6       5      5      .      .      .      3     30    63     4
159   102    34    6     2      6       2       5       4       5      5      .      .      .      2     22    43     4
160   102    35    6     2      6       3       5       5       4      5      .      .      .      1     24    38     4
161   102    36    6     2      6       4       5       .       .      .      .      .      .      .     22    54     5
162   102    37    1     .      .       .       .       .       .      .      .      .      .      .      .     .     0
163   102    38    1     .      .       .       .       .       .      .      .      .      .      .      .     .     0
164   102    39    6     2      5       3       5       3       4      5      .      .      .      3     33    53     4
165   102    40    3     3      3       3       6       3       5      5      .      .      .      3     42    60     4
166   102    41    6     2      5       4       5       6       4      5      .      .      .      3     33    36     5
167   102    42    5     3      4       3       5       .       .      .      .      .      .      .     33    35     3
168   102    43    1     .      .       .       .       .       .      .      .      .      .      .      .     .     0
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                                                       SAS

OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

169   102     44   5      2      4       3       5     17       5     5      .      .      .      3    37    43    5
170   103      1   6      5      3       3       5      .       .     .      .      .      .      .    30    33    3
171   103      2   6      3      4       3       5      3       5     8      8      0      0      3    62    74    6
172   103      3   6      2      5       3       5      4       5    14     14      0      0      3    74    62    6
173   103      4   6      5      3       4       5      .       .     .      .      .      .      .    28    20    3
174   103      5   6      3      5       2       7      2       5     5      .      .      .      3    79    87    6
175   103      6   6      3      4       3       5      5       5     6      6      0      0      3    63    54    6
176   103      7   6      1      4       3       5      4       4     5      .      .      .      3    69    66    5
177   103      8   6      3      4       3       6      2       5     5      .      .      .      3    56    60    5
178   103      9   6      3      6       3       5      3       5     8      8      1      0      3    42    50    5
179   103     10   6      2      5       3       5      3       5    12     10      1      1      3    50    72    5
180   103     11   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
181   103     12   3      3      5       3       5      2       5     5      .      .      .      3    31    29    4
182   103     13   6      5      3       3       5      .       .     .      .      .      .      .    31    30    4
183   103     14   6      4      5       3       5      2       5    14     13      1      0      3    33    40    5
184   103     15   6      3      4       3       5      4       5    10      8      0      2      3    64    66    6
185   103     16   4      5      3       3       5      .       .     .      .      .      .      .    24    29    2
186   103     17   6      3      5       3       5      3       5     6      6      0      0      3    56    82    6
187   103     18   6      3      5       4       7      3       4     6      6      0      0      3    26    24    3
188   103     19   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
189   103     20   6      4      4       3       7     14       4     5      .      .      .      3    52    57    5
190   103     21   5      3      5       3       5      2       4     5      .      .      .      3    55    47    5
191   103     22   6      4      5       3       5      4       5     5      .      .      .      3    66    60    6
192   103     23   6      3      4       3       5      4       5    12     11      1      0      3    64    74    5
193   103     24   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
194   103     25   6      2      4       3       5      3       5     9      8      1      0      3    64    67    6
195   103     26   6      5      4       3       6      3       5    12     12      0      0      3    23    21    3
196   103     27   6      2      5       3       5      2       5     5      .      .      .      3    52    73    6
197   103     28   6      3      4       3       5     14       4     7      7      0      0      3    41    44    5
198   103     29   6      3      4       3       5      4       5     7      6      1      0      3    57    46    5
199   103     30   6      3      5       2       5      2       4    10      6      2      2      3    56    62    5
200   103     31   6      3      5       3       5      4       5     5      .      .      .      3    59    74    6
201   103     32   6      2      5       3       5      4       3     5      .      .      .      3    73    85    6
202   103     33   6      3      5       2       5      3       4     5      .      .      .      3    60    80    6
203   103     34   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
204   103     35   6      3      5       3       5      4       5     5      .      .      .      3    60    59    6
205   103     36   6      3      5       2       5      2       4    14     12      2      0      3    56    55    5
206   103     37   5      4      4       4       5      2       5     7      7      0      0      3    42    44    5
207   103     38   6      3      5       3       5      3       4     6      5      0      1      3    59    65    5
208   103     39   6      3      5       3       5      2       4     5      .      .      .      3    46    53    5
209   103     40   6      3      5       3       5      2       4    14     12      2      0      3    31    44    4
210   103     41   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
211   103     42   6      3      5       4       5      3       5    11     10      0      1      3    55    57    5
212   103     43   6      5      3       3       5      4       4     5      .      .      .      3    32    32    4
213   103     44   5      3      4       2       5      6       6     6      6      0      0      3    77    76    6
214   103     45   6      3      5       4       5      2       5     5      .      .      .      3    58    55    5
215   103     46   6      3      4       3       5      4       4    14     14      0      0      3    60    67    6
216   103     47   6      3      3       3       7      3       6    13     12      1      0      3    80    85    8
217   103     48   6      2      5       3       5      2       4     5      .      .      .      3    46    63    4
218   103     49   6      3      4       3       5      3       5     5      .      .      .      3    74    79    7
219   103     50   6      3      4       3       5      4       4    12      7      3      2      3    65    64    6
220   103     51   6      4      4       2       5      2       5     5      .      .      .      3    71    65    7
221   103     52   5      8      3       4       5      .       .     .      .      .      .      .    18    16    1
222   103     53   2      8      3       4       5      .       .     .      .      .      .      .    14    13    1
223   103     54   4      8      4       4       5      .       .     .      .      .      .      .    38    29    2
224   103     55   6      8      3       4       5      5       4     5      .      .      .      3    77    89    7
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                                          SAS

OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

225   103     56   6      3      4       4       5      4       5     5      .      .      .      3    73    59    7
226   103     57   6      3      4       3       5      4       5    13     11      0      2      3    25    24    3
227   103     58   4      8      4       4       5      .       .     .      .      .      .      .     7     9    1
228   103     59   2      8      3       5       5      3       4    12      8      2      2      3    68    65    6
229   103     60   6      4      4       4       5      2       4     5      .      .      .      3    70    59    3
230   103     61   6      3      5       3       6      5       5     5      .      .      .      3    38    33    4
231   103     62   6      4      4       5       5      2       4     5      .      .      .      3    23    35    4
232   103     63   5      3      4       4       5      3       3     7      7      0      0      3    28    34    4
233   103     64   6      8      3       4       5      4       4     5      .      .      .      3    41    49    5
234   103     66   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
235   103     67   6      3      4       3       5      4       5     5      .      .      .      3    80    94    7
236   103     68   6      2      4       3       5      3       5     5      .      .      .      3    74    75    7
237   103     69   6      3      4       4       5      3       3     5      .      .      .      2    54    36    4
238   103     70   6      3      5       3       5      4       5     5      .      .      .      3    77    83    7
239   104      1   6      3      4       2       5      4       5     5      .      .      .      3    67    91    6
240   104      2   6      3      4       4       5      .       .     .      .      .      .      .    25    32    4
241   104      3   6      3      4       2       5      5       5     5      .      .      .      3    70    95    7
242   104      4   6      3      4       2       5      5       5     5      .      .      .      3    76    99    7
243   104      5   6      3      3       2       5      3       5     5      .      .      .      3    35    67    6
244   104      6   6      3      2       2       5      6       4     5      .      .      .      3    76    65    6
245   104      7   6      3      4       2       5      3       4     5      .      .      .      3    71    92    6
246   104      8   6      3      4       2       5      6       4     5      .      .      .      3    55    57    5
247   104      9   6      3      3       3       5      6       5     5      .      .      .      3    65    87    5
248   104     10   6      3      4       2       5      6       5     5      .      .      .      3    62    67    5
249   104     11   6      3      3       3       5      6       4     5      .      .      .      3    65    75    5
250   104     12   6      3      4       2       5      4       4     5      .      .      .      2    67    81    5
251   104     13   6      2      4       2       5      5       4     5      .      .      .      3    51    51    4
252   104     14   6      3      4       2       5      6       4     5      .      .      .      3    57    97    6
253   104     15   6      3      3       1       5      6       5     5      .      .      .      3    46    98    5
254   104     16   6      2      4       1       6      6       5     5      .      .      .      3    68    99    7
255   104     17   6      4      3       2       5      6       7     5      .      .      .      3    64    92    6
256   104     18   6      3      4       3       5      4       3     5      .      .      .      1    57    64    5
257   104     19   6      3      4       3       6      3       5     5      .      .      .      2    67    90    5
258   104     20   6      2      3       2       5      7       4     5      .      .      .      3    65    94    5
259   104     21   6      4      3       1       5      5       5     5      .      .      .      3    72    84    7
260   104     22   6      3      4       3       7      3       3     5      .      .      .      3    74    76    5
261   104     23   6      4      4       2       5      3       4     5      .      .      .      3    69    74    6
262   104     24   6      3      4       2       5      2       5     5      .      .      .      3    65    77    5
263   104     25   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
264   104     26   6      3      4       3       5      4       4     5      .      .      .      3    47    56    3
265   104     27   6      3      4       2       5      4       5     5      .      .      .      3    56    99    7
266   104     28   6      3      4       3       5      7       4     5      .      .      .      3    52    84    4
267   104     29   6      4      3       3       5      6       4     5      .      .      .      3    34    41    4
268   104     30   6      2      3       3       5      .       .     .      .      .      .      .    51    60    5
269   104     31   6      4      3       2       5      3       4     5      .      .      .      3    72    74    6
270   104     32   6      7      4       1       5      3       4     5      .      .      .      3    80    99    7
271   104     33   6      4      4       2       5      3       5     5      .      .      .      3    62    95    5
272   104     34   6      3      4       2       5      6       5     5      .      .      .      3    63    68    5
273   104     35   6      3      4       2       5      6       6     5      .      .      .      3    69    92    6
274   104     36   6      3      4       3       5      3       5     5      .      .      .      3    35    43    4
275   104     37   6      2      4       2       6      4       6     5      .      .      .      3    81    99    8
276   104     38   6      3      4       3       5      6       5     5      .      .      .      3    61    86    5
277   104     39   6      3      4       2       5      7       4     5      .      .      .      3    71    75    5
278   104     40   6      3      4       3       5      4       4     5      .      .      .      3    35    71    5
279   104     41   6      2      4       1       5      4       5     5      .      .      .      3    73    99    7
280   104     42   6      3      4       2       6      5       5     5      .      .      .      3    59    80    7
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

281   104    43    6    3      4      2       5       4      5      5      .      .      .      3     68    96    7
282   104    44    6    3      4      2       5       4      3      5      .      .      .      1     62    73    5
283   104    45    6    3      4      2       5       6      5      5      .      .      .      3     70    79    5
284   104    46    6    2      4      1       6       4      4      5      .      .      .      3     78    82    7
285   104    47    6    3      4      3       5       6      5      5      .      .      .      2     74    85    7
286   104    48    6    3      4      2       5       4      6      5      .      .      .      2     59    75    6
287   104    49    6    3      4      3       5       4      5      5      .      .      .      2     28    78    4
288   104    50    6    3      4      2       6       5      4      5      .      .      .      1     58    61    5
289   104    51    6    3      5      3       5       2      5      5      .      .      .      2     61    83    5
290   104    52    6    3      4      2       5       4      6      5      .      .      .      3     87    95    8
291   104    53    6    2      5      3       5       4      4      5      .      .      .      3     56    56    5
292   104    54    6    3      4      2       6       4      4      5      .      .      .      3     79    92    7
293   104    55    6    3      4      3       5       6      4      5      .      .      .      3     55    85    4
294   104    56    6    3      4      2       7       3      5      5      .      .      .      3     50    98    6
295   104    57    6    3      4      2       8       5      4      5      .      .      .      3     72    92    7
296   104    58    6    3      4      3       5       6      4      5      .      .      .      3     61    57    5
297   104    59    6    3      4      3       5       5      4      5      .      .      .      3     66    70    6
298   104    60    6    3      4      2       7       3      5      5      .      .      .      3     64    81    5
299   104    61    6    3      4      2       5       7      5      5      .      .      .      2     60    84    6
300   104    62    6    7      5      1       7       2      4      5      .      .      .      3     72    98    7
301   104    63    6    3      4      4       5       5      4      5      .      .      .      3     53    65    6
302   104    64    6    3      4      2       5       6      5      5      .      .      .      3     58    87    5
303   104    65    6    3      5      1       7       3      5      5      .      .      .      3     62    97    7
304   104    66    6    3      4      2       6       6      5      5      .      .      .      3     75    77    7
305   104    67    6    3      4      3       5       6      5      5      .      .      .      3     61    88    6
306   104    68    6    3      5      3       5       2      5      5      .      .      .      3     45    87    6
307   104    69    2    3      5      5       5       .      .      .      .      .      .      .     24    35    3
308   106     1    6    4      3      3       5       4      3      5      .      .      .      3     76    76    6
309   106     2    6    2      3      4       7       5      5      5      .      .      .      3     74    98    6
310   106     3    6    3      4      3       7       3      5      5      .      .      .      1     81    99    6
311   106     4    6    4      3      3       5       4      6      5      .      .      .      3     72    97    6
312   106     5    3    2      3      4       5       6      3      5      .      .      .      3     24    31    3
313   106     6    6    5      2      5       5       .      .      .      .      .      .      .     55    31    4
314   106     7    2    3      3      4       7       4      4      5      .      .      .      3     50    94    7
315   106     8    6    3      4      4       7       3      4      5      .      .      .      2     69    72    6
316   106     9    6    4      3      4       5       7      3      5      .      .      .      3     35    62    5
317   106    10    6    3      4      5       5       3      5      5      .      .      .      1     50    54    5
318   106    11    6    4      3      3       8       4      4      5      .      .      .      3     91    85    8
319   106    12    6    2      3      3       6       5      6      5      .      .      .      3     70    99    7
320   106    13    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
321   106    14    6    3      2      3       7       4      6      5      .      .      .      3     73    90    7
322   106    15    6    3      3      2       7       4      5      5      .      .      .      3     84    99    7
323   106    16    6    4      3      3       5       7      6      5      .      .      .      3     71    55    7
324   106    17    6    2      3      2       7       2      5      5      .      .      .      3     58    99    7
325   106    18    6    3      2      3       5       4      6      5      .      .      .      2     60    90    5
326   106    19    6    3      3      3       5       7      5      5      .      .      .      2     55    89    5
327   106    20    6    3      4      3       5       3      5      5      .      .      .      3     52    36    5
328   106    21    6    3      3      3       5       7      5      6      6      0      0      3     54    60    5
329   106    22    3    3      4      4       7       2      5      5      .      .      .      1     56    72    5
330   106    23    6    3      3      3       5       5      6      5      .      .      .      1     61    96    6
331   106    24    6    3      3      4       7       4      4      5      .      .      .      1     70    81    6
332   107     1    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
333   107     2    6    2      5      3       7       2      4      5      .      .      .      3     30    43    3
334   107     3    6    3      5      4       6       2      3      5      .      .      .      3     22    34    4
335   107     4    6    3      5      6       7       .      .      .      .      .      .      .     11    15    2
336   107     5    6    2      3      3       7       2      5      5      .      .      .      3     42    65    6
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

337  107     6     1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
338  107     7     6    3      3      3       7       3      4      5      .      .      .      1     46    69    6
339  107     8     2    3      4      5       7       .      .      .      .      .      .      .      8     8    1
340  107     9     6    3      3      3       8       2      3      5      .      .      .      1     36    35    4
341  107    10     6    2      5      3       7       .      .      .      .      .      .      .     27    36    3
342  107    11     6    2      4      4       7       .      .      .      .      .      .      .     18    24    3
343  108     1     6    4      2      2       5       3      5      5      .      .      .      3     82    90    7
344  108     2     6    3      3      2       5       3      6      5      .      .      .      1     98    99    8
345  108     3     6    4      4      3       5       3      4      5      .      .      .      1     62    95    5
346  108     4     6    3      2      2       5       4      4      5      .      .      .      3     58    61    5
347  108     5     6    3      1      3       6       6      3      5      .      .      .      2     58    42    5
348  108     6     6    3      2      3       5       7      4      6      6      0      0      3     62    88    6
349  108     7     6    3      3      3       6       4      3      5      .      .      .      1     74    85    6
350  108     8     6    3      4      2       5       3      5      5      .      .      .      3     68    97    5
351  108     9     6    3      4      2       7       3      4      5      .      .      .      3     74    99    7
352  108    10     6    3      3      2       5       3      5      5      .      .      .      3     71    91    6
353  108    11     6    3      4      2       5       4      3      5      .      .      .      3     69    95    5
354  108    12     6    3      4      2       7       4      3      5      .      .      .      3     67    91    6
355  108    13     6    3      3      2       6       5      4      5      .      .      .      3     68    83    6
356  108    14     6    4      2      2       6       3      5      5      .      .      .      3     67    57    5
357  108    15     6    3      2      2       7       5      5      5      .      .      .      3     72    98    5
358  108    16     6    3      3      4       5       7      4      5      .      .      .      3     50    76    5
359  108    17     6    3      4      4       7       .      .      .      .      .      .      .     60    70    3
360  108    18     6    4      3      3       5       2      5      5      .      .      .      2     71    79    6
361  108    19     6    3      3      2       5       2      6      5      .      .      .      3     58    66    5
362  108    20     6    3      2      3       5       4      3      7      7      0      0      3     31    44    3
363  108    21     6    2      3      2       7       7      3      8      7      1      0      3     74    68    6
364  108    22     6    3      2      3       7       7      5      5      .      .      .      3     64    99    6
365  108    23     6    3      4      3       5      33      4      5      .      .      .      1     68    70    5
366  108    24     6    2      4      3       5       3      4      5      .      .      .      3     59    88    5
367  108    25     6    4      4      3       5       6      4      5      .      .      .      3     47    50    4
368  108    26     6    3      3      3       5       2      3      5      .      .      .      3     57    99    4
369  108    27     6    3      4      3       5       4      5      5      .      .      .      3     75    83    6
370  108    28     6    3      3      3       5       5      5      5      .      .      .      3     58    55    7
371  108    29     6    3      4      3       5       6      5      5      .      .      .      3     89    88    5
372  108    30     6    3      4      3       7       3      5      5      .      .      .      3     64    71    6
373  108    31     6    3      3      3       5       7      5      5      .      .      .      3     62    99    5
374  108    32     6    3      4      3       6       6      5      5      .      .      .      2     58    80    5
375  108    33     6    3      3      2       6       3      6      5      .      .      .      3     58    54    5
376  108    34     6    3      3      3       5       3      6      5      .      .      .      3     65    66    5
377  108    35     6    4      4      3       5       6      5      5      .      .      .      3     55    62    6
378  108    36     6    3      4      4       5       3      4      5      .      .      .      3     50    35    5
379  108    37     6    3      3      3       6       .      .      .      .      .      .      .     29    62    3
380  108    38     6    4      4      3       5       4      4      5      .      .      .      3     66    79    5
381  108    39     6    7      5      3       5       7      4      5      .      .      .      3     79    88    6
382  108    40     1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
383  108    41     6    3      3      3       5       .      .      .      .      .      .      .     57    55    4
384  108    42     6    3      3      2       6       4      5      5      .      .      .      3     78    99    8
385  108    43     6    3      3      2       7       5      5      5      .      .      .      3     61    38    5
386  108    44     6    3      4      3       7       3      5      5      .      .      .      1     63    98    5
387  108    45     6    4      4      2       7       3      4      5      .      .      .      3     62    77    5
388  108    46     6    3      4      3       7       4      3      5      .      .      .      1     45    57    4
389  108    47     6    3      5      2       7       7      3      5      .      .      .      3     68    92    5
390  108    48     6    3      4      4       5       2      4      5      .      .      .      3     72    84    6
391  108    49     6    2      3      2       8       2      3      5      .      .      .      1     82    96    7
392  108    50     6    3      4      2       5       6      4      5      .      .      .      3     64    99    6
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

393  108    51    6     3      4      2       5       3      5       5     .      .      .      3     53    65    4
394  108    52    6     3      4      2       7       3      5       5     .      .      .      3     54    99    6
395  108    53    6     2      4      2       7       3      3       5     .      .      .      2     72    99    6
396  108    54    6     3      4      1       9       5      3       5     .      .      .      3     73    77    6
397  108    55    6     3      4      2       7       2      4       5     .      .      .      3     50    77    5
398  108    56    6     3      3      2       6       3      3       5     .      .      .      3     77    93    6
399  108    57    6     3      4      4       5       3      4       5     .      .      .      3     22    34    2
400  108    58    6     3      3      2       7       4      4       5     .      .      .      1     54    98    5
401  108    59    6     3      4      2       7       3      4       5     .      .      .      2     70    65    6
402  108    60    6     3      4      3       5       .      .       .     .      .      .      .     37    45    5
403  108    61    6     3      4      3       5       6      5       5     .      .      .      3     51    78    5
404  108    62    6     3      3      4       7       2      5       5     .      .      .      2     72    63    6
405  108    63    6     3      4      2       5       3      5       5     .      .      .      3     33    60    5
406  108    64    6     3      3      5       6       5      5       5     .      .      .      1     69    78    5
407  109     1    6     2      5      3       5       5      5       8     8      0      0      3     42    46    5
408  109     2    6     2      6      3       5       .      .       .     .      .      .      .     26    24    2
409  109     3    6     3      5      3       5       .      .       .     .      .      .      .     30    28    3
410  109     4    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
411  109     5    6     2      6      3       5       4      4       5     .      .      .      3     34    62    4
412  109     6    6     2      6      3       5       5      4       5     .      .      .      3     51    57    5
413  109     7    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
414  109     8    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
415  109     9    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
416  109    10    6     3      4      3       6       5      4       5     .      .      .      3     53    83    6
417  109    11    6     3      5      4       5       6      3       5     .      .      .      3     42    37    3
418  109    12    6     3      5      4       5       5      5       5     .      .      .      3     22    44    3
419  109    13    6     2      6      4       5       .      .       .     .      .      .      .     20    35    2
420  109    14    6     2      5      4       5       6      6       5     .      .      .      3     64    98    .
421  109    15    6     3      4      2       6       2      5       5     .      .      .      3     43    64    3
422  109    16    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
423  109    17    6     3      5      3       5       6      4       5     .      .      .      3     37    63    5
424  109    18    6     3      5      3       5       6      4       5     .      .      .      3     30    23    2
425  109    19    6     2      5      3       7       4      5       5     .      .      .      3     61    94    6
426  111     1    6     3      2      3       5      31      5       5     .      .      .      2     59    94    6
427  111     2    5     4      4      3       7       .      .       .     .      .      .      .     48    34    4
428  111     3    6     3      4      3       6       3      5       5     .      .      .      1     69    97    6
429  111     4    6     3      4      3       5       7      5       5     .      .      .      1     66    85    6
430  111     5    5     3      4      4       7      17      4       5     .      .      .      1     70    74    5
431  111     6    5     3      3      4       5       .      .       .     .      .      .      .     22    24    3
432  111     7    5     3      3      3       6       5      5       7     6      1      0      3     74    83    6
433  111     8    5     3      3      4       7       .      .       .     .      .      .      .     67    80    6
434  111     9    5     3      3      4       7      17      4       5     .      .      .      3     63    59    6
435  111    10    6     3      3      3       7       6      4       5     .      .      .      3     57    70    5
436  111    11    6     3      4      3       7       4      5       5     .      .      .      3     54    75    5
437  111    12    6     3      4      5       7       4      2       5     .      .      .      3     54    67    5
438  111    13    6     3      3      4       7       5      3       5     .      .      .      3     51    62    6
439  111    14    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
440  111    15    4     3      3      4       7       .      .       .     .      .      .      .     66    68    5
441  111    16    5     3      3      4       7       4      4       5     .      .      .      3     72    82    6
442  111    17    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
443  111    18    4     3      4      3       7       .      .       .     .      .      .      .     71    78    6
444  111    19    2     4      3      3       7       6      5       5     .      .      .      3     49    64    5
445  111    20    4     3      3      4       5       4      5       5     .      .      .      3     56    52    5
446  111    21    4     3      2      4       5       .      .       .     .      .      .      .     66    44    5
447  111    22    4     3      3      3       7       4      5       5     .      .      .      2     70    64    5
448  111    23    5     3      3      4       7       4      4       5     .      .      .      3     67    64    5
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

449  .111   24    5     3      3      4       7       4      4       5     .      .      .      3     53    37    4
450   111   25    4     3      4      4       7       .      .       .     .      .      .      .     47    50    5
451   111   26    6     3      3      4       6       5      4       5     .      .      .      3     61    46    5
452   111   27    3     3      3      3       7       .      .       .     .      .      .      .     70    46    5
453   111   28    4     3      3      2       7       5      4       5     .      .      .      3     80    81    7
454   111   29    4     3      4      4       7       4      3       5     .      .      .      3     47    51    4
455   111   30    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
456   111   31    6     3      2      4       5       .      .       .     .      .      .      .     67    75    5
457   112    1    5     3      4      3       5      20      5       5     .      .      .      3     64    84    6
458   112    2    6     3      3      4       7       6      4       5     .      .      .      3     52    55    4
459   112    3    6     3      4      3       6       4      4       5     .      .      .      3     56    57    4
460   112    4    6     3      4      3       5      31      4       6     5      0      1      3     77    98    6
461   112    5    3     3      4      4       5       .      .       .     .      .      .      .     25    20    2
462   112    6    5     3      5      3       5      17      4       5     .      .      .      3     65    41    5
463   112    7    6     3      4      4       6      31      4       5     .      .      .      3     57    67    5
464   113    1    6     4      4      3       5       3      5       5     .      .      .      2     50    64    4
465   113    2    5     3      4      3       6       3      5       5     .      .      .      3     76    84    7
466   113    3    6     5      4      4       5       .      .       .     .      .      .      .     25    18    2
467   113    4    6     5      4      3       6       .      .       .     .      .      .      .     28    41    3
468   113    5    6     3      3      2       7       6      5       5     .      .      .      3     71    97    6
469   113    6    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
470   113    7    4     3      3      3       5       3      4      12    12      0      0      3     56    61    6
471   113    8    6     4      3      4       5       .      .       .     .      .      .      .     17    13    2
472   115    1    6     3      3      3       5       4      4       5     .      .      .      3     36    45    4
473   115    2    6     3      4      2       5       3      5       5     .      .      .      3     55    65    5
474   115    3    6     3      4      4       5       2      4       6     6      0      0      3     60    53    5
475   115    4    6     3      4      3       5       .      .       .     .      .      .      .     36    45    3
476   115    5    6     3      4      3       7       2      4       5     .      .      .      3     64    72    4
477   117    1    .     3      4      1       7       2      5       5     .      .      .      3     50    42    6
478   117    2    .     3      4      2       7       .      .       .     .      .      .      .     28    20    4
479   117    4    .     3      4      2       7       2      4       5     .      .      .      3     43    48    6
480   117    5    .     3      5      2       7       2      5       7     5      2      0      3     49    46    6
481   117    6    .     3      4      2       7       2      4       5     .      .      .      3     20    32    4
482   117    9    .     3      4      1       7       2      5       5     .      .      .      3     49    19    6
483   117   10    .     3      4      2       7       2      4       5     .      .      .      3     40    23    5
484   117   12    .     3      4      3       7       2      4       5     .      .      .      3     22    23    4
485   117   14    .     3      4      2       7       2      4       5     .      .      .      3     35    32    5
486   122    1    5     3      4      4       5      30      4      10    10      0      0      3     47    78    7
487   122    2    6     3      3      2       7       6      5       5     .      .      .      3     81    97    7
488   122    3    5     3      3      3       5      17      5       5     .      .      .      3     38    48    4
489   122    4    2     8      4      5       5       .      .       .     .      .      .      .      3    10    1
490   122    5    6     3      3      4       5       3      6       5     .      .      .      3     52    70    5
491   122    6    6     3      4      3       5       2      5       9     9      0      0      3     55    78    7
492   122    7    6     4      3      4       7       .      .       .     .      .      .      .     35    43    3
493   122    8    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
494   122    9    6     2      4      4       5       7      3       5     .      .      .      3     44    80    6
495   122   10    4     4      3      4       7      30      5       5     .      .      .      3     74    97    7
496   122   11    6     8      4      4       5       .      .       .     .      .      .      .     16    15    2
497   122   12    6     3      3      3       7       6      5       5     .      .      .      3     66    95    6
498   122   13    6     4      4      4       7       3      5       5     .      .      .      3     68    55    5
499   122   14    6     2      4      3       7       3      6       5     .      .      .      3     64    95    7
500   122   15    3     4      4      5       5       .      .       .     .      .      .      .     50    54    3
501   122   16    6     4      4      4       5       3      3       5     .      .      .      3     42    56    5
502   122   17    5     3      3      3       7       2      5       5     .      .      .      3     64    80    6
503   122   18    5     4      3      4       5       6      5      11    10      1      0      3     48    60    5
504   122   19    1     .      .      .       .       .      .       .     .      .      .      .      .     .    0
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SAS

OBS	CODE	PLNUM	WI	LFCOL	LFPUB	LFSIZE	NUMLFL	FLCOL	FLDIAM	NPET	NLPET	NMPET	NSPET	PETOV	HGHT	WDTH	VIG
505	123	1	4	3	4	3	7	2	5	5	.	.	.	3	59	86	6
506	123	2	6	3	4	2	7	2	5	5	.	.	.	1	66	72	5
507	123	3	6	3	4	3	7	2	5	5	.	.	.	1	73	80	6
508	123	4	6	3	4	4	7	3	6	6	6	0	0	3	76	60	6
509	123	5	5	3	4	5	5	2	4	5	.	.	.	1	55	44	4
510	123	6	6	3	4	4	7	2	5	5	.	.	.	1	50	61	6
511	123	7	6	2	5	2	7	2	4	5	.	.	.	1	86	80	6
512	123	8	6	3	4	3	5	2	4	5	.	.	.	2	20	12	2
513	123	9	6	3	4	3	5	2	5	5	.	.	.	2	55	56	5
514	123	10	1	.	.	.	.	.	.	.	.	.	.	.	.	.	0
515	125	1	6	3	4	3	5	2	4	5	.	.	.	3	58	62	5
516	125	2	4	3	3	3	7	.	.	.	.	.	.	.	36	32	3
517	125	3	6	2	4	2	7	2	6	5	.	.	.	3	69	99	8
518	125	4	4	3	4	3	7	3	5	5	.	.	.	3	78	80	7
519	125	5	6	3	4	4	7	2	5	5	.	.	.	.	17	29	3
520	125	6	6	2	4	5	7	2	5	5	.	.	.	3	61	42	4
521	125	7	6	3	2	4	7	.	.	.	.	.	.	.	71	83	5
522	125	8	6	2	4	4	7	2	5	5	.	.	.	3	63	73	5
523	125	9	5	4	4	4	6	2	4	5	.	.	.	1	42	66	4
524	125	10	6	3	3	3	6	3	5	5	.	.	.	3	37	56	4
525	125	11	6	7	5	3	7	2	6	5	.	.	.	3	53	72	6
526	125	12	6	3	4	3	5	2	6	5	.	.	.	3	36	56	5
527	125	13	6	3	4	4	5	.	.	.	.	.	.	.	45	56	4
528	125	14	6	3	5	2	7	2	6	5	.	.	.	3	83	92	7
529	125	15	6	3	4	2	7	2	7	5	.	.	.	2	69	96	7
530	125	16	6	3	4	4	7	3	5	5	.	.	.	3	54	35	4
531	125	17	6	2	4	4	7	3	5	5	.	.	.	3	69	70	5
532	125	18	6	2	4	5	5	28	4	5	.	.	.	2	36	26	3
533	125	19	6	3	5	4	7	2	6	5	.	.	.	3	52	62	5
534	125	20	3	3	4	4	5	2	4	5	.	.	.	3	70	55	4
535	125	21	6	3	5	4	5	.	.	.	.	.	.	.	35	34	3
536	125	22	5	3	4	4	7	2	4	5	.	.	.	2	76	68	6
537	125	23	4	3	3	3	7	5	5	5	.	.	.	3	84	75	6
538	125	24	6	3	4	5	5	3	5	5	.	.	.	3	57	46	5
539	125	25	5	3	4	4	7	17	4	5	.	.	.	3	62	62	4
540	125	26	6	2	4	2	7	2	6	5	.	.	.	3	56	97	7
541	125	27	6	3	4	4	5	17	5	5	.	.	.	1	57	52	4
542	125	28	2	3	4	5	5	.	.	.	.	.	.	.	10	17	2
543	125	29	6	3	4	5	5	3	4	5	.	.	.	2	57	62	4
544	125	30	6	3	4	4	5	2	6	5	.	.	.	2	57	65	5
545	125	31	6	3	4	2	7	6	5	5	.	.	.	3	63	89	6
546	125	32	6	4	4	5	7	.	.	.	.	.	.	.	18	34	2
547	125	33	6	3	4	3	5	2	5	5	.	.	.	3	43	35	3
548	125	34	6	2	4	2	7	2	5	5	.	.	.	3	69	81	6
549	125	35	6	3	5	4	5	3	3	5	.	.	.	2	21	23	3
550	125	36	6	3	4	5	7	2	4	5	.	.	.	2	56	43	5
551	125	37	4	3	4	4	7	3	5	5	.	.	.	3	72	55	6
552	125	38	6	3	5	3	7	4	5	5	.	.	.	3	80	80	6
553	125	39	6	3	4	5	5	.	.	.	.	.	.	2	50	44	4
554	125	40	6	2	4	3	5	2	6	5	.	.	.	2	73	72	6
555	125	41	5	2	4	4	5	3	4	5	.	.	.	3	76	77	6
556	125	42	6	3	4	4	5	4	3	5	.	.	.	3	28	38	3
557	125	43	5	3	4	3	6	2	4	5	.	.	.	3	14	54	5
558	125	44	6	2	5	3	6	2	5	5	.	.	.	3	81	85	7
559	125	45	6	3	4	5	6	4	5	5	.	.	.	3	75	66	6
560	125	46	6	2	4	4	5	2	6	5	.	.	.	3	60	61	5

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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

561   125     47   6    3      4      3       7       2      6       5     .      .      .      3     55    64    6
562   125     49   6    7      5      3       7       2      5       5     .      .      .      3     78    40    7
563   125     49   6    3      4      2       7       2      5       5     .      .      .      3     60    90    5
564   125     51   5    3      3      4       5      17      3       5     .      .      .      3     61    41    5
565   125     52   6    2      4      3       5       3      5       5     .      .      .      3     52    58    5
566   125     53   6    2      4      3       7       2      4       5     .      .      .      3     97    60    9
567   125     54   5    3      4      3       7       3      5       5     .      .      .      3     89    74    7
568   125     55   6    3      4      2       7       2      5       5     .      .      .      3     68    72    6
569   125     56   6    3      4      4       7      17      4       5     .      .      .      3     51    55    4
570   125     57   6    3      4      4       5      25      5       7     7      0      0      3     46    45    4
571   125     58   6    3      3      2       7       3      5       5     .      .      .      3     79    77    5
572   125     59   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
573   125     60   6    3      4      5       7      33      4       5     .      .      .      3     47    54    5
574   125     61   6    3      4      3       5       3      6       5     .      .      .      3     52    54    5
575   125     62   6    3      4      4       7       .      .       .     .      .      .      .     24    15    2
576   125     63   4    3      3      3       7       2      5       5     .      .      .      3     70    86    7
577   125     64   6    3      4      4       5       6      3       5     .      .      .      3     20    10    2
578   125     65   5    3      4      4       7       4      4       5     .      .      .      3     65    58    5
579   125     66   5    3      4      4       7       3      5       5     .      .      .      3     74    61    5
580   125     67   6    3      3      4       5      28      5       6     6      0      0      3     62    48    5
581   125     68   5    3      3      2       7       3      5       5     .      .      .      3     61    55    6
582   125     69   5    3      3      3       5      17      4       5     .      .      .      3     58    64    6
583   125     70   6    2      3      3       7       2      5       5     .      .      .      3     72    90    6
584   125    550   4    4      4      5       7       4      3       5     .      .      .      3     76    42    4
585   126      1   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
586   126      2   6    3      4      3       5       7      5       5     .      .      .      3     66    80    7
587   126      3   6    5      3      4       5       .      .       .     .      .      .      .     34    40    3
588   126      4   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
589   126      5   6    2      4      4       5       7      5       8     7      1      0      3     51    71    6
590   126      6   6    4      4      3       5       4      4       5     .      .      .      3     55    58    5
591   126      7   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
592   126      8   6    3      3      3       5       4      6       8     7      0      1      3     65    72    6
593   126      9   6    3      3      3       5       6      5       5     .      .      .      3     70    68    6
594   126     10   6    3      3      4       5       5      4       5     .      .      .      3     45    54    5
595   126     11   6    3      4      3       6      25      4       5     .      .      .      3     48    74    5
596   126     12   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
597   126     13   6    3      4      3       5       3      5       8     8      0      0      3     65    75    5
598   126     14   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
599   126     15   6    3      4      3       5       7      5       6     6      0      0      3     53    62    5
600   126     16   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
601   126     17   6    3      4      4       5       4      6       5     .      .      .      3     46    48    5
602   126     18   6    3      4      3       5       7      5       6     6      0      0      3     58    66    5
603   126     19   6    4      3      3       5       .      .       .     .      .      .      .     52    39    4
604   126     20   6    3      4      3       5       7      5       5     5      0      0      3     48    80    5
605   126     21   1    .      .      .       .       .      .       .     .      .      .      .      .     .    0
606   126     22   2    3      4      3       5       7      5       5     .      .      .      3     51    37    4
607   126     23   6    3      4      4       5       7      5       5     .      .      .      3     44    53    4
608   126     24   6    3      3      3       5       7      5      14    12      1      1      3     51    59    5
609   126     25   6    3      4      3       5       6      4      12     8      2      2      3     54    44    4
610   126     26   6    3      4      3       6       6      5       5     .      .      .      2     77    70    6
611   126     27   6    3      5      3       7       3      5       5     .      .      .      3     68    77    6
612   126     28   6    2      3      2       5       7      5       5     .      .      .      3     48    66    5
613   126     29   2    8      3      5       5       .      .       .     .      .      .      .     10    12    1
614   126     30   6    3      4      4       5       7      5       5     .      .      .      3     64    48    5
615   126     31   6    4      3      3       5       7      4       5     .      .      .      3     63    50    5
616   126     32   6    3      3      3       5       6      5       5     .      .      .      3     55    49    5
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 OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

 617   126     33   6      4      3       4       5      .       .     .      .      .      .      .    33    33    3
 618   126     34   6      3      2       3       5     28       4     5      .      .      .      3    72    91    6
 619   126     35   6      3      3       3       7      4       5     5      .      .      .      3    75    93    7
 620   126     36   6      3      3       4       5      5       5     5      .      .      .      3    35    59    2
 621   126     37   6      3      4       3       5      7       5    14     14      0      0      3    64    84    6
 622   126     38   6      3      4       3       5      7       5     6      5      1      0      3    52    61    5
 623   126     39   6      3      3       3       5      7       5     6      5      1      0      3    60    67    5
 624   126     40   6      3      2       2       7      7       6     5      .      .      .      3    89    94    9
 625   126     41   6      2      2       2       7      7       5     5      .      .      .      3    87    94    9
 626   126     42   6      3      4       4       5      5       5     5      .      .      .      3    38    60    4
 627   126     43   6      2      3       3       7      7       5    12     12      2      1      3    80    92    7
 628   126     44   6      4      4       5       5     11       4     5      .      .      .      3    32    44    2
 629   126     45   6      4      3       4       5      7       5     5      .      .      .      3    58    64    5
 630   126     46   6      3      4       3       5     14       5     5      .      .      .      3    77    95    8
 631   126     47   3      3      4       3       5      6       5     5      .      .      .      1    48    38    3
 632   126     48   6      3      4       4       7     25       5     9      9      0      0      3    72    88    7
 633   126     49   6      2      4       3       5      5       4     5      .      .      .      3    70    89    5
 634   126     50   6      3      3       3       7      7       5     5      .      .      .      3    68    92    6
 635   126     51   6      2      4       3       5      7       5    14     13      1      1      3    60    83    7
 636   126     52   6      4      3       2       7      6       5     8      8      0      0      3    81    81    7
 637   126     53   6      3      4       2       5      7       5     5      .      .      .      3    86    82    7
 638   126     54   6      3      3       3       5     28       5     5      .      .      .      3    68    70    6
 639   126     55   6      3      4       3       5      7       5     5      .      .      .      3    76    94    6
 640   126     56   6      3      5       3       5      7       6     7      7      0      0      3    71    95    7
 641   128      1   6      2      5       3       5      1       6     5      .      .      .      3    44    81    4
 642   128      2   6      3      5       2       6      3       5     5      .      .      .      2    70    98    8
 643   128      3   6      3      4       1       7      2       5     5      .      .      .      3    83    98    8
 644   128      4   6      3      4       1       9      2       4     5      .      .      .      3    66    75    6
 645   128      5   6      2      4       1       7      2       6     5      .      .      .      3    58    89    5
 646   128      5   6      3      5       1       7      2       7     5      .      .      .      3    57    58    5
 647   128      7   5      3      5       3       7      2       3     5      .      .      .      2    46    51    4
 648   128      8   6      3      5       2       7      2       6     5      .      .      .      3    68    42    7
 649   128      9   6      3      5       2       7      2       5     5      .      .      .      3    74    96    7
 650   128     10   6      3      4       3       7      2       5     5      .      .      .      3    67    67    5
 651   128     11   6      2      4       1       5      2       6     5      .      .      .      3    87    99    9
 652   128     12   6      2      5       2       7      2       5     5      .      .      .      3    73    90    8
 653   128     13   6      3      4       1       7      2       5     5      .      .      .      3    83    88    8
 654   128     14   6      3      3       2       7      2       4     5      .      .      .      3    62    72    8
 655   128     15   6      7      4       2       7      1       7     5      .      .      .      3    63    99    9
 656   128     16   6      3      4       2       7      2       5     5      .      .      .      3    84    87    8
 657   128     17   6      3      4       2       7      2       5     5      .      .      .      3    74    98    7
 658   128     18   6      3      4       2       7      2       5     5      .      .      .      3    70    98    7
 659   128     19   6      3      4       3       7      2       4     5      .      .      .      3    78    83    7
 660   128     20   6      3      4       1       7      2       5     5      .      .      .      3    79    98    8
 661   128     21   6      3      5       2       7      2       5     5      .      .      .      3    67    77    7
 662   128     22   6      3      4       1       7      2       5     5      .      .      .      3    80    93    8
 663   129      1   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
 664   129      2   4      3      5       5       5      3       3     5      .      .      .      3    36    50    3
 665   129      3   6      2      3       3       5      6       4     5      .      .      .      2    56    64    5
 666   129      4   5      3      4       4       7      3       5     5      .      .      .      3    76    74    7
 667   129      5   6      3      4       3       7      3       5     5      .      .      .      3    63    90    6
 668   129      6   6      3      4       3       7      3       5     5      .      .      .      3    57    83    6
 669   129      7   6      4      4       3       7      2       5     5      .      .      .      1    63    97    6
 670   133      1   6      2      4       3       7      7       5     5      .      .      .      3    65    96    6
 671   133      2   6      3      4       3       5      7       4     5      .      .      .      3    35    53    4
 672   133      3   6      4      3       4       5      .       .     .      .      .      .      .    10    17    2
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

673   133     4    6    3      3      2       5       7      5      5     .      .      .      3     93    97    8
674   133     5    6    2      3      4       5       6      4      5     .      .      .      2     75    72    7
675   133     6    6    3      4      3       7       4      5      5     .      .      .      2     42    99    7
676   133     7    6    3      4      3       5       7      4      5     .      .      .      3     44    74    4
677   133     8    6    2      4      2       5       6      6      5     .      .      .      3     78    99    8
678   133     9    6    4      4      2       5       7      5      5     .      .      .      3     86    86    7
679   133    10    6    3      4      2       7       6      6      5     .      .      .      3     77    99    8
680   133    11    6    4      4      2       7       7      5      5     .      .      .      3     79    99    7
681   133    12    6    6      5      2       5       7      5      5     .      .      .      3     83    99    8
682   133    13    6    3      4      3       5       7      6      5     .      .      .      3     57    92    7
683   133    14    6    3      4      3       5       6      5      5     .      .      .      2     51    99    7
684   133    15    6    3      4      2       5       7      3      5     .      .      .      3     56    78    6
685   133    16    6    3      5      3       5       5      4      5     .      .      .      3     51    74    4
686   133    17    6    3      4      3       5       7      5      5     .      .      .      3     61    88    5
687   133    18    6    4      3      2       5       6      5      5     .      .      .      3     89    84    8
688   133    19    6    3      4      2       6       6      6      5     .      .      .      3     66    99    7
689   133    20    6    4      3      3       5       7      5      5     .      .      .      3     53    99    7
690   133    21    6    4      3      2       5       7      4      5     .      .      .      3     67    98    5
691   133    22    6    3      4      2       5       6      6      5     .      .      .      3     62    99    6
692   133    23    6    3      3      2       6       7      4      5     .      .      .      3     78    98    6
693   133    24    6    2      3      2       7       7      6      5     .      .      .      3     79    99    6
694   268     1    6    3      4      4       7       2      5      5     .      .      .      2     30    37    4
695   268     2    6    3      2      3       7       4      5      5     .      .      .      2     77    82    5
696   268     3    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
697   268     4    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
698   268     5    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
699   268     6    6    3      5      4       7       3      6      5     .      .      .      2     50    42    4
700   268     7    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
701   268     8    6    3      4      4       7       3      4      5     .      .      .      3     47    56    4
702   268     9    6    3      4      4       6       4      5      5     .      .      .      3     48    53    4
703   268    10    6    3      3      4       5       4      4      5     .      .      .      3     65    58    5
704   268    11    5    3      4      3       5      11      5      5     .      .      .      1     61    50    5
705   268    12    4    3      4      3       5       4      5      5     .      .      .      3     53    47    5
706   268    13    4    3      4      3       6       .      .      .     .      .      .      .     30    54    5
707   268    14    5    3      5      4       5       4      4      5     .      .      .      3     29    42    5
708   268    15    6    3      5      3       5       2      4      5     .      .      .      3     31    50    5
709   268    16    3    4      4      4       5       4      4      5     .      .      .      3     31    46    5
710   268    17    3    4      3      3       5       3      4      5     .      .      .      3     30    46    4
711   268    18    5    3      5      3       5       2      4      5     .      .      .      3     34    53    5
712   268    19    6    3      4      3       5       2      6      5     .      .      .      3     38    59    5
713   268    20    6    3      5      3       6       2      6      5     .      .      .      3     51    61    6
714   268    21    6    3      5      3       5       2      6      5     .      .      .      3     42    63    5
715   268    22    6    3      4      3       5       1      4      5     .      .      .      3     57    76    6
716   268    23    4    3      4      3       7       5      6      5     .      .      .      3     36    47    5
717   268    24    6    3      4      4       5       .      .      .     .      .      .      .     25    61    5
718   268    25    4    3      5      3       5       5      5      5     .      .      .      3     25    42    4
719   268    26    3    3      4      3       5       4      5      5     .      .      .      3     24    51    4
720   268    27    4    3      4      4       5       5      5      5     .      .      .      3     33    48    4
721   268    28    6    3      4      3       5       2      6      5     .      .      .      3     41    55    5
722   268    29    3    4      4      3       5       2      5      5     .      .      .      3     26    42    4
723   269     1    6    3      5      2       5       2      3      5     .      .      .      2     58    49    6
724   269     2    6    7      4      2       5       2      4      5     .      .      .      2     42    35    3
725   269     3    6    7      4      2       5       2      5      5     .      .      .      3     44    30    3
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B) Open-pollinated families.

SAS

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                           L   N       F                                       F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
  O    O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
  B    D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
  S    E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

  1  135   1   .   8   4   4   5   .   .   .   .   .   .   .  15  17   1   .   .   .   .   .   .   .   .   .   .   .
  2  135   2   .   8   3   3   6   2   4   5   .   .   .   2   5  11   1   .   .   .   .   .   .   .   .   .   .   .
  3  135   3   .   3   4   2   8   .   .   .   .   .   .   .  21  38   4   3   5   5   .   .   .   .   3   4   7   3
  4  135   4   .   3   5   3   7   2   4   5   .   .   .   1  41  42   6   3   3   5   .   .   .   .   3   5   7   3
  5  135   5   .   3   5   4   5   1   4   5   .   .   .   3  26  41   6   2   3   5   .   .   .   .   3   4   5   3
  6  135   7   .   8   4   3   5   .   .   .   .   .   .   .  16  13   1   .   .   .   .   .   .   .   .   .   .   .
  7  136   7   .   2   4   4   7   1   4   5   .   .   .   3  28  36   5   .   .   .   .   .   .   .   .   .   .   .
  8  136   8   .   3   4   3   5   2   4   5   .   .   .   3  34  47   6   2   4   5   .   .   .   .   3   4   7   3
  9  136   9   .   3   4   3   7   2   5   5   .   .   .   3  46  66   6   2   5   5   .   .   .   .   3   5   7   3
 10  136  10   .   2   5   3   7   2   6   5   .   .   .   3  56  89   7   2   6   5   .   .   .   .   3   4   5   3
 11  136  12   .   3   3   4   7   2   5   5   .   .   .   3  36  40   7   .   .   .   .   .   .   .   .   .   .   .
 12  136  14   .   3   3   3   7  11   5   5   .   .   .   3  40  56   6   .   .   .   .   .   .   .   .   .   .   .
 13  136  15   .   3   4   3   7  11   4   5   .   .   .   3  30  51   5   .   .   .   .   .   .   .   .   .   .   .
 14  136  16   .   3   4   3   7   2   5   5   .   .   .   3  31  43   6   .   .   .   .   .   .   .   .   .   .   .
 15  136  17   .   3   4   4   5   2   4   5   .   .   .   2  40  46   6   .   .   .   .   .   .   .   .   .   .   .
 16  136  20   .   3   4   2   7   3   5   5   .   .   .   3  48  55   7   3   4   5   .   .   .   .   6   5   7   2
 17  136  25   .   4   4   3   6   3   5   5   .   .   .   3  39  46   5   8   3   5   .   .   .   .   4   4   5   .
 18  136  26   .   3   4   3   7   3   6   5   .   .   .   3  48  56   6   3   4   5   .   .   .   .   3   4   7   3
 19  136  27   .   2   4   3   7   2   5   5   .   .   .   3  52  66   6   .   .   .   .   .   .   .   .   .   .   .
 20  136  28   .   3   3   4   5   3   6   5   .   .   .   3  33  39   5   .   .   .   .   .   .   .   .   .   .   .
 21  136  29   .   3   4   4   5   .   .   .   .   .   .   .  13  38   3   .   .   .   .   .   .   .   .   .   .   .
 22  136  30   .   3   4   3   6   2   6   5   .   .   .   3  20  37   5   .   .   .   .   .   .   .   .   .   .   .
 23  136  31   .   3   4   3   6   2   5   5   .   .   .   3  29  38   5   2   4   5   .   .   .   .   3   5   7   3
 24  136  33   .   3   4   4   5   2   4   5   .   .   .   2  26  54   4   .   .   .   .   .   .   .   .   .   .   .
 25  136  34   .   3   4   3   6  11   5   5   .   .   .   3  35  60   5   .   .   .   .   .   .   .   .   .   .   .
 26  136  36   .   3   4   3   6   2   4   5   .   .   .   3  46  37   6   .   .   .   .   .   .   .   .   .   .   .
 27  136  37   .   3   4   3   7   2   5   5   .   .   .   3  30  36   5   .   .   .   .   .   .   .   .   .   .   .
 28  136  38   .   4   4   3   7   2   4   5   .   .   .   3  42  46   6   .   .   .   .   .   .   .   .   .   .   .
 29  136  39   .   4   4   3   7   2   6   5   .   .   .   3  50  34   7   .   .   .   .   .   .   .   .   .   .   .
 30  136  40   .   4   4   3   7   2   7   5   .   .   .   3  40  47   8   .   .   .   .   .   .   .   .   .   .   .
 31  136  41   .   4   4   3   7   2   5   5   .   .   .   3  34  44   6   .   .   .   .   .   .   .   .   .   .   .
 32  136  42   .   2   5   4   5   2   6   5   .   .   .   1  51  49   5   .   .   .   .   .   .   .   .   .   .   .
 33  137   1   .   2   4   2   5   4   4   5   .   .   .   3  34  46   5   .   .   .   .   .   .   .   .   .   .   .
 34  137   3   .   2   5   3   7   5   5   5   .   .   .   3  29  41   5   .   .   .   .   .   .   .   .   .   .   .
 35  137   4   .   3   3   3   6   3   4   5   .   .   .   2  43  52   5   .   .   .   .   .   .   .   .   .   .   .
 36  137   6   .   3   4   3   6   3   4   5   .   .   .   3  40  45   5   3   3   5   .   .   .   .   3   4   5   3
 37  137   7   .   3   4   2   7   3   6   5   .   .   .   3  44  49   6   3   5   5   .   .   .   .   3   4   7   3
 38  137   8   .   3   4   2   6   3   5   5   .   .   .   3  19  61   5   3   4   6   6   0   0   .   3   3   5   3
 39  137   9   .   3   4   3   5   4   4   5   .   .   .   1  28  40   5   3   4   6   6   0   0   .   .   .   .   .
 40  137  10   .   3   4   2   7   4   5   5   .   .   .   3  56  53   5   3   5   5   .   .   .   .   3   3   5   3
 41  137  11   .   3   5   3   5   3   5   5   .   .   .   3  30  48   5   4   5   5   .   .   .   .   3   3   5   3
 42  137  12   .   3   4   2   7   3   6   5   .   .   .   3  39  50   6   3   5   5   .   .   .   .   .   .   .   .
 43  137  13   .   3   4   2   5   3   5   5   .   .   .   2  35  52   5   .   .   .   .   .   .   .   .   .   .   .
 44  137  14   .   3   4   3   5   2   6   6   6   0   0   3  45  51   6   3   6   5   .   .   .   .   .   .   .   .
 45  137  15   .   3   4   2   5   3   5   5   .   .   .   3  50  54   6   2   5   5   .   .   .   .   3   2   5   3
 46  137  16   .   2   3   2   6   .   .   .   .   .   .   .  56  31   6   3   6   5   .   .   .   .   1   3   5   3
 47  137  17   .   3   4   3   5   3   5   5   .   .   .   2  48  66   7   3   6   5   .   .   .   .   3   3   5   3
 48  137  18   .   3   4   3   5   3   5   5   .   .   .   3  34  47   5   2   4   5   .   .   .   .   .   .   .   .
 49  137  19   .   3   4   2   6   3   6   5   .   .   .   3  54  50   7   3   6   5   .   .   .   .   .   .   .   .
 50  137  20   .   3   4   3   6   3   5   5   .   .   .   3  30  43   6   3   4   5   .   .   .   .   .   .   .   .
 51  137  22   .   3   4   3   5   3   3   5   .   .   .   2  39  47   5   3   4   5   .   .   .   .   3   3   5   3
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                                                                      SAS

                                        L    N         F                                                       F         N    N    N    P    L    L    N
               P         L    L    F    U    F    L              N    N    N    P                        F    L    N    L    M    S    E    F    F    M
          C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
     O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
     B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
     S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

    52  137   23    .    3    4    3    6    3    4    5    .    .    .    2   29   50    5    .    .    .    .    .    .    .    .    .    .    .
    53  137   27    .    2    4    3    5    4    5    5    .    .    .    3   18   61    5    .    .    .    .    .    .    .    .    .    .    .
    54  137   28    .    3    4    3    5    3    5    5    .    .    .    1   22   47    4    3    4    5    .    .    .    .    3    2    7    3
    55  137   30    .    3    4    3    5    3    4    5    .    .    .    3   23   35    5    .    .    .    .    .    .    .    .    .    .    .
    56  137   31    .    3    4    3    5    3    6    5    .    .    .    3   21   46    5    .    .    .    .    .    .    .    .    .    .    .
    57  137   32    .    3    4    3    7    4    6    5    .    .    .    1   36   66    5    .    .    .    .    .    .    .    .    .    .    .
    58  137   34    .    2    4    3    5    3    4    5    .    .    .    3   30   35    5    .    .    .    .    .    .    .    .    .    .    .
    59  137   35    .    3    4    3    6    4    4    5    .    .    .    3   40   42    6    .    .    .    .    .    .    .    .    .    .    .
    60  137   36    .    3    4    3    5    3    5    5    .    .    .    2   28   47    5    3    5    6    6    0    0    .    .    .    .    .
    61  137   37    .    3    5    3    6    3    5    5    .    .    .    3   31   45    5    .    .    .    .    .    .    .    .    .    .    .
    62  137   38    .    3    4    2    7    4    6    5    .    .    .    3   47   52    6    .    .    .    .    .    .    .    .    .    .    .
    63  137   39    .    2    3    3    6    3    5    5    .    .    .    2   26   63    5    3    5    5    .    .    .    .    3    3    5    3
    64  137   40    .    3    3    3    5    2    4    5    .    .    .    3   34   44    5    3    6    5    .    .    .    .    .    .    .    .
    65  137   41    .    2    4    3    6    2    4    5    .    .    .    3   39   54    6    .    .    .    .    .    .    .    .    .    .    .
    66  137   42    .    2    4    3    5    3    6    5    .    .    .    3   40   36    5    .    .    .    .    .    .    .    .    .    .    .
    67  137   43    .    3    3    3    5    3    5    5    .    .    .    2   37   46    5    3    5    5    .    .    .    .    5    3    5    3
    68  137   44    .    2    4    2    6    3    6    5    .    .    .    2   45   69    7    4    4    5    .    .    .    .    1    5    5    3
    69  137   45    .    2    4    3    5    3    4    5    .    .    .    3   29   42    5    .    .    .    .    .    .    .    .    .    .    .
    70  137   46    .    3    4    3    6    3    4    7    6    0    1    3   30   40    5    3    4    5    1    0    3    .    3    2    5    3
    71  137   47    .    3    4    3    5    3    5    5    .    .    .    1   38   37    6    .    .    .    .    .    .    .    .    .    .    .
    72  137   48    .    3    5    3    5    3    4    5    .    .    .    2   30   42    6    .    .    .    .    .    .    .    .    .    .    .
    73  137   49    .    3    4    3    6    3    4    5    .    .    .    2   25   27    4    .    .    .    .    .    .    .    .    .    .    .
    74  137   50    .    3    2    2    7    3    5    5    .    .    .    3   40   54    6    3    6    5    .    .    .    .    .    .    .    .
    75  137   51    .    2    4    2    5    3    6    5    .    .    .    3   43   76    6    .    .    .    .    .    .    .    .    .    .    .
    76  137   52    .    3    3    4    5    3    4    5    .    .    .    2   31   37    5    3    5    5    .    .    .    .    .    .    .    .
    77  137   54    .    3    4    3    5    3    5    5    .    .    .    3   32   54    5    3    4    5    .    .    .    .    3    3    5    3
    78  137   55    .    4    3    3    5    3    5    5    .    .    .    2   41   51    5    3    4    5    .    .    .    .    .    .    .    .
    79  137   56    .    2    5    2    7    3    5    5    .    .    .    3   34   34    5    .    .    .    .    .    .    .    .    .    .    .
    80  137   57    .    3    4    2    6    3    5    5    .    .    .    3   43   51    5    3    5    5    .    .    .    .    3    3    7    3
    81  137   58    .    2    4    3    6    4    4    5    .    .    .    3   38   42    5    .    .    .    .    .    .    .    .    .    .    .
    82  137   59    .    3    3    3    5    3    5    5    .    .    .    3   30   38    6    3    5    5    .    .    .    .    .    .    .    .
    83  137   60    .    3    4    2    7    3    5    6    6    0    0    3   60   54    6    3    6    5    .    .    .    .    3    4    5    3
    84  137   61    .    4    4    2    5    3    4    5    .    .    .    1   30   52    5    .    .    .    .    .    .    .    .    .    .    .
    85  137   62    .    3    4    2    5    2    4    7    7    0    0    3   44   52    6    .    .    .    .    .    .    .    .    .    .    .
    86  137   63    .    3    4    3    5    4    4    5    .    .    .    3   36    0    5    .    .    .    .    .    .    .    .    .    .    .
    87  137   64    .    3    4    3    6    3    4    5    .    .    .    3   41   33    5    3    5    5    .    .    .    .    .    .    .    .
    88  137   65    .    4    4    3    5    3    5    5    .    .    .    3   34   52    6    .    .    .    .    .    .    .    .    .    .    .
    89  137   66    .    3    4    3    7    4    5    5    .    .    .    1   27   44    5    .    .    .    .    .    .    .    .    .    .    .
    90  137   67    .    3    3    2    5    3    4    5    .    .    .    3   49   48    6    3    5    5    .    .    .    .    .    .    .    .
    91  137  100    .    3    4    5    5    .    .    .    .    .    .    .   16   44    3    .    .    .    .    .    .    1    .    .    .    .
    92  138    1    .    2    5    2    7    3    5    5    .    .    .    3   33   41    6    2    5    9    6    1    2    .    3    5    5    3
    93  138    2    .    3    5    3    6    .    .    .    .    .    .    .   24   33    4    2    5    5    .    .    .    .    3    2    6    4
    94  138    3    .    4    3    3    5    1    5    5    .    .    .    3   20   31    4    2    5    5    .    .    .    .    4    3    5    4
    95  138    4    .    6    5    2    6    2    4    6    6    0    0    3   26   32    5    2    4    5    .    .    .    .    6    6    7    4
    96  139    1    .    3    4    3    5    2    4    5    .    .    .    3   34   30    5    2    5    5    .    .    .    .    3    3    5    3
    97  139    3    .    2    3    3    6    3    4    5    .    .    .    3   34   50    6    .    .    .    .    .    .    .    .    .    .    .
    98  139    4    .    3    4    2    7    3    4    6    6    0    0    3   62   57    7    3    7   10    7    3    0    .    .    .    .    .
    99  139    5    .    2    4    2    7    4    6    5    .    .    .    3   32   50    6    3    5    5    .    .    .    .    3    3    6    3
   100  139    6    .    2    4    2    6    4    5    5    .    .    .    3   47   80    5    3    4    5    .    .    .    .    3    4    5    3
   101  139    8    .    3    4    3    6    3    4   15   15    0    0    3   42   56    6    3    4   15   15    0    0    .    3    3    5    3
   102  139    9    .    3    4    3    5    3    5   12   10    1    1    3   37   57    7    3    4   10    9    0    1    .    3    4    5    3
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                                                                                                         SAS

                                L    N         F                                                 F         N    N    N    P    L    L    N
            P         L    L    F    U    F    L         N    N    N    P                   F    L    N    L    M    S    E    F    F    M
       C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
  O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
  B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
  S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

103  139   10    .    2    4    3    7    4    7    5    .    .    .    3   53   61    6    3    5    5    .    .    .    .    3    2    5    3
104  139   12    .    4    3    2    5    3    5    5    .    .    .    3   43   70    6    .    .    .    .    .    .    .    .    .    .    .
105  139   13    .    3    3    3    5    4    4    5    .    .    .    3   43   63    6    3    5    5    .    .    .    .    .    .    .    .
106  139   14    .    3    4    3    5    4    4    5    .    .    .    2   42   48    6    3    5    5    .    .    .    .    3    4    5    3
107  139   15    .    3    4    3    6    4    5    5    .    .    .    3   47   22    5    2    6    5    .    .    .    .    3    4    7    3
108  139   16    .    3    3    2    6    4    6    6    6    0    0    3   55   72    7    3    7    5    .    .    .    .    3    2    5    3
109  139   17    .    2    4    3    6    3    4    5    .    .    .    3   27   53    6    .    .    .    .    .    .    .    .    .    .    .
110  139   18    .    4    4    2    5    3    7    7    5    2    0    3   41   68    6    3    7    5    .    .    .    .    3    2    5    3
111  139   19    .    2    4    3    5    .    .    .    .    .    .    .   18   48    4    .    .    .    .    .    .    .    .    .    .    .
112  139   20    .    1    4    3    5    4    5    5    .    .    .    3   36   62    6    3    4    7    5    2    0    .    3    4    5    3
113  139   21    .    1    4    3    5    4    6    5    .    .    .    3   30   55    6    3    5    5    .    .    .    .    3    4    5    3
114  139   23    .    3    4    3    5    5    5    5    .    .    .    3   42   56    6    3    4    5    .    .    .    .    3    5    5    3
115  139   25    .    3    4    4    5    4    6    5    .    .    .    3   32   32    5    .    .    .    .    .    .    .    .    .    .    .
116  139   27    .    3    4    2    7    3    6    7    7    0    0    3   55   56    8    2    5    5    .    .    .    .    3    4    7    .
117  139   28    .    2    4    2    6    3    5    5    .    .    .    3   51   65    7    3    5    5    .    .    .    .    3    3    5    3
118  139   29    .    2    4    2    5    4    5    5    .    .    .    3   59   71    6    3    5    5    .    .    .    .    3    .    5    .
119  139   31    .    2    4    3    7    3    4    7    7    0    0    3   42   46    5    .    .    .    .    .    .    .    .    .    .    .
120  139   33    .    3    3    3    5    3    4    5    .    .    .    3   23   52    5    .    .    .    .    .    .    .    .    .    .    .
121  139   34    .    1    4    3    5    4    5   12    9    1    2    3   30   56    5    3    4   10   10    0    0    .    3    5    5    3
122  139   35    .    3    3    3    5    3    5   10    9    0    1    3   46   74    6    3    4    9    7    2    0    .    3    3    5    3
123  139   36    .    2    4    3    6    2    5    5    .    .    .    3   48   63    7    2    5    5    .    .    .    .    3    3    6    3
124  139   37    .    2    3    2    7    3    5    5    .    .    .    3   44   28    6    2    6    5    .    .    .    .    .    .    .    .
125  139   38    .    3    4    2    6    3    5    5    .    .    .    3   36   58    5    2    5    5    .    .    .    .    .    .    .    .
126  139   39    .    2    5    3    6    4    5   13   12    1    0    3   42   51    7    .    .    .    .    .    .    .    .    .    .    .
127  139   43    .    3    4    4    5    4    4    5    .    .    .    3   11   28    5    .    .    .    .    .    .    .    .    .    .    .
128  139   44    .    2    4    3    6    2    4    5    .    .    .    3   44   53    6    3    6    7    7    0    0    .    5    4    5    3
129  139   45    .    2    4    2    6    3    5    5    .    .    .    3   24   73    6    3    7    5    .    .    .    .    5    3    5    3
130  139   47    .    2    4    2    7    3    5    5    .    .    .    3   45   69    5    3    5    5    .    .    .    .    4    4    5    .
131  139   48    .    3    4    3    5    4    4    5    .    .    .    1   29   48    5    3    3    5    .    .    .    .    3    2    6    3
132  139   49    .    2    4    4    5    2    5    5    .    .    .    3   32   53    6    2    6    5    .    .    .    .    3    3    5    3
133  139   50    .    3    3    3    6    3    5   10    8    0    2    3   42   69    6    2    4   10    9    1    0    .    3    4    5    3
134  139   52    .    2    4    2    7    4    6    5    .    .    .    3   55   83    6    3    5    5    .    .    .    .    2    4    5    4
135  139   54    .    3    4    3    5    3    5    9    6    3    0    3   41   63    5    2    5    9    5    2    2    .    3    4    5    4
136  139   55    .    2    4    3    5    4    .    5    .    .    .    3   20   37    5    3    4    5    .    .    .    .    3    5    5    3
137  139   56    .    3    4    3    5    3    5    6    6    0    0    3   51   58    6    2    5    5    .    .    .    .    .    .    .    .
138  139   58    .    2    4    3    6    3    4   14   14    0    0    3   31   18    5    .    .    .    .    .    .    .    .    .    .    .
139  139   59    .    3    4    3    6    4    5    5    .    .    .    3   49   61    6    2    4    5    .    .    .    .    3    4    7    3
140  139   61    .    3    3    3    5    3    6    5    .    .    .    1   43   49    6    .    .    .    .    .    .    .    .    .    .    .
141  139   62    .    3    4    3    6    3    6    9    8    1    0    3   46   64    7    3    6    8    6    2    0    .    3    2    5    3
142  139   63    .    2    3    3    5    2    5    5    .    .    .    3   48   49    6    3    7    5    .    .    .    .    3    4    6    3
143  139   64    .    3    4    3    5    5    4    5    .    .    .    3   35   21    6    2    6    5    .    .    .    .    .    .    .    .
144  139   65    .    2    4    2    6    3    4   10   10    0    0    3   52   87    7    3    5    6    5    0    1    .    1    3    5    3
145  139   66    .    3    4    3    5    4    5    5    .    .    .    3   41   48    6    2    5    5    .    .    .    .    .    .    .    .
146  139   67    .    3    4    2    6    4    5    5    .    .    .    3   44   61    6    2    5    5    .    .    .    .    .    .    .    .
147  139   68    .    3    4    2    5    3    6    6    6    0    0    3   56   56    7    3    4    5    .    .    .    .    .    .    .    .
148  139   69    .    2    4    3    5    3    4    5    .    .    .    3   23   41    5    3    4    5    .    .    .    .    1    5    5    3
149  139   70    .    2    5    3    6    3    4    5    .    .    .    3   43   46    6    .    .    .    .    .    .    .    .    .    .    .
150  139   71    .    2    4    2    5    3    5    5    .    .    .    3   40   62    7    2    6    3    .    .    .    .    3    3    5    3
151  139   72    .    2    3    2    7    3    5    5    .    .    .    3   58   79    7    2    3    5    .    .    .    .    3    4    .    2
152  139   73    .    2    4    3    5    3    4   10   10    0    0    3   38   58    6    3    5    5    .    .    .    .    3    4    5    3
153  139   74    .    2    3    3    5    3    5    5    .    .    .    3   32   83    7    2    7    5    .    .    .    .    3    2    5    3
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                                                SAS

                                  L    N         F                                                 F         N    N    N    P    L    L    N
               P         L    L    F    U    F    L         N    N    N    P                   F    L    N    L    M    S    E    F    F    M
         C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
    O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
    B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
    S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

  154  139   75    .    4    3    3    6    3    5    5    .    .    .    3   40   51    6    2    4    5    .    .    .    .    3    4    6    3
  155  139   76    .    3    3    2    6    3    6    5    .    .    .    3   50   68    6    .    .    .    .    .    .    .    .    .    .    .
  156  139   77    .    2    3    2    6    4    6    5    .    .    .    3   48   81    7    3    4    6    5    1    0    .    3    2    5    3
  157  139   78    .    2    4    2    7    3    6    5    .    .    .    3   40   60    6    .    .    .    .    .    .    .    .    .    .    .
  158  139   79    .    2    3    2    6    4    6   14   14    0    0    3   58   62    7    3    3    6    6    0    0    .    3    2    6    3
  159  139   80    .    3    4    3    6    2    4    5    .    .    .    2   35   33    5    .    .    .    .    .    .    .    .    .    .    .
  160  139   83    .    2    4    3    5    4    6   15   13    2    0    3   50   50    6    .    .    .    .    .    .    .    .    .    .    .
  161  139   85    .    2    5    3    6    4    4    5    .    .    .    3   40   47    7    3    3    5    .    .    .    .    2    4    5    3
  162  139   86    .    2    4    3    5    3    5    5    .    .    .    3   42   54    6    2    5    5    .    .    .    .    6    6    5    3
  163  139   87    .    2    4    3    7    4    4    5    .    .    .    3   29   46    6    .    .    .    .    .    .    .    .    .    .    .
  164  139   89    .    1    4    2    6    3    5   15   15    0    0    3   34   56    6    3    4   15   14    1    0    .    3    3    5    3
  165  139   90    .    1    4    2    5    3    5    5    .    .    .    3   39   81    6    3    4    5    .    .    .    .    2    3    5    3
  166  139   91    .    2    4    3    5    4    6    5    .    .    .    3   35   57    6    2    5    5    .    .    .    .    3    5    5    3
  167  139   92    .    3    4    3    6    4    5    5    .    .    .    3   33   79    7    3    4    5    .    .    .    .    2    4    7    3
  168  139   93    .    1    4    3    5    3    5   13   12    1    0    3   38   51    5    3    4    9    9    0    0    .    3    5    5    3
  169  139   94    .    1    3    2    5    .    .    .    .    .    .    .   30   73    6    .    .    .    .    .    .    .    .    .    .    .
  170  139   95    .    1    4    3    7    .    .    .    .    .    .    .   17   52    5    .    .    .    .    .    .    .    .    .    .    .
  171  139   96    .    1    4    2    6    3    4    5    .    .    .    3   40   49    6    .    .    .    .    .    .    .    .    .    .    .
  172  140    1    .    3    5    3    5    .    .    .    .    .    .    .    9   40    4    .    .    .    .    .    .    .    .    .    .    .
  173  140    2    .    3    5    3    5    .    .    .    .    .    .    .   12   16    3    2    7    5    .    .    .    .    1    5    5    3
  174  140    3    .    3    5    2    7    2    6    5    .    .    .    3   27   34    5    2    3    5    .    .    .    .    3    4    7    3
  175  140    4    .    2    5    3    6    2    4    5    .    .    .    3   25    4    4    2    4    5    .    .    .    .    3    4    5    3
  176  140    5    .    2    4    3    6    2    5    5    .    .    .    3   28   28    5    .    .    5    .    .    .    .    3    4    6    .
  177  140    6    .    3    4    3    5    2    4    5    .    .    .    3   31   40    6    2    4    5    5    .    .    .    3    4    5    5
  178  140    7    .    3    5    3    5    2    3    5    .    .    .    3   25   48    5    2    6    5    .    .    .    .    6    5    5    4
  179  140    8    .    2    5    3    6    2    7    5    .    .    .    3   31   53    5    2    4    5    .    .    .    .    3    4    5    3
  180  140   10    .    2    5    3    5    2    5    8    8    0    0    3   26   53    5    2    5    5    .    .    .    .    3    2    5    3
  181  140   11    .    6    5    5    5    .    .    .    .    .    .    .   12   35    4    2    4    5    .    .    .    .    3    3    5    3
  182  140   13    .    3    5    4    5    .    .    .    .    .    .    .    6   18    2    .    .    .    .    .    .    .    .    .    .    .
  183  140   14    .    2    4    2    7    2    5    5    .    .    .    3   38    6    5    2    7    5    .    .    .    .    3    4    5    3
  184  140   15    .    3    4    3    5    2    6    5    .    .    .    3   23   46    5    2    5    5    .    .    .    .    3    4    5    4
  185  140   16    .    3    4    3    5    2    4    5    .    .    .    3   20   44    5    2    5    5    5    .    .    .    3    4    5    5
  186  141    1    .    3    4    4    5    2    5    5    .    .    .    3   20   24    5    2    5    5    .    .    .    .    3    2    7    3
  187  141    2    .    3    4    3    7    .    .    .    .    .    .    .   25   34    4    2    6    5    .    .    .    .    3    3    5    3
  188  141    4    .    3    5    4    5    2    5    5    .    .    .    3   15   26    5    2    5    5    .    .    .    .    4    2    5    3
  189  141    6    .    1    4    4    6    .    .    .    .    .    .    .   12   22    4    .    .    .    .    .    .    .    .    .    .    .
  190  141    7    .    3    4    4    5    2    6    5    .    .    .    3   14   47    4    2    5    5    .    .    .    .    3    2    5    3
  191  141    8    .    3    5    3    7    2    5    5    .    .    .    3   12   25    4    2    3    5    .    .    .    .    .    .    .    .
  192  141    9    .    1    4    2    7    2    7    6    .    .    .    3   21   58    6    2    4    5    .    .    .    .    3    2    7    3
  193  141   10    .    6    5    4    7    3    4    6    6    0    0    3   16   39    5    2    5    5    .    .    .    .    3    2    7    3
  194  141   11    .    2    4    4    5    .    .    .    .    .    .    .   14   24    3    .    .    .    .    .    .    .    .    .    .    .
  195  141   12    .    1    4    3    7    .    .    .    .    .    .    .   29   52    5    2    6    5    .    .    .    .    3    2    6    3
  196  141   13    .    4    4    4    7    3    5    5    .    .    .    3   12   22    3    2    7    5    .    .    .    .    3    5    7    3
  197  141   14    .    1    5    3    7    2    6    5    .    .    .    3   25   33    5    .    .    .    .    .    .    .    .    .    .    .
  198  141   15    .    3    4    3    5    2    5    5    .    .    .    3   13   27    4    2    5    5    .    .    .    .    3    4    5    3
  199  141   20    .    2    3    2    5    3    7    5    .    .    .    3   25   50    6    2    5    5    .    .    .    .    3    4    5    4
  200  141   21    .    3    4    3    5    .    .    .    .    .    .    .   30   56    6    2    3    5    .    .    .    .    2    4    6    .
  201  141   22    .    2    4    3    7    .    .    .    .    .    .    .   23   56    5    2    5    5    .    .    .    .    3    4    6    3
  202  141   23    .    3    3    4    5    2    5    5    .    .    .    3   16   34    5    2    6    5    .    .    .    .    3    2    5    3
  203  142    1    .    2    4    3    5    2    6    5    .    .    .    3   17   48    5    2    6    5    .    .    .    .    4    3    5    3
  204  142    3    .    2    4    3    5    2    4    5    .    .    .    2   19   32    4    2    5    5    .    .    .    .    3    4    5    3
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SAS

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OBS CODE PLNUM WI LFCOL LFPUB LFSIZE NUMLFL FLCOL FLDIAM NPET NLPET NMPET NSPET PETOV HGHT WDTH VIG FLCOG FLDAMG NPETG NLPETG NMPETG NSPETG PETOVG LFCOLG LFPUBG NMLFLG VIGG

205  142     5  .     3     4      3      5     2      5    5     .     .     .     3   18   34   4     2      4     5      .      .      .      .      .      .      .    .
206  142     6  .     2     4      3      6     2      7    6     .     .     .     3   28   50   5     2      5     5      .      .      .      .      3      .      7    3
207  142     7  .     6     5      5      5     .      .    .     .     .     .     .    7   25   3     2      6     5      .      .      .      .      3      4      6    2
208  142     8  .     3     4      3      7     2      5    5     .     .     .     3   22   36   5     2      5     5      .      .      .      .      .      .      .    .
209  142    10  .     6     5      3      6     .      .    .     .     .     .     .   21   15   1     2      6     5      .      .      .      .      6      6      6    3
210  142    11  .     6     5      4      5     .      .    .     .     .     .     .   12   34   4     .      .     .      .      .      .      .      .      .      .    .
211  142    12  .     6     4      3      7     2      6    6     6     0     0     3   26   43   4     .      .     .      .      .      .      .      .      .      .    .
212  142    13  .     2     4      2      6     2      5    5     .     .     .     3   33   49   5     2      4     5      .      .      .      .      .      .      .    .
213  142    15  .     6     5      3      7     .      .    .     .     .     .     .   24   60   4     .      .     .      .      .      .      .      .      .      .    .
214  142    16  .     6     4      3      6     2      5    5     .     .     .     3   22   35   5     2      7     5      .      .      .      .      .      .      .    .
215  142    17  .     6     5      3      6     2      5    5     .     .     .     3   26   38   5     2      5     5      .      .      .      .      6      6      7    5
216  142    19  .     6     6      3      5     2      6    5     .     .     .     3   18   43   4     2      6     5      .      .      .      .      .      .      .    .
217  142    21  .     2     4      3      6     2      6   13    10     2     1     3   27   61   4     .      .     .      .      .      .      .      .      .      .    .
218  142    22  .     2     5      4      7     .      .    .     .     .     .     .   19   17   4     .      .     .      .      .      .      .      .      .      .    .
219  144     1  .     3     4      3      6     3      4    5     .     .     .     3   38   34   7     3      5     5      .      .      .      .      3      2      6    3
220  144     2  .     2     4      3      6     3      5    5     .     .     .     3   30   41   6     .      .     .      .      .      .      .      .      .      .    .
221  144     3  .     2     4      2      6     3      5    5     .     .     .     3   32   49   6     2      4     5      .      .      .      .      1      2      5    3
222  144     4  .     3     4      4      5     4      4    6     6     0     0     3   30   22   4     2      5     6      6      0      0      .      3      3      5    3
223  144     5  .     6     5      6      5     .      .    .     .     .     .     .    8   16   1     3      5     6      5      1      0      .      3      3      5    3
224  144     6  .     3     5      3      7     .      .    .     .     .     .     .   34   30   5     2      4     5      4      1      0      .      3      4      7    3
225  144     7  .     4     5      3      5     2      6    5     .     .     .     3   26   34   5     2      3     7      7      0      0      .      6      5      7    3
226  144     8  .     2     3      3      5     3      5    5     .     .     .     3   33   38   6     .      .     .      .      .      .      .      .      .      .    .
227  144     9  .     3     5      4      5     3      4    5     .     .     .     3   12   23   4     2      5     5      .      .      .      .      3      3      5    3
228  144    10  .     1     4      2      6     2      5   14    13     1     0     3   34   46   6     2      4     5      .      .      .      .      3      4      5    3
229  145     1  .     1     4      4      5     .      .    .     .     .     .     .   14   32   2     .      .     .      .      .      .      .      .      .      .    .
230  145     2  .     2     4      3      5    25      5    5     .     .     .     3   40   22   5     6      3     5      .      .      .      .      3      4      5    3
231  145     3  .     2     3      3      5     7      5    8     7     1     0     3   53   49   7     7      4     5      .      .      .      .      5      3      5    2
232  145     5  .     2     4      4      5    11      4   10    10     0     0     3   22   22   4    14      4     5      .      .      .      .      5      4      5    .
233  145     6  .     3     4      4      5     .      .    .     .     .     .     .   20   41   4     .      .     .      .      .      .      .      .      .      .    .
234  145     7  .     4     4      4      5     .      .    .     .     .     .     .   24   41   3     .      .     .      .      .      .      .      .      .      .    .
235  145     9  .     3     5      5      5     .      .    .     .     .     .     .   21   35   4     .      .     .      .      .      .      .      .      .      .    .
236  145    10  .     3     4      4      5     .      .    .     .     .     .     .   25   17   4     3      4     5      .      .      .      .      3      3      5    3
237  145    11  .     6     5      3      5     3      4    5     .     .     .     3   35   35   5     3      5    10     10      0      0      .      3      3      5    3
238  145    12  .     3     4      3      5     .      .    .     .     .     .     .   43   38   6     3      3     9      9      0      0      .      3      3      5    3
239  145    13  .     3     4      5      5     .      .    .     .     .     .     .   15   24   3     .      .     .      .      .      .      .      .      .      .    .
240  145    14  .     2     4      3      5    25      5    5     .     .     .     3   34   33   5    25      5     5      .      .      .      .      3      3      5    3
241  145    16  .     2     4      4      5    25      4    5     .     .     .     3   25   28   6    24      4     5      .      .      .      .      3      3      5    3
242  145    17  .     2     4      3      5    33      5    5     .     .     .     3   42   37   6    33      5     5      .      .      .      .      4      4      5    3
243  145    18  .     6     5      2      5    25      5    9     7     2     0     3   41   47   6    24      4     5      .      .      .      .      6      6      5    3
244  145    19  .     3     4      3      5    22      5    5     .     .     .     3   43   45   6    34      4     6      5      0      1      .      3      5      7    3
245  145    20  .     4     5      4      5     .      .    .     .     .     .     .   15   45   4     .      .     .      .      .      .      .      .      .      .    .
246  145    21  .     4     4      4      5     .      .    .     .     .     .     .    6   20   3     .      .     .      .      .      .      .      .      .      .    .
247  146     1  .     3     4      3      5     .      .    .     .     .     .     .   27   42   5     7      4     5      .      .      .      .      2      .      5    3
248  146     2  .     3     3      3      5     .      .    .     .     .     .     .   40   40   5     6      5     5      .      .      .      .      3      3      5    3
249  146     3  .     4     4      3      7     4      5    5     .     .     .     3   36   34   5     .      .     .      .      .      .      .      .      .      .    .
250  146     4  .     3     4      4      5    28      6   12    10     2     0     3   49   41   5     7      2     8      7      1      0      .      3      3      5    3
251  146     5  .     3     4      3      6     .      .    .     .     .     .     .   41   38   5    29      4     5      .      .      .      .      3      3      5    3
252  146     8  .     4     4      5      5     .      .    .     .     .     .     .   10   15   3     3      5     5      .      .      .      .      3      4      7    3
253  146     9  .     3     4      3      7    28      6    8     7     1     0     3   58   53   6    28      4     5      .      .      .      .      .      3      6    3
254  146    10  .     3     3      3      7     5      6    5     .     .     .     3   40   40   5     .      .     .      .      .      .      .      .      .      .    .
255  146    11  .     3     4      5      6     .      .    .     .     .     .     .   20   29   3     .      .     .      .      .      .      .      .      .      .    .
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OBS	CODE	PLNUM	WI	LFCOL	LFPUB	LFSIZE	NUMLFL	FLCOL	FLDIAM	NPET	NLPET	NMPET	NSPET	PETOV	HGHT	WDTH	VIG	FLCOG	FLDAMG	NPETG	NLPETG	NMPETG	NSPETG	PETOVG	LFCOLG	LFPUBG	NMLFLG	VIGG
256	146	12	.	3	4	3	7	.	.	.	.	.	.	.	43	30	5	.	.	.	.	.	.	.	.	.	.	.
257	146	13	.	4	4	3	5	.	.	.	.	.	.	.	43	41	6	.	.	.	.	.	.	.	.	.	.	.
258	146	14	.	.	.	.	.	.	.	.	.	.	.	.	2	7	1	.	.	.	.	.	.	.	.	.	.	.
259	146	15	.	3	4	3	6	28	4	5	.	.	.	3	41	49	5	31	5	5	.	.	.	.	3	2	7	3
260	146	16	.	2	3	4	5	.	.	.	.	.	.	.	15	17	3	6	4	5	.	.	.	.	1	4	5	3
261	146	17	.	4	4	4	5	6	4	8	8	0	0	3	17	24	4	24	3	12	8	2	2	.	3	2	7	3
262	146	18	.	4	4	4	5	6	3	6	6	0	0	3	20	23	5	24	3	9	5	4	0	.	3	2	5	3
263	146	19	.	3	3	3	6	7	5	5	.	.	.	3	48	30	6	.	.	.	.	.	.	.	.	.	.	.
264	146	20	.	3	4	2	7	6	6	15	15	0	0	3	36	62	6	.	.	.	.	.	.	.	.	.	.	.
265	146	21	.	3	4	3	6	7	5	5	.	.	.	3	53	58	6	.	.	.	.	.	.	.	.	.	.	.
266	146	22	.	3	4	4	5	.	.	.	.	.	.	.	25	28	4	.	.	.	.	.	.	.	.	.	.	.
267	146	23	.	4	4	4	5	.	.	.	.	.	.	.	35	35	5	4	3	11	6	3	2	.	3	3	5	3
268	146	24	.	3	4	3	6	22	4	5	.	.	.	1	47	39	5	.	.	.	.	.	.	.	.	.	.	.
269	146	25	.	3	5	3	5	28	5	5	.	.	.	1	38	41	5	31	7	5	.	.	.	.	1	4	5	3
270	146	26	.	4	3	3	5	4	4	5	.	.	.	1	32	62	7	4	5	5	.	.	.	.	3	4	5	3
271	146	27	.	2	3	3	6	7	5	5	.	.	.	3	51	44	5	7	5	5	.	.	.	.	1	3	5	3
272	146	28	.	4	4	3	5	28	4	5	.	.	.	3	33	46	5	.	.	.	.	.	.	.	.	.	.	.
273	146	29	.	3	4	4	5	.	.	.	.	.	.	.	28	33	5	7	4	6	5	1	0	.	3	2	5	3
274	147	1	.	3	3	5	5	6	4	5	.	.	.	3	29	19	5	7	3	5	.	.	.	.	5	2	5	4
275	147	2	.	4	4	4	5	7	5	8	7	1	0	3	38	40	5	4	4	7	6	1	0	.	3	2	5	3
276	147	5	.	3	4	3	5	28	4	5	.	.	.	3	33	25	5	.	.	.	.	.	.	.	.	.	.	.
277	147	7	.	4	2	4	5	.	.	.	.	.	.	.	31	25	6	7	3	10	8	1	1	.	5	3	5	3
278	147	9	.	2	4	2	5	25	5	5	.	.	.	3	48	47	7	24	5	5	.	.	.	.	3	3	5	3
279	147	10	.	4	4	3	5	6	4	5	.	.	.	3	46	59	6	6	4	5	.	.	.	.	3	3	5	3
280	147	12	.	3	3	3	6	6	4	8	8	0	0	3	30	46	5	.	.	.	.	.	.	.	.	.	.	.
281	147	13	.	4	3	3	5	.	.	.	.	.	.	.	17	25	3	7	3	5	.	.	.	.	3	3	5	3
282	147	14	.	5	2	4	6	7	4	6	6	0	0	3	23	28	4	.	.	.	.	.	.	.	.	.	.	.
283	147	15	.	4	3	4	5	.	.	.	.	.	.	.	20	25	4	7	5	6	6	0	0	.	2	4	5	3
284	147	16	.	5	3	3	5	.	.	.	.	.	.	.	38	24	5	7	3	5	.	.	.	.	5	2	5	3
285	147	17	.	3	4	4	5	28	5	5	.	.	.	3	42	58	6	6	4	5	.	.	.	.	3	3	5	3
286	147	18	.	3	4	4	7	25	5	5	.	.	.	3	22	33	5	4	4	5	.	.	.	.	3	4	6	3
287	147	19	.	3	4	4	5	.	.	.	.	.	.	.	28	30	4	4	3	5	.	.	.	.	3	5	5	3
288	147	20	.	3	4	4	5	17	4	11	10	1	0	3	36	40	6	4	4	11	9	1	1	.	3	2	5	1
289	147	21	.	3	4	4	5	33	3	9	8	1	0	3	33	45	6	.	.	.	.	.	.	.	.	.	.	.
290	147	22	.	6	5	4	5	4	5	5	.	.	.	3	38	37	4	.	.	.	.	.	.	.	.	.	.	.
291	147	23	.	3	4	4	5	25	4	5	.	.	.	3	21	41	5	.	.	.	.	.	.	.	.	.	.	.
292	147	24	.	3	4	5	5	.	.	.	.	.	.	.	22	29	4	.	.	.	.	.	.	.	.	.	.	.
293	147	25	.	3	4	4	5	5	4	8	8	0	0	3	45	58	5	.	.	.	.	.	.	.	.	.	.	.
294	147	26	.	3	4	4	5	20	3	11	8	3	0	3	33	39	5	.	.	.	.	.	.	.	.	.	.	.
295	147	55	.	4	4	3	5	28	4	7	7	0	0	3	41	43	7	25	5	5	.	.	.	.	5	3	5	3
296	147	56	.	3	4	5	5	.	.	.	.	.	.	.	17	24	4	25	4	8	7	1	0	.	5	3	6	3
297	147	57	.	3	4	4	5	.	.	.	.	.	.	.	33	44	4	25	5	7	6	1	0	.	3	3	6	3
298	148	2	.	5	2	4	5	5	4	8	7	1	0	3	15	23	6	6	1	7	7	0	0	.	5	2	5	3
299	148	3	.	4	3	4	5	6	5	12	12	0	0	3	41	50	7	3	5	10	8	2	0	.	3	2	5	3
300	148	5	.	3	3	4	5	7	5	5	.	.	.	3	37	8	6	7	5	6	5	1	0	.	2	2	5	3
301	148	6	.	3	3	3	5	5	5	13	10	3	0	3	41	67	7	2	4	10	10	0	0	.	3	3	7	3
302	148	7	.	3	3	4	5	5	4	7	7	0	0	3	33	41	5	18	5	10	6	2	2	.	3	2	5	3
303	148	9	.	2	4	4	5	.	.	.	.	.	.	.	16	27	4	.	3	5	.	.	.	.	3	3	.	3
304	149	2	.	4	4	4	5	.	.	.	.	.	.	.	24	19	4	29	3	9	9	0	0	.	3	4	5	3
305	149	3	.	3	4	3	5	25	5	11	11	0	0	3	36	22	5	25	5	11	7	3	1	.	3	2	5	3
306	149	4	.	5	4	4	5	.	.	.	.	.	.	.	20	23	3	.	.	.	.	.	.	.	.	.	.	.

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                               L   N       F                                           F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

 307 149   5   .   4   4   4   5   6   4   9   9   0   0   3  23  32   4   .   .   .   .   .   .   .   .   .   .   .
 308 149   6   .   5   4   4   5   7   3  12  12   0   0   3  12  48   4   .   .   .   .   .   .   .   .   .   .   .
 309 149   7   .   5   3   3   5   .   .   .   .   .   .   .  19  27   3   .   .   .   .   .   .   .   .   .   .   .
 310 149  10   .   4   4   4   7  25   3   7   7   0   0   3  39  24   4   .   .   .   .   .   .   .   .   .   .   .
 311 149  12   .   5   3   4   5   .   .   .   .   .   .   .  19  14   3   .   .   .   .   .   .   .   .   .   .   .
 312 149  19   .   4   3   2   7   .   .   .   .   .   .   .  41  53   5   .   .   .   .   .   .   .   .   .   .   .
 313 150   2   .   2   4   3   6   .   .   .   .   .   .   .  18  27   4   .   .   .   .   .   .   .   .   .   .   .
 314 150   3   .   4   4   4   5  22   5   9   7   2   0   3  37  44   6   3   6   8   8   0   0   .   3   2   7   3
 315 150   5   .   4   4   3   5   .   .   .   .   .   .   .  36  42   6   3   4  10   9   0   1   .   3   4   5   3
 316 151   2   .   4   4   3   5   3   3   5   .   .   .   3  38  37   6   3   4   5   .   .   .   .   3   2   5   3
 317 151   3   .   3   4   2   7   4   4   5   .   .   .   3  37  40   5   2   4   5   .   .   .   .   3   2   6   3
 318 151   5   .   1   2   2   6   .   .   .   .   .   .   .  22  27   4   .   .   .   .   .   .   .   .   .   .   .
 319 151   6   .   3   3   2   6   3   5   5   .   .   .   3  42  48   5   2   4   5   .   .   .   .   2   3   5   3
 320 151   7   .   2   3   2   5   3   3   5   .   .   .   3  50  71   7   3   4   5   .   .   .   .   3   3   5   3
 321 151   9   .   3   4   5   5   4   4   5   .   .   .   3  11  21   3   .   .   .   .   .   .   .   .   .   .   .
 322 151  10   .   3   4   2   7   3   4   8   8   0   0   3  50  38   6   3   5   7   7   0   0   .   3   3   7   3
 323 151  11   .   3   4   3   6   3   4   5   .   .   .   3  45   5   5   .   .   .   .   .   .   .   .   .   .   .
 324 151  13   .   3   4   2   7   3   4   5   .   .   .   3  49  50   7   3   3   5   .   .   .   .   3   4   5   3
 325 151  14   .   3   3   2   5   4   4   5   .   .   .   1  55  58   9   3   6   5   .   .   .   .   3   3   5   3
 326 151  15   .   3   3   2   5   3   4   5   .   .   .   2  46  51   7   3   4   5   .   .   .   .   3   3   5   3
 327 151  16   .   3   5   3   5   5   4   5   .   .   .   3  40  46   5   3   4   6   .   .   .   .   3   .   6   3
 328 151  17   .   3   4   3   7   4   4   5   .   .   .   3  36  36   5   4   4   5   .   .   .   .   3   5   7   3
 329 151  18   .   3   4   2   5   4   3   5   .   .   .   2  38  43   7   3   4   5   .   .   .   .   3   3   5   4
 330 151  19   .   3   4   2   7   4   4   5   .   .   .   2  54  34   6   3   4   5   .   .   .   .   2   3   5   3
 331 151  20   .   2   3   2   5   3   4   5   .   .   .   3  42  56   7   3   3   5   .   .   .   .   3   4   5   3
 332 151  21   .   2   3   3   5   3   4   5   .   .   .   3  44  51   7   3   4   5   .   .   .   .   3   2   5   3
 333 151  22   .   1   4   3   7   3   4   5   .   .   .   3  23  32   5   .   .   .   .   .   .   .   .   .   .   .
 334 151  23   .   2   4   2   6   4   4   5   .   .   .   3  44  74   6   3   3   5   .   .   .   .   3   2   5   3
 335 151  24   .   2   4   2   7   4   4   5   .   .   .   3  42  55   6   3   3   5   .   .   .   .   3   4   5   3
 336 151  25   .   3   3   2   5   3   4   5   .   .   .   3  49  61   8   3   5   5   .   .   .   .   3   3   5   3
 337 152   1   .   2   4   2   5   7   4   5   .   .   .   3  24  31   5   7   3   5   .   .   .   .   3   4   5   3
 338 152   2   .   2   4   2   5   7   5   5   .   .   .   3  37  34   5   7   4   5   .   .   .   .   3   .   5   3
 339 152   4   .   2   3   1   7   7   5   5   .   .   .   3  62  88   8   .   .   .   .   .   .   .   .   .   .   .
 340 152   5   .   2   3   2   7   7   5   5   .   .   .   3  41  40   7   7   5   5   .   .   .   .   3   2   5   3
 341 152   6   .   2   3   2   5   7   4   5   .   .   .   3  38  50   6   .   .   .   .   .   .   .   .   .   .   .
 342 152   7   .   4   2   2   5   7   4   5   .   .   .   2  48  42   7   .   .   .   .   .   .   .   .   .   .   .
 343 152   8   .   4   4   2   5   7   4   5   .   .   .   2  26  34   5   .   .   .   .   .   .   .   .   .   .   .
 344 153   1   .   4   3   3   5   3   4   5   .   .   .   3  35  64   6   .   .   .   .   .   .   .   .   .   .   .
 345 153   2   .   3   4   3   7   .   .   .   .   .   .   .  44  59   6   3   5   6   5   1   0   .   3   2   7   3
 346 153   3   .   3   .   6   5   .   .   .   .   .   .   .  12  34   3   .   .   .   .   .   .   .   .   .   .   .
 347 153   4   .   3   3   3   5   3   5   8   5   1   1   3  34  44   6   .   .   .   .   .   .   .   .   .   .   .
 348 153   5   .   3   3   2   5   4   4   5   .   .   .   3  39  41   6   3   4   5   .   .   .   .   1   3   5   3
 349 153   6   .   3   4   3   7   3   5   5   .   .   .   3  36  46   6   3   6   5   .   .   .   .   3   3   5   3
 350 153   8   .   2   4   3   7   5   5   5   .   .   .   3  28  65   6   3   4   5   .   .   .   .   3   5   5   3
 351 154   1   .   2   3   3   5   4   4   5   .   .   .   3  28  23   3   .   .   .   .   .   .   .   .   .   .   .
 352 154   2   .   2   4   3   6   4   4  10   8   2   0   3  46  44   6   3   4   8   5   1   2   .   1   3   5   3
 353 154   4   .   5   3   4   5   .   .   .   .   .   .   .  46  27   5   4   5  10   5   0   5   .   .   .   .   .
 354 154   5   .   2   4   3   5   5   5  12  12   0   0   3  52  49   6   4   4  15  15   0   0   .   .   .   .   .
 355 154   6   .   3   4   4   5   5   4   5   .   .   .   3  23  40   4   .   .   .   .   .   .   .   .   .   .   .
 356 154   7   .   3   3   2   5   3   4   5   .   .   .   3  51  44   6   3   5   7   6   0   1   .   3   3   5   3
 357 154   8   .   2   4   3   7   5   5   5   .   .   .   3  45  39   6   4   4   5   .   .   .   .   6   5   5   3
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                                   L    N         F                                                                            F         N    N    N    P    L    L    N
            P         L    L    F    U    F    L         N    N    N    P                   F    L    N    L    M    S    E    F    F    M
       C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
  O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
  B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
  S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

  358  154    9    .    3    3    3    6    4    4    5    .    .    .    3   42   42    6    3    5    5    .    .    .    .    .    .    .    .
  359  154   10    .    3    3    2    6    3    4    5    .    .    .    3   45   35    6    3    4    5    .    .    .    .    .    .    .    .
  360  154   11    .    3    3    3    5    5    5    5    .    .    .    3   39   30    4    .    .    .    .    .    .    .    .    .    .    .
  361  154   12    .    2    4    2    5    4    5    5    .    .    .    3   48   45    6    3    6    5    .    .    .    .    .    .    .    .
  362  154   13    .    6    5    3    5    4    5    5    .    .    .    3   38   28    6    2    4    5    .    .    .    .    .    .    .    .
  363  154   14    .    3    3    2    6    5    4    5    .    .    .    3   50   55    6    4    4    5    .    .    .    .    .    .    .    .
  364  154   15    .    3    3    3    5    3    4    5    .    .    .    3   48   34    6    3    4    5    .    .    .    .    .    .    .    .
  365  154   16    .    4    4    3    5    5    4    6    6    0    0    3   27   28    5    3    3    7    7    0    0    .    .    .    .    .
  366  154   17    .    3    4    3    6    5    5    5    .    .    .    3   42   54    7    3    4    5    .    .    .    .    .    .    .    .
  367  154   18    .    4    3    3    5    4    5   10    8    1    1    3   36   45    6    .    .    .    .    .    .    .    .    .    .    .
  368  154   20    .    3    3    3    5    5    5   15   15    0    0    3   48   35    6    3    6   16   11    2    3    .    .    .    .    .
  369  154   21    .    4    3    3    6    4    5    7    7    0    0    3   36   58    5    .    .    .    .    .    .    .    .    .    .    .
  370  154   23    .    2    4    3    5    .    .    .    .    .    .    .   40   35    5    3    4    8    6    0    2    .    .    .    .    .
  371  154   24    .    3    4    4    5    4    5    5    .    .    .    3   25   38    5    .    .    .    .    .    .    .    .    .    .    .
  372  154   25    .    4    4    4    5    6    4    8    8    0    0    3   24   35    4    .    .    .    .    .    .    .    .    .    .    .
  373  154   26    .    2    3    2    5    5    6   13   10    2    1    3   42   48    6    .    .    .    .    .    .    .    .    .    .    .
  374  154   27    .    2    3    2    6    5    6    5    .    .    .    3   55   74    7    .    .    .    .    .    .    .    .    .    .    .
  375  154   28    .    3    4    4    5    .    .    .    .    .    .    .   12   18    4    2    3    5    .    .    .    .    .    .    .    .
  376  154   30    .    3    3    3    5    3    5   14   13    0    1    3   44   47    5    3    4   15   14    1    0    .    .    .    .    .
  377  154   31    .    2    3    2    6    5    4    5    .    .    .    3   48   41    6    .    .    .    .    .    .    .    .    .    .    .
  378  154   32    .    2    4    4    5   11    5    5    .    .    .    3   30   50    5    .    .    .    .    .    .    .    .    .    .    .
  379  154   33    .    2    4    3    5    .    .    .    .    .    .    .   42   46    5    .    .    .    .    .    .    .    .    .    .    .
  380  154   34    .    3    3    3    5    4    5   14   13    1    0    3   46   43    6    .    .    .    .    .    .    .    .    .    .    .
  381  154   35    .    2    3    3    5    4    4   14   14    0    0    3   39   55    6    3    5   13   10    3    0    .    .    .    .    .
  382  154   36    .    3    4    2    6    6    5   10    8    2    0    3   39   44    6    .    .    .    .    .    .    .    .    .    .    .
  383  154   37    .    3    3    3    5    5    5    6    6    0    0    3   41   44    6    .    .    .    .    .    .    .    .    .    .    .
  384  154   38    .    3    4    3    5    4    4    5    .    .    .    3   39   77    6    .    .    .    .    .    .    .    .    .    .    .
  385  154   39    .    2    4    3    5    5    3   15   15    0    0    3   29   33    5    .    .    .    .    .    .    .    .    .    .    .
  386  154   40    .    3    4    2    5    3    4    8    7    1    0    3   33   39    5    .    .    .    .    .    .    .    .    .    .    .
  387  154   41    .    2    3    3    5    3    5    5    .    .    .    3   38   47    5    .    .    .    .    .    .    .    .    .    .    .
  388  154   42    .    3    4    3    5    6    4    8    8    0    0    3   49   46    6    3    4    9    5    1    3    .    .    .    .    .
  389  154   43    .    2    4    3    5    5    5    5    .    .    .    3   51   53    7    .    .    .    .    .    .    .    .    .    .    .
  390  154   44    .    3    3    2    5    .    .    .    .    .    .    .   37   43    6    6    4   10    5    4    1    .    3    2    5    3
  391  154   45    .    5    4    3    5    .    .    .    .    .    .    .   28   30    4    .    .    .    .    .    .    .    .    .    .    .
  392  154   46    .    4    4    3    5    .    .    .    .    .    .    .   16   29    4    .    .    .    .    .    .    .    .    .    .    .
  393  154   47    .    3    3    3    5    .    .    .    .    .    .    .   30   30    4    .    .    .    .    .    .    .    .    .    .    .
  394  154   48    .    2    4    2    5    3    4    8    8    0    0    3   37   39    6    2    4    6    5    0    1    .    3    2    5    3
  395  154   49    .    4    4    3    5    4    4    5    .    .    .    3   25   31    5    .    .    .    .    .    .    .    .    .    .    .
  396  154   51    .    3    4    3    5    6    3    5    .    .    .    3   34   26    5    .    .    .    .    .    .    .    .    .    .    .
  397  154   52    .    4    4    4    5    .    .    .    .    .    .    .   18   23    4    6    4    7    7    0    0    .    .    .    .    .
  398  154   53    .    2    4    2    5    4    4   15   11    0    4    3   54   50    7    4    3   15    8    4    3    .    2    3    5    3
  399  154   54    .    2    3    3    5    5    5   14   14    0    0    3   44   45    5    .    .    .    .    .    .    .    .    .    .    .
  400  154   55    .    3    3    2    5    4    5    7    7    0    0    3   44   63    7    3    3    5    .    .    .    .    1    3    5    3
  401  154   56    .    3    4    2    5    5    3    5    .    .    .    3   44   48    6    4    4   12    5    2    5    .    3    2    5    3
  402  154   57    .    2    3    3    5    3    5    5    .    .    .    3   43   52    6    4    4    5    .    .    .    .    .    .    .    .
  403  154   58    .    2    2    3    6    4    4    8    6    2    0    3   50   33    6    4    4   10    8    1    1    .    .    .    .    .
  404  154   60    .    3    4    3    5    4    4   10    9    1    0    3   43   58    6    3    5    5    .    .    .    .    .    .    .    .
  405  154   62    .    5    3    4    5    .    .    .    .    .    .    .   22   27    4    .    .    .    .    .    .    .    .    .    .    .
  406  154   63    .    2    3    3    6    4    5   15   15    0    0    3   37   34    5    .    .    .    .    .    .    .    .    .    .    .
  407  154   64    .    3    4    2    5    5    5    5    .    .    .    3   49   54    6    .    .    .    .    .    .    .    .    .    .    .
  408  154   65    4    3    3    5    .    .    .    .    .    .    .    .   14   29    3    4    3    5    .    .    .    .    3    2    7    3
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                                                  SAS

                                L    N         F                                                 F         N    N    N    P    L    L    N
            P         L    L    F    U    F    L         N    N    N    P                   F    L    N    L    M    S    E    F    F    M
       C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
  O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
  B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
  S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

409  154   66    .    3    5    3    5    2    4    5    .    .    .    3   27   37    5    2    3    7    5    1    1    .    1    2    5    3
410  154   67    .    5    2    3    5    .    .    .    .    .    .    .   31   27    4    .    .    .    .    .    .    .    .    .    .    .
411  154   68    .    3    3    3    5    5    4    9    9    0    0    3   34   30    5    .    .    .    .    .    .    .    .    .    .    .
412  154   69    .    2    4    2    5    .    .    .    .    .    .    .   45   30    6    6    5   17   10    3    4    .    1    2    5    3
413  154   70    .    5    3    2    6    4    4    7    6    1    0    3   32   32    4    4    5    5    .    .    .    .    .    .    .    .
414  154   71    .    3    3    2    5    4    5    8    6    2    0    3   54   64    6    4    5    6    5    1    0    .    .    .    .    .
415  154   72    .    2    3    2    6    4    6   15   15    0    0    3   47   55    8    .    .    .    .    .    .    .    .    .    .    .
416  154   73    .    2    4    2    6    4    6    5    .    .    .    3   56   55    8    .    .    .    .    .    .    .    .    .    .    .
417  154   74    .    4    4    3    5    4    4   17   15    2    0    3   42   44    7    .    .    .    .    .    .    .    .    .    .    .
418  154   75    .    5    3    3    5    .    .    .    .    .    .    .   28   37    4    .    .    .    .    .    .    .    .    .    .    .
419  154   76    .    3    3    3    6    3    5    6    6    0    0    3   30   33    5    .    .    .    .    .    .    .    .    .    .    .
420  154   77    .    3    3    3    6    .    .    .    .    .    .    .   36   26    5    .    .    .    .    .    .    .    .    .    .    .
421  154   78    .    5    3    3    5    .    .    .    .    .    .    .   28   27    4    .    .    .    .    .    .    .    .    .    .    .
422  154   79    .    2    4    3    5    4    5   14   14    0    0    3   35   36    6    .    .    .    .    .    .    .    .    .    .    .
423  154   80    .    3    3    3    6    6    4   12    8    1    3    3   34   45    6    6    4   16   12    2    2    .    .    .    .    .
424  154   81    .    4    3    3    5    3    4    6    6    0    0    3   30   42    5    .    .    .    .    .    .    .    .    .    .    .
425  154   83    .    2    4    3    5    4    5    6    6    0    0    3   40   27    6    .    .    .    .    .    .    .    .    .    .    .
426  154   84    .    3    3    2    5    5    5    6    6    0    0    3   46   45    5    .    .    .    .    .    .    .    .    .    .    .
427  154   85    .    3    4    2    6    5    4    8    8    0    0    3   41   39    5    .    .    .    .    .    .    .    .    .    .    .
428  154   86    .    4    3    3    5    .    .    .    .    .    .    .   33   40    5    .    .    .    .    .    .    .    .    .    .    .
429  154   87    .    2    3    3    5    5    5    5    .    .    .    3   38   40    5    3    4    7    5    1    1    .    .    .    .    .
430  154   92    .    3    3    2    5    4    6   15   15    0    0    3   35   44    5    .    .    .    .    .    .    .    .    .    .    .
431  154   94    .    5    4    4    5    4    3   14   13    0    1    3   31   44    5    .    .    .    .    .    .    .    .    .    .    .
432  154   95    .    2    2    2    5    5    6   14   13    1    0    3   54   75    7    .    .    .    .    .    .    .    .    .    .    .
433  154   96    .    2    3    2    5    6    4    5    .    .    .    3   38   44    5    .    .    .    .    .    .    .    .    .    .    .
434  154   97    .    3    3    3    5    6    5    5    .    .    .    3   23   31    3    .    .    .    .    .    .    .    .    .    .    .
435  154   98    .    5    3    4    5    .    .    .    .    .    .    .   28   25    3    4    4   15   10    1    4    .    2    4    5    3
436  154   99    .    2    4    3    5    4    4   12   10    2    0    3   29   38    5    .    .    .    .    .    .    .    .    .    .    .
437  154  100    .    1    5    3    5    .    .    .    .    .    .    .   32   33    6    .    .    .    .    .    .    1    .    .    .    .
438  154  101    .    2    4    2    5    3    4   12   12    0    0    3   49   59    7    .    .    .    .    .    .    1    .    .    .    .
439  154  103    .    2    3    2    5    4    6    5    .    .    .    3   40   53    6    3    5    5    .    .    .    1    .    .    .    .
440  154  104    .    1    4    3    5    3    6    9    7    2    0    3   44   52    6    .    .    .    .    .    .    1    .    .    .    .
441  156    1    .    4    4    4    5    6    5    5    .    .    .    3   30   19    3    3    5    5    .    .    .    .    3    2    6    3
442  156    2    .    3    4    3    5    6    4    5    .    .    .    3   50   46    6    6    6    5    .    .    .    .    1    3    5    5
443  156    8    .    3    4    4    5    6    4    5    .    .    .    3   41   26    6    4    4   12    5    2    5    .    3    2    5    3
444  156   10    .    5    4    6    5    .    .    .    .    .    .    .   10   25    1    .    .    .    .    .    .    .    .    .    .    .
445  156   14    .    3    4    4    5    5    4    6    6    0    0    3   24   32    2    3    4    9    9    0    0    .    3    2    5    .
446  156   15    .    5    2    4    5    .    .    .    .    .    .    .   16   22    3    .    .    .    .    .    .    .    .    .    .    .
447  156   16    .    3    3    4    5    .    .    .    .    .    .    .   22   32    5    6    4    5    .    .    .    .    3    3    5    3
448  156   17    .    2    4    3    5    4    5   15   15    0    0    3   51   34    6    4    4   15   11    4    0    .    3    3    5    3
449  156   18    .    4    3    3    6    6    5   12   10    2    0    3   31   34    7    6    4   10    8    2    0    .    3    2    5    3
450  156  101    .    3    4    3    5    6    5    6    6    0    0    1   43   43    6    5    4    7    7    0    0    1    3    5    5    3
451  157    1    .    3    3    2    7    5    6    5    .    .    .    3   52   30    8    3    5    5    .    .    .    .    1    6    5    3
452  157    2    .    3    3    2    5    4    5    6    6    0    0    3   51   52    8    4    5    5    .    .    .    .    3    4    5    3
453  157    3    .    2    4    3    5    5    4    5    .    .    .    3   23   31    5    .    .    .    .    .    .    .    .    .    .    .
454  157    4    .    3    4    2    6    5    3    5    .    .    .    3   45   37    7    5    3    5    .    .    .    .    3    3    5    3
455  157    5    .    3    4    3    5    5    3    6    6    0    0    3   46   37    7    4    3    6    6    0    0    .    1    5    5    3
456  157    6    .    3    5    3    5    3    4    5    .    .    .    3   39   37    6    3    5    5    .    .    .    .    1    6    5    3
457  157    7    .    4    4    2    5    .    .    .    .    .    .    .   46   31    7    3    4    5    .    .    .    .    6    6    5    1
458  157    8    .    3    3    2    5    4    5    5    .    .    .    3   38   29    5    .    .    .    .    .    .    .    .    .    .    .
459  157    9    .    3    4    2    5    3    4    5    .    .    .    3   35   18    5    .    .    .    .    .    .    .    .    .    .    .
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                                                SAS

                       L  N     F                                 F       N  N  N  P  L  L  N
           P     L  L  F  U  F  L       N  N  N  P             F  L   N   L  M  S  E  F  F  M
       C   L     F  F  S  M  L  D   N   L  M  S  E   H   W     L  D   P   P  P  P  T  C  P  L  V
  O    O   N     C  P  I  L  C  I   P   P  P  P  T   G   D  V  C  A   E   E  E  E  O  O  U  F  I
  B    D   U  W  O  U  Z  F  O  A   E   E  E  E  O   H   T  I  O  M   T   T  T  T  V  L  B  L  G
  S    E   M  I  L  B  E  L  L  M   T   T  T  T  V   T   H  G  G  G   G   G  G  G  G  G  G  G  G
460  157  10  .  2  5  4  5  5  5   6   6  0  0  3  18  25  5  .  .   .   .  .  .  .  .  .  .  .
461  157  11  .  3  4  3  5  .  .   .   .  .  .  .  11   9  2  .  .   .   .  .  .  .  .  .  .  .
462  157  12  .  2  3  3  5  4  5   5   .  .  .  3  40  31  5  .  .   .   .  .  .  .  .  .  .  .
463  157  13  .  2  4  2  5  3  5   5   .  .  .  3  44  33  6  .  .   .   .  .  .  .  .  .  .  .
464  158   1  .  3  4  3  5  2  3   5   .  .  .  3  37   1  6  2  4   5   .  .  .  .  3  3  5  3
465  158   2  .  3  4  3  5  2  5   5   .  .  .  3  26  45  5  .  .   .   .  .  .  .  .  .  .  .
466  158   3  .  3  4  3  5  2  5   5   .  .  .  3  10  39  5  2  4   5   .  .  .  .  3  3  5  3
467  158   4  .  3  3  2  5  2  6  12  12  0  0  3  49  30  8  2  4  10   7  2  1  .  3  3  5  3
468  158   5  .  3  4  4  5  2  5   5   .  .  .  3  36  48  5  .  .   .   .  .  .  .  .  .  .  .
469  158   7  .  3  4  3  5  2  5   7   7  0  0  3  33  31  5  2  4   5   .  .  .  .  3  3  5  3
470  158   9  .  3  4  3  5  2  3   5   .  .  .  3  35  26  5  2  5   5   .  .  .  .  3  2  7  3
471  158  10  .  3  4  4  5  2  5   5   .  .  .  3  15  29  5  2  4   5   .  .  .  .  3  2  5  3
472  158  11  .  3  4  3  7  .  .   .   .  .  .  .  29  24  5  2  7   5   .  .  .  .  3  3  5  3
473  158  12  .  1  .  .  .  .  .   .   .  .  .  .   .   .  0  .  .   .   .  .  .  .  .  .  .  .
474  158  14  .  2  4  3  5  2  5   5   .  .  .  3  25  45  5  .  .   .   .  .  .  .  .  .  .  .
475  158  15  .  3  5  4  5  2  4   5   .  .  .  3  24  30  5  .  .   .   .  .  .  .  .  .  .  .
476  158  16  .  3  5  4  5  2  4   5   .  .  .  3  17  30  5  2  5   5   .  .  .  .  4  2  5  3
477  158  17  .  4  3  2  6  2  5   5   .  .  .  3  31  26  6  .  .   .   .  .  .  .  .  .  .  .
478  158  19  .  3  4  3  5  2  5   5   .  .  .  2  40  39  7  2  6   5   .  .  .  .  3  2  5  4
479  159   1  .  5  3  3  5  .  .   .   .  .  .  .  26  15  3  .  .   .   .  .  .  .  .  .  .  .
480  159   2  .  3  4  4  5  3  5  13  13  0  0  3  29  35  4  .  .   .   .  .  .  .  .  .  .  .
481  159   3  .  3  4  4  5  .  .   .   .  .  .  .  13  20  3  .  .   .   .  .  .  .  .  .  .  .
482  159   6  .  3  4  3  5  3  4  15  15  0  0  3  45  40  6  3  5  13  10  3  0  .  3  2  5  3
483  159   7  .  3  4  4  5  2  4   7   7  0  0  3  23  28  5  2  4   5   .  .  .  .  3  2  5  3
484  160   1  .  5  2  4  5  5  3  10  10  0  0  3  12  32  4  .  .   .   .  .  .  .  .  .  .  .
485  160   2  .  4  4  5  5  .  .   .   .  .  .  .  21  24  4  .  .   .   .  .  .  .  .  .  .  .
486  160   3  .  5  3  3  5  .  .   .   .  .  .  .  27  31  4  .  .   .   .  .  .  .  .  .  .  .
487  160   4  .  3  4  3  5  3  4   5   .  .  .  3  25  59  5  .  .   .   .  .  .  .  .  .  .  .
488  160   5  .  2  4  2  6  3  5   6   6  0  0  3  41  40  6  .  .   .   .  .  .  .  .  .  .  .
489  160   6  .  5  4  3  5  .  .   .   .  .  .  .  28  46  4  .  .   .   .  .  .  .  .  .  .  .
490  160   7  .  2  4  3  5  6  3  15   9  4  2  .  27  36  5  4  5  15  14  1  0  .  1  5  5  3
491  160   8  .  5  3  4  5  .  .   .   .  .  .  .  17  25  4  .  .   .   .  .  .  .  .  .  .  .
492  160   9  .  5  2  2  5  4  3  10   8  2  0  3  35  27  4  4  4  10   4  2  4  .  .  .  .  .
493  160  10  .  3  4  3  5  4  3   9   8  0  1  3  42  27  6  4  4   5   .  .  .  .  .  .  .  .
494  160  11  .  3  3  3  5  4  6  13  13  0  0  3  38  36  5  .  .   .   .  .  .  .  .  .  .  .
495  160  12  .  5  3  3  5  .  .   .   .  .  .  .  20  33  4  .  .   .   .  .  .  .  .  .  .  .
496  160  13  .  5  3  3  5  .  .   .   .  .  .  .  25  37  4  .  .   .   .  .  .  .  .  .  .  .
497  160  14  .  4  3  3  6  4  4  12  12  0  0  3  31  48  5  4  4   7   5  1  1  .  .  .  .  .
498  160  15  .  2  4  2  5  4  4   5   .  .  .  3  39  54  5  .  .   .   .  .  .  .  .  .  .  .
499  160  17  .  3  4  3  5  4  4  14  10  0  4  3  40  31  6  3  6  13  10  1  2  .  3  3  5  3
500  160  18  .  5  3  3  5  4  4  13  10  0  3  3  33  37  5  .  .   .   .  .  .  .  .  .  .  .
501  160  19  .  3  3  2  6  3  4   5   .  .  .  3  46  48  6  3  4   6   5  0  1  .  3  3  5  3
502  160  20  .  3  4  4  5  5  4  13  11  1  1  3  21  22  4  3  4  15  10  3  2  .  3  3  5  3
503  160  21  .  3  4  2  5  6  4   8   8  0  0  3  45  39  6  3  3  15   6  3  6  .  .  .  .  .
504  160  22  .  5  4  4  5  .  .   .   .  .  .  .  11  19  3  .  .   .   .  .  .  .  .  .  .  .
505  160  23  .  5  3  3  5  5  3  10  10  0  0  3  31  23  4  .  .   .   .  .  .  .  .  .  .  .
506  160  24  .  5  4  4  5  3  3   7   6  1  1  3  24  35  5  .  .   .   .  .  .  .  .  .  .  .
507  160  27  .  2  4  3  5  .  .   .   .  .  .  .  43  35  5  .  .   .   .  .  .  .  .  .  .  .
508  160  29  .  4  3  3  5  5  4  14  14  0  0  3  33  25  4  4  4  14  13  0  0  .  .  .  .  .
509  160  30  .  3  4  3  5  4  4   6   6  0  0  3  19  29  5  3  4  15  13  2  0  .  .  .  .  .
510  160  32  .  2  4  3  5  3  4  12   8  4  0  3  37  37  5  3  5  13  10  0  3  .  .  .  .  .
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                          L   N       F                                           F       N   N   N   P   L   L   N
          P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
      C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
  O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
  B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
  S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

511 160  34   .   4   4   4   5   .   .   .   .   .   .   .  35  51   5   .   .   .   .   .   .   .   .   .   .   .
512 160  35   .   2   3   3   6   5   5   7   7   0   0   3  37  31   4   .   .   .   .   .   .   .   .   .   .   .
513 160  36   .   3   4   3   6   .   .   .   .   .   .   .  27  36   5   4   4   .   .   .   .   .   3   2   5   3
514 160  37   .   2   3   3   5   .   .   .   .   .   .   .  31  38   5   .   .   .   .   .   .   .   .   .   .   .
515 160  38   .   2   4   3   5   4   5   5   .   .   .   3  41  26   5   .   .   .   .   .   .   .   .   .   .   .
516 160  39   .   5   2   4   6   .   .   .   .   .   .   .  23  26   3   .   .   .   .   .   .   .   .   .   .   .
517 160  43   .   4   4   4   5   3   3   8   7   1   0   3  32  47   5   .   .   .   .   .   .   .   .   .   .   .
518 160  44   .   2   4   2   5   3   5  12  12   0   0   3  33  46   6   3   6   9   8   1   0   .   .   .   .   .
519 160  45   .   3   4   3   5   .   .   .   .   .   .   .  46  44   6   3   5  10   7   2   1   .   3   3   5   3
520 160  46   .   4   3   2   5   5   5   7   6   1   0   3  48  39   6   .   .   .   .   .   .   .   .   .   .   .
521 160  47   .   4   4   3   5   4   5  15  15   0   0   3  35  40   5   3   5  15  15   0   0   .   .   .   .   .
522 160  50   .   2   4   2   6   5   4  12  10   2   0   3  61  57   6   .   .   .   .   .   .   .   .   .   .   .
523 160  51   .   2   5   3   7   .   .   .   .   .   .   .  50  43   6   4   4   6   5   1   0   .   .   .   .   .
524 160  53   .   2   4   2   5   4   5  11  10   1   0   3  45  58   6   .   .   .   .   .   .   .   .   .   .   .
525 160  54   .   3   4   3   6   5   4   7   7   0   0   3  39  44   6   4   4  15  11   1   3   .   3   4   5   3
526 161   1   .   3   4   2   6   1   5   8   7   1   0   3  48  35   6   .   .   .   .   .   .   .   .   .   .   .
527 161   2   .   2   5   2   5   2   4   6   6   0   0   3  46  50   6   .   .   .   .   .   .   .   .   .   .   .
528 161   3   .   3   4   2   6   2   6   5   .   .   .   3  48  58   6   .   .   .   .   .   .   .   .   .   .   .
529 161   4   .   7   4   3   7   2   5   5   .   .   .   3  31  34   5   2   4   5   .   .   .   .   2   4   7   3
530 161   5   .   3   4   2   5   2   3   5   .   .   .   3  31  43   5   2   4   5   .   .   .   .   .   4   5   3
531 161   6   .   3   4   2   5   2   5   5   .   .   .   2  44  66   6   .   .   .   .   .   .   .   .   .   .   .
532 161   7   .   6   5   3   5   2   3   5   .   .   .   3  30  32   5   3   4   5   .   .   .   .   .   .   .   .
533 161   8   .   3   5   3   7   2   3   5   .   .   .   3  30  28   4   2   4   8   5   1   2   .   3   5   5   3
534 161   9   .   2   5   2   5   2   4   6   6   0   0   3  35  33   5   .   .   .   .   .   .   .   .   .   .   .
535 161  10   .   3   4   3   6   2   5   7   7   0   0   3  39  43   5   2   4   9   5   3   1   .   3   3   5   3
536 161  11   .   2   4   3   5   2   5   8   6   0   2   3  28  40   5   .   .   .   .   .   .   .   .   .   .   .
537 161  12   .   3   5   3   6   2   5   5   .   .   .   3  45  37   6   2   5   5   .   .   .   .   .   .   .   .
538 161  13   .   3   4   2   6   2   6   7   7   0   0   3  45  59   6   .   .   .   .   .   .   .   .   .   .   .
539 161  14   .   2   4   2   5   3   4   5   .   .   .   3   2  56   5   .   .   .   .   .   .   .   .   .   .   .
540 161  15   .   3   4   2   6   2   5   5   .   .   .   3  46  40   6   .   .   .   .   .   .   .   .   .   .   .
541 161  16   .   2   5   2   6   2   4   6   5   0   1   3  42  35   6   2   4   6   5   0   1   .   .   3   6   .
542 161  17   .   3   4   3   6   2   6   7   7   0   0   3  41  42   6   2   3   6   5   1   0   .   .   .   .   .
543 161  18   .   2   4   2   6   1   5   8   7   1   0   3  40  65   6   .   .   .   .   .   .   .   .   .   .   .
544 161  19   .   3   5   3   7   2   4   5   .   .   .   3  38  42   6   2   4   5   .   .   .   .   .   .   .   .
545 161  20   .   2   4   2   5   2   4   5   .   .   .   3  34  41   5   2   4   5   .   .   .   .   3   4   5   3
546 161  21   .   3   4   2   6   2   4   6   6   0   0   3  28  32   5   2   4   7   5   1   1   .   3   3   5   3
547 161  22   .   2   4   2   5   2   5   5   .   .   .   3  38  48   6   .   .   .   .   .   .   .   .   .   .   .
548 161  23   .   3   4   2   7   2   5   5   .   .   .   3  44  21   7   .   .   .   .   .   .   .   .   .   .   .
549 161  24   .   2   4   2   7   2   6   5   .   .   .   3  41  37   7   .   .   .   .   .   .   .   .   .   .   .
550 161  25   .   7   5   3   6   2   4   5   .   .   .   3  30  33   5   2   6   5   .   .   .   .   3   4   7   4
551 161  26   .   3   4   2   6   2   5   6   6   0   0   3  45  35   6   .   .   .   .   .   .   .   .   .   .   .
552 161  27   .   2   5   3   7   3   4   5   .   .   .   3  23  26   5   2   5   5   .   .   .   .   3   4   7   4
553 161  28   .   2   4   3   5   2   4   6   5   2   1   3  35  47   5   .   .   .   .   .   .   .   .   .   .   .
554 161  29   .   3   4   2   7   2   4   5   .   .   .   3  50  38   7   2   5   5   .   .   .   .   .   .   .   .
555 161  30   .   3   3   2   5   2   5   7   7   0   0   3  38  42   5  14   5   7   6   1   0   .   4   3   5   3
556 161  31   .   3   4   3   5   2   3  12  10   2   0   3  16  25   4   2   4  11   7   2   2   .   3   3   5   3
557 161  33   .   3   5   3   5   2   5   5   .   .   .   3  36  28   5   .   .   .   .   .   .   .   .   .   .   .
558 161  35   .   2   4   3   5   2   4   5   .   .   .   3  38  39   5   2   3   7   6   0   1   .   3   3   5   3
559 161  36   .   3   4   3   7   2   4   6   6   0   0   3  42  46   6   .   .   .   .   .   .   .   .   .   .   .
560 161  37   .   3   4   3   5   2   4   5   .   .   .   3  31  31   5   .   .   .   .   .   .   .   .   .   .   .
561 161  38   .   3   4   3   7   2   4   7   5   1   1   3  29  31   5   2   3   5   .   .   .   .   3   4   5   3
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                                        L    N         F                                                       F         N    N    N    P    L    L    N
              P         L    L    F    U    F    L         N    N    N    P                   F    L    N    L    M    S    E    F    F    M
         C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
    O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
    B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
    S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

  562  161   39    .    3    5    2    6    2    5    5    .    .    .    3   35   41    6    .    .    .    .    .    .    .    .    .    .    .
  563  161   40    .    7    4    2    6    2    4    5    .    .    .    3   40   44    6    2    4    5    .    .    .    .    3    5    5    3
  564  161   41    .    3    4    3    7    .    .    .    .    .    .    .   19   21    2    .    .    .    .    .    .    .    .    .    .    .
  565  161   42    .    3    5    2    6    2    5    5    .    .    .    3   31   29    5    2    4    5    .    .    .    .    3    3    7    3
  566  161   43    .    3    4    2    7    2    5    5    .    .    .    3   43   40    6    .    .    .    .    .    .    .    .    .    .    .
  567  161   44    .    2    4    3    6    2    4    5    .    .    .    3   33   45    6    2    4    5    .    .    .    .    3    3    5    3
  568  161   45    .    7    5    2    6    2    4    5    .    .    .    3   36   33    5    2    4    5    .    .    .    .    3    3    6    3
  569  161   46    .    3    4    2    6    2    5    8    5    3    0    3   43   66    6    .    .    .    .    .    .    .    .    .    .    .
  570  161   48    .    3    5    3    7    2    5    8    6    2    0    3   33   28    6    2    5    8    5    3    0    .    3    4    5    4
  571  161   49    .    2    4    3    5    2    4    8    5    1    1    3   38   31    5    2    2    5    .    .    .    .    3    2    5    3
  572  161   50    .    3    5    3    7    2    5    5    .    .    .    3   39   36    6    2    4    5    .    .    .    .    .    .    .    .
  573  161   51    .    3    5    3    6    2    4    5    .    .    .    3   33   44    6    2    4    5    .    .    .    .    3    5    5    2
  574  161   52    .    3    4    2    5    2    5    9    6    2    1    3   47   43    7    2    5   15    9    4    2    .    .    .    .    .
  575  161   53    .    7    4    4    5    2    3    6    6    0    0    3   26   29    5    3    4    6    5    1    0    .    3    3    5    3
  576  161   54    .    3    5    3    7    2    5    5    .    .    .    2   35   42    6    2    5    5    .    .    .    .    3    5    7    3
  577  161   55    .    3    5    3    6    2    5    5    .    .    .    3   47   57    6    2    5    5    .    .    .    .    .    .    .    .
  578  161   56    .    3    5    3    7    2    3    5    .    .    .    3   32   40    6    2    4    5    .    .    .    .    .    .    .    .
  579  161   57    .    3    4    3    5    2    4    5    .    .    .    3   43   47    6    2    4    5    .    .    .    .    6    6    6    3
  580  161   58    .    2    3    2    7    2    3    5    .    .    .    2   34   25    5    .    .    .    .    .    .    .    .    .    .    .
  581  161   59    .    3    4    3    7    2    5   12   10    1    1    3   33   29    5    2    5    5    .    .    .    .    .    .    .    .
  582  161   60    .    3    4    3    5    2    5    7    6    0    1    3   37   40    6    .    .    .    .    .    .    .    .    .    .    .
  583  162    1    .    3    4    3    5    8    4    6    5    1    0    3   37   39    6   14    4    5    .    .    .    .    .    .    .    .
  584  162    2    .    8    4    3    5    .    .    .    .    .    .    .   10   11    2    .    .    .    .    .    .    .    .    .    .    .
  585  162    3    .    4    4    3    5    .    .    .    .    .    .    .   36   40    5    3    3    5    .    .    .    .    .    .    .    .
  586  162    4    .    4    4    4    5    3    4    6    5    1    0    3   17   23    4    .    .    .    .    .    .    .    .    .    .    .
  587  162    5    .    3    4    3    5    4    4    6    6    0    0    3   38   52    5    3    4    5    .    .    .    .    4    2    5    3
  588  162    6    .    1    4    4    5    3    3   13   12    0    1    3   23   30    4    .    .    .    .    .    .    .    .    .    .    .
  589  162    7    .    3    4    4    5    3    3    6    6    0    0    3   33   48    5    2    4    6    6    0    0    .    3    4    5    3
  590  162    8    .    4    4    3    5    3    4    5    .    .    .    3   51   51    6    3    4    5    .    .    .    .    3    3    5    3
  591  162   10    .    4    3    3    5    3    4    5    .    .    .    3   37   43    6    3    3    6    5    0    1    .    .    .    .    .
  592  162   11    .    3    5    4    5   11    4    5    .    .    .    3   48   40    5    2    3    5    .    .    .    .    .    .    .    .
  593  162   12    .    2    5    3    5    3    4    7    5    1    1    3   25   40    4    .    .    .    .    .    .    .    .    .    .    .
  594  162   13    .    4    4    3    5    .    .    .    .    .    .    .   33   33    5    3    4    5    .    .    .    .    3    2    5    3
  595  162   14    .    3    4    3    5   11    4    5    .    .    .    3   30   33    5    .    .    .    .    .    .    .    .    .    .    .
  596  162   15    .    3    4    3    5   14    5    6    5    1    0    3   48   51    6    2    5    5    .    .    .    .    3    2    5    3
  597  162   16    .    3    4    3    5   14    4    5    .    .    .    3   37   39    5    3    2    7    5    1    1    .    3    4    6    3
  598  162   17    .    1    4    3    5    2    4    5    .    .    .    3   33   43    5    .    .    .    .    .    .    .    .    .    .    .
  599  162   18    .    4    3    4    5   17    4    7    6    0    1    3   42   37    4    3    3    7    6    0    1    .    .    .    .    .
  600  162   19    .    3    3    3    5   14    5    5    .    .    .    3   38   52    5    .    .    .    .    .    .    .    .    .    .    .
  601  162   20    .    3    4    4    5   30    4    5    .    .    .    3   34   29    5    2    4    5    .    .    .    .    3    4    5    3
  602  162   21    .    5    4    5    5    .    .    .    .    .    .    .   15   25    3    .    .    .    .    .    .    .    .    .    .    .
  603  162   22    .    3    4    4    6   17    4    5    .    .    .    3   35   38    5    .    .    .    .    .    .    .    .    .    .    .
  604  162   24    .    5    4    4    5    3    5    5    .    .    .    3   22   27    3    .    .    .    .    .    .    .    .    .    .    .
  605  162   28    .    4    3    4    5    2    4    5    .    .    .    3   29   26    5    .    .    .    .    .    .    .    .    .    .    .
  606  162   29    .    4    4    3    5    4    4    9    7    2    0    3   30   39    5    3    5   14   13    1    0    .    .    .    .    .
  607  162   30    .    3    4    3    5   14    4    8    8    0    0    3   38   53    5   14    5    7    6    1    0    .    5    3    5    3
  608  162   31    .    3    4    4    5   14    5    5    .    .    .    3   29   38    5   11    4    5    .    .    .    .    3    3    5    3
  609  162   33    .    4    2    3    6    4    5    5    .    .    .    3   32   34    5    .    .    .    .    .    .    .    .    .    .    .
  610  162   34    .    4    4    3    5   11    4    5    .    .    .    3   23   24    4    .    .    .    .    .    .    .    .    .    .    .
  611  162   35    .    5    3    3    5    .    .    .    .    .    .    .   38   47    5    .    .    .    .    .    .    .    .    .    .    .
  612  162   36    .    4    4    4    5    4    3    6    5    0    1    3   18   21    3    .    .    .    .    .    .    .    .    .    .    .
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SAS

OBS	CODE	PLNUM	WI	LFCOL	LFPUB	LFSIZE	NUMLFL	FLCOL	FLDIAM	NPET	NLPET	NMPET	NSPET	PETOV	HGHT	WDTH	VIG	FLCOG	FLDAMG	NPETG	NLPETG	NMPETG	NSPETG	PETOVG	LFCOLG	LFPUBG	NMLFLG	VIGG
613	162	37	.	4	4	5	5	3	3	5	.	.	.	3	14	23	3	.	.	.	.	.	.	.	.	.	.	.
614	162	38	.	5	4	4	5	4	4	6	6	0	0	3	24	22	4	.	.	.	.	.	.	.	.	.	.	.
615	162	39	.	5	4	4	5	.	.	.	.	.	.	.	18	30	3	.	.	.	.	.	.	.	.	.	.	.
616	162	41	.	5	4	4	5	.	.	.	.	.	.	.	18	24	4	.	.	.	.	.	.	.	.	.	.	.
617	162	42	.	3	4	4	5	14	4	13	13	0	0	3	23	32	4	.	.	.	.	.	.	.	.	.	.	.
618	162	43	.	5	3	4	5	4	4	5	.	.	.	3	39	41	5	.	.	.	.	.	.	.	.	.	.	.
619	162	44	.	2	4	3	5	2	4	5	.	.	.	3	42	30	5	.	.	.	.	.	.	.	.	.	.	.
620	162	45	.	3	4	4	5	4	5	5	.	.	.	3	40	36	5	3	3	5	.	.	.	.	3	5	3	.
621	162	46	.	4	3	4	5	3	5	5	.	.	.	3	24	27	4	.	.	.	.	.	.	.	.	.	.	.
622	162	47	.	8	4	4	5	11	4	6	6	0	0	3	15	22	3	.	.	.	.	.	.	.	.	.	.	.
623	162	48	.	2	4	5	5	4	3	6	6	0	0	3	3	22	2	.	.	.	.	.	.	.	.	.	.	.
624	162	49	.	4	3	3	6	3	5	5	.	.	.	3	32	20	4	3	3	7	6	0	1	.	4	3	7	3
625	162	50	.	5	4	4	5	.	.	.	.	.	.	.	23	28	3	.	.	.	.	.	.	.	.	.	.	.
626	162	51	.	3	4	3	5	4	4	7	7	0	0	3	34	43	5	3	4	5	.	.	.	.	3	2	5	3
627	162	52	.	4	3	4	5	3	4	14	13	1	0	3	25	35	4	.	.	.	.	.	.	.	.	.	.	.
628	162	53	.	5	4	4	5	.	.	.	.	.	.	.	25	27	4	.	.	.	.	.	.	.	.	.	.	.
629	162	55	.	3	4	4	5	3	4	5	.	.	.	3	34	44	5	.	.	.	.	.	.	.	.	.	.	.
630	162	56	.	5	4	4	5	.	.	.	.	.	.	.	19	24	4	.	.	.	.	.	.	.	.	.	.	.
631	162	57	.	3	4	3	5	3	4	5	.	.	.	3	27	41	5	.	.	.	.	.	.	.	.	.	.	.
632	162	58	.	5	3	4	5	3	3	15	14	1	0	3	21	19	3	.	.	.	.	.	.	.	.	.	.	.
633	162	59	.	5	3	4	5	.	.	.	.	.	.	.	8	16	2	.	.	.	.	.	.	.	.	.	.	.
634	162	60	.	8	4	4	5	.	.	.	.	.	.	.	20	10	3	.	.	.	.	.	.	.	.	.	.	.
635	162	61	.	5	4	3	5	4	3	11	9	2	0	3	15	40	3	.	.	.	.	.	.	.	.	.	.	.
636	162	62	.	4	3	3	5	4	4	5	.	.	.	3	40	35	5	3	4	5	.	.	.	.	.	.	.	.
637	162	63	.	5	3	4	5	.	.	.	.	.	.	.	19	14	3	.	.	.	.	.	.	.	.	.	.	.
638	162	64	.	4	4	3	6	3	3	5	.	.	.	3	34	36	5	.	.	.	.	.	.	.	.	.	.	.
639	162	65	.	5	3	4	5	.	.	.	.	.	.	.	17	22	3	2	4	5	.	.	.	.	4	3	5	3
640	162	66	.	4	4	3	5	14	5	5	.	.	.	3	32	43	5	3	3	5	.	.	.	.	3	5	5	3
641	162	67	.	4	4	3	5	3	3	5	.	.	.	3	40	30	5	2	4	5	.	.	.	.	3	2	5	3
642	162	68	.	5	4	4	5	.	.	.	.	.	.	.	13	12	4	.	.	.	.	.	.	.	.	.	.	.
643	162	69	.	5	3	4	5	.	.	.	.	.	.	.	17	16	2	2	5	5	.	.	.	.	3	2	6	3
644	162	70	.	5	3	4	5	.	.	.	.	.	.	.	23	28	4	.	.	.	.	.	.	.	.	.	.	.
645	162	71	.	4	3	4	5	14	4	6	6	0	0	3	35	41	5	2	4	5	.	.	.	.	3	2	5	3
646	162	72	.	3	3	3	5	3	4	5	.	.	.	3	38	37	5	.	.	.	.	.	.	.	.	.	.	.
647	162	73	.	5	3	4	5	.	.	.	.	.	.	.	26	19	3	.	.	.	.	.	.	.	.	.	.	.
648	162	74	.	5	4	4	5	.	.	.	.	.	.	.	17	10	2	.	.	.	.	.	.	.	.	.	.	.
649	162	75	.	3	4	4	5	14	4	10	10	0	0	3	41	37	5	3	4	14	14	0	0	.	.	.	.	.
650	162	80	.	4	2	3	5	14	4	7	5	2	0	3	35	25	4	3	4	9	7	2	0	.	3	3	5	3
651	162	83	.	1	4	4	5	8	3	8	6	2	0	3	15	25	4	.	.	.	.	.	.	.	.	.	.	.
652	162	88	.	4	3	4	5	14	4	8	8	0	0	3	38	48	6	4	4	6	5	1	0	.	.	.	.	.
653	162	89	.	4	3	3	5	.	.	.	.	.	.	.	37	49	5	.	.	.	.	.	.	.	.	.	.	.
654	162	90	.	4	4	4	5	2	3	7	5	1	1	3	31	38	5	3	3	5	.	.	.	.	1	5	5	3
655	162	91	.	4	4	3	5	3	4	13	13	0	0	3	28	44	5	3	5	5	.	.	.	.	1	4	5	3
656	162	93	.	2	4	3	5	5	5	13	11	2	0	3	37	53	8	4	5	12	7	2	3	.	1	4	5	3
657	162	94	.	3	4	3	5	14	4	13	13	0	0	3	38	36	5	3	4	8	5	1	2	.	3	4	5	3
658	162	95	.	2	4	4	5	3	4	5	.	.	.	3	32	32	5	2	5	5	.	.	.	.	3	5	5	3
659	162	96	.	3	3	3	5	3	4	6	6	0	0	3	38	37	5	3	5	7	7	0	0	.	3	4	5	3
660	162	97	.	4	3	3	7	14	4	5	.	.	.	3	38	27	5	2	5	5	.	.	.	.	2	3	6	3
661	162	100	.	4	3	3	5	3	4	5	.	.	.	3	25	26	4	.	.	.	.	.	.	1	.	.	.	.
662	162	101	.	4	4	3	5	.	.	.	.	.	.	.	46	32	5	3	5	11	11	0	0	1	.	.	.	.
663	162	102	.	2	4	4	5	11	4	5	.	.	.	3	31	24	5	.	.	.	.	.	.	1	.	.	.	.

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                           L   N       F                                       F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

 664 162 110   .   3   3   3   5   3   5   5   .   .   .   3  36  33   5   .   .   .   .   .   .   1   .   .   .   .
 665 162 112   .   2   4   4   5   3   5   5   .   .   .   3  26  50   3   3   4   5   4   0   1   1   .   .   .   .
 666 163   1   .   3   5   3   7   4   4   5   .   .   .   3  43  37   7   3   4   5   .   .   .   .   4   4   7   3
 667 163   2   .   3   4   4   5  17   5   5   .   .   .   3  38  55   5   2   4   5   .   .   .   .   3   3   5   3
 668 163   3   .   3   4   3   5   2   5   5   .   .   .   3  33  31   6   2   3   6   5   1   0   .   3   4   5   3
 669 163   4   .   3   3   4   5  20   4   5   .   .   .   3  30  30   5   3   3   5   .   .   .   .   5   2   5   2
 670 163   5   .   3   4   3   5  19   5  14  12   2   0   3  18  33   5   .   .   .   .   .   .   .   .   .   .   .
 671 163   6   .   3   4   3   6  17   5   5   .   .   .   3  41  46   5   3   3   5   .   .   .   .   3   3   6   3
 672 163   7   .   4   4   3   5   3   4   5   .   .   .   3  42  36   5   .   .   .   .   .   .   .   .   .   .   .
 673 163   8   .   6   5   4   7   3   3   5   .   .   .   2  34  34   4   .   .   .   .   .   .   .   .   .   .   .
 674 163   9   .   4   3   3   5   3   5   9   9   0   0   3  24  17   4   2   5   6   6   0   0   .   .   .   .   .
 675 163  10   .   3   5   4   6   3   4   5   .   .   .   2  42  39   6   2   4   5   .   .   .   .   .   .   .   .
 676 163  11   .   3   4   3   5   3   4   6   6   0   0   3  30  34   5   3   4   5   .   .   .   .   .   .   .   .
 677 163  12   .   4   4   4   5   2   4   5   .   .   .   2  15  44   4   3   3   6   6   0   0   .   3   4   5   3
 678 163  13   .   3   4   4   5  14   5   5   .   .   .   3  34  48   5   .   .   .   .   .   .   .   .   .   .   .
 679 163  14   .   3   5   4   5   .   .   .   .   .   .   .  15  20   2   .   .   .   .   .   .   .   .   .   .   .
 680 163  15   .   3   4   5   5  11   4   5   .   .   .   2  26  22   4   .   .   .   .   .   .   .   .   .   .   .
 681 163  16   .   3   5   3   6   3   4   5   .   .   .   2  27  36   6   .   .   .   .   .   .   .   .   .   .   .
 682 163  17   .   6   5   3   7   4   4   5   .   .   .   2  41  46   6   3   3   5   .   .   .   .   3   3   5   3
 683 163  18   .   3   4   3   5   3   4   5   .   .   .   2  25  36   5   .   .   .   .   .   .   .   .   .   .   .
 684 163  19   .   3   4   3   6   3   5   5   .   .   .   2  52  50   5   2   6   5   .   .   .   .   .   .   .   .
 685 163  20   .   3   4   5   5   .   .   .   .   .   .   .  15  20   3   2   5   5   .   .   .   .   3   2   6   3
 686 163  21   .   3   4   4   5   .   .   .   .   .   .   .  30  30   4   .   .   .   .   .   .   .   .   .   .   .
 687 163  22   .   6   5   3   6   4   4   5   .   .   .   3  42  47   6   3   4   5   .   .   .   .   6   5   7   3
 688 163  24   .   6   5   4   5   3   4   5   .   .   .   .  28  32   5   3   4   5   .   .   .   .   3   5   5   3
 689 163  25   .   3   4   3   7   4   5   5   .   .   .   3  47  58   6   .   .   .   .   .   .   .   .   .   .   .
 690 163  26   .   4   4   4   5   .   .   .   .   .   .   .  17  19   3   .   .   .   .   .   .   .   .   .   .   .
 691 163  27   .   2   4   3   5   2   5   5   .   .   .   3  33  48   6   .   .   .   .   .   .   .   .   .   .   .
 692 163  28   .   3   4   3   5   4   4   6   5   0   1   3  32  41   5   3   3   5   .   .   .   .   2   3   6   3
 693 163  30   .   6   5   4   6  19   4   6   6   0   0   3  37  33   5   2   4   5   .   .   .   .   .   .   .   .
 694 163  31   .   4   4   3   5   3   3   6   6   0   0   3  27  30   5   3   5   5   .   .   .   .   .   .   .   .
 695 163  32   .   3   5   4   5   .   .   .   .   .   .   .  34  18   4   2   5   5   .   .   .   .   3   4   7   3
 696 163  34   .   4   4   4   6  14   3   5   .   .   .   3  36  49   5   2   5   5   .   .   .   .   3   3   7   3
 697 163  35   .   3   5   4   5  17   4   5   .   .   .   2  31  23   5   3   5   5   .   .   .   .   3   3   6   3
 698 163  36   .   3   4   3   7  17   4   5   .   .   .   3  45  77   6   .   .   .   .   .   .   .   .   .   .   .
 699 163  37   .   3   4   4   6   4   5   5   .   .   .   3  32  51   5   3   4   5   .   .   .   .   .   .   .   .
 700 163  38   .   3   4   3   5   3   5   5   .   .   .   2  50  48   6   3   4   5   .   .   .   .   3   3   7   3
 701 163  39   .   3   4   3   6   3   4   5   .   .   .   3  43  33   6   2   4   5   .   .   .   .   .   .   .   .
 702 163  40   .   3   4   3   5  14   5   5   .   .   .   3  42  38   5   3   5   5   .   .   .   .   .   .   .   .
 703 163  41   .   4   4   3   5   2   3   5   .   .   .   2  33  32   5   2   5   5   .   .   .   .   5   3   5   3
 704 163  42   .   3   4   3   5   3   5   5   .   .   .   2  33  37   6   .   .   .   .   .   .   .   .   .   .   .
 705 163  43   .   3   4   4   5  11   4   5   .   .   .   3  38  24   5   3   4   5   .   .   .   .   .   .   .   .
 706 163  44   .   3   4   4   5  17   5  15  15   0   0   3  39  31   5   3   6   6   5   1   0   .   3   5   6   3
 707 163  45   .   3   4   3   5   2   4   5   .   .   .   3  32  42   6   2   4   5   .   .   .   .   4   4   5   3
 708 163  46   .   3   4   3   5  33   4   5   .   .   .   3  22  22   5   .   .   .   .   .   .   .   .   .   .   .
 709 163  47   .   3   4   3   5  11   5   5   .   .   .   3  37  40   5   2   4   5   .   .   .   .   3   3   5   .
 710 163  48   .   3   3   3   7  33   3   5   .   .   .   3  29  30   5   .   .   .   .   .   .   .   .   .   .   .
 711 163  49   .   6   5   3   7  17   4   5   .   .   .   3  35  53   5   3   4   7   5   2   0   .   2   4   7   3
 712 163  50   .   6   5   4   5   5   5   5   .   .   .   1  32  37   5   .   .   .   .   .   .   .   .   .   .   .
 713 163  52   .   3   4   4   6   3   4   5   .   .   .   3  29  33   5   .   .   .   .   .   .   .   .   .   .   .
 714 163  53   .   3   5   3   7   2   4   5   .   .   .   1  30  34   6   .   .   .   .   .   .   .   .   .   .   .
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                                                                                          SAS

                                L    N         F                                                F         N    N    N    P    L    L    N
               P         L    L    F    U    F    L         N    N    N    P              F    L    N    L    M    S    E    F    F    M
       C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
  O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
  B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
  S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

715  163   54    .    3    4    4    5    .    .    .    .    .    .    .   26   28    5    .    .    .    .    .    .    .    .    .    .    .
716  163   54    .    4    4    4    5    4    3    5    .    .    .    3   26   24    4    .    .    .    .    .    .    .    .    .    .    .
717  163   55    .    3    5    3    6    4    4    9    9    0    0    1   40   29    5    3    5    7    7    0    0    .    .    .    .    .
718  163   56    .    3    3    3    7   17    4    5    .    .    .    2   32   40    5    .    .    .    .    .    .    .    .    .    .    .
719  163   57    .    3    4    3    5    2    4   15   12    2    1    3   30   35    5    3    4   10    6    1    3    .    .    .    .    .
720  163   58    .    3    4    4    7   17    5    5    .    .    .    3   43   41    5    2    4   12    6    5    1    .    2    3    7    3
721  163   59    .    3    4    3    6    .    .    .    .    .    .    .   31   46    5    .    .    .    .    .    .    .    .    .    .    .
722  163   60    .    3    4    3    5    3    5    5    .    .    .    2   29   47    5    2    5    4    4    0    0    .    .    .    .    .
723  163   61    .    4    4    3    7    .    .    .    .    .    .    .   29   33    5    .    .    .    .    .    .    .    .    .    .    .
724  163   62    .    3    4    3    6    2    4    5    .    .    .    3   35   45    5    .    .    .    .    .    .    .    .    .    .    .
725  163   64    .    6    5    4    6    .    .    .    .    .    .    .   31   48    5    3    4    5    .    .    .    .    .    .    .    .
726  163   65    .    2    4    4    5   14    5    5    .    .    .    3   30   41    5    .    .    .    .    .    .    .    .    .    .    .
727  163   66    .    3    4    3    6    3    5    5    .    .    .    3   33   27    5    .    .    .    .    .    .    .    .    .    .    .
728  163   67    .    4    4    4    6    .    .    .    .    .    .    .   31   36    5    .    .    .    .    .    .    .    .    .    .    .
729  163   68    .    3    4    3    6    2    4    5    .    .    .    2   35   42    5    3    5    5    .    .    .    .    .    .    .    .
730  163   69    .    3    4    3    5   30    5    5    .    .    .    3   31   26    5    .    .    .    .    .    .    .    .    .    .    .
731  163   70    .    3    5    3    5   11    3    5    .    .    .    2   23   32    5    .    .    .    .    .    .    .    .    .    .    .
732  163   71    .    3    4    4    5   11    5   10   10    0    0    2   26   29    5    .    .    .    .    .    .    .    .    .    .    .
733  163   72    .    3    4    3    6    4    4    5    .    .    .    3   34   39    5    .    .    .    .    .    .    .    .    .    .    .
734  163   73    .    3    4    4    6   17    4    5    .    .    .    3   32   29    5   14    4    5    .    .    .    .    3    2    6    2
735  163   74    .    2    5    4    5    2    4    5    .    .    .    2   38   44    5    3    3    5    .    .    .    .    3    4    6    3
736  163   75    .    .    .    .    .    .    .    .    .    .    .    .    9   10    3    3    3    5    .    .    .    .    .    .    .    .
737  163   76    .    3    4    3    5   17    4    5    .    .    .    3   29   29    5    3    5    5    .    .    .    .    3    3    7    3
738  163   77    .    6    5    4    5    2    4    5    .    .    .    3   31   37    5    3    5    5    .    .    .    .    3    3    6    3
739  163   78    .    2    4    4    5    4    5    5    .    .    .    2   30   39    5    .    .    .    .    .    .    .    .    .    .    .
740  163   79    .    3    4    3    5    2    4    5    .    .    .    3   23   28    5    2    3    5    .    .    .    .    3    2    5    3
741  163   80    .    3    5    3    5    3    4    5    .    .    .    3   32   37    5    3    4    6    6    0    0    .    5    2    5    3
742  163   81    .    3    4    3    6   11    5    5    .    .    .    3   35   36    5    2    5    5    .    .    .    .    .    .    .    .
743  163   82    .    3    5    4    5    .    .    .    .    .    .    .   25   38    4    .    .    .    .    .    .    .    .    .    .    .
744  163   83    .    2    5    3    7    2    5    5    .    .    .    1   40   38    5    .    .    .    .    .    .    .    .    .    .    .
745  163   84    .    2    4    4    5    5    4    6    5    0    1    3   24   28    5    4    5    6    5    1    0    .    3    4    5    3
746  163   85    .    2    4    3    5    5    4    7    7    0    0    3   28   44    5    .    .    .    .    .    .    .    .    .    .    .
747  163   86    .    3    4    4    5    1    3    5    .    .    .    3   33   23    5    2    4    5    .    .    .    .    3    5    5    3
748  163   87    .    3    4    3    6    3    5    5    .    .    .    3   39   39    5    .    .    .    .    .    .    .    .    .    .    .
749  163   88    .    3    5    3    7    .    .    .    .    .    .    .   37   32    5    .    .    .    .    .    .    .    .    .    .    .
750  163   89    .    3    4    3    5    2    5    5    .    .    .    3   30   41    5    .    .    .    .    .    .    .    .    .    .    .
751  163   90    .    3    4    3    7    2    4    5    .    .    .    2   33   52    5    .    .    .    .    .    .    .    .    .    .    .
752  163   91    .    3    4    4    5    3    4    6    6    0    0    2   22   32    5    3    5    6    6    0    0    .    .    .    .    .
753  163   92    .    3    5    4    5    3    3    5    .    .    .    3   36   25    5    3    4    6    5    0    1    .    .    .    .    .
754  163   93    .    4    5    3    6    2    4    5    .    .    .    2   40   35    5    2    5    5    .    .    .    .    3    4    5    3
755  163   94    .    3    4    3    6   17    4    5    .    .    .    2   32   45    5    3    5    6    6    0    0    .    3    3    7    3
756  163   95    .    3    5    3    5    2    4    5    .    .    .    3   38   34    5    2    6    5    .    .    .    .    .    .    .    .
757  163   97    .    4    4    3    5   14    4    6    6    0    0    3   22   33    4    3    4    5    .    .    .    .    5    3    5    3
758  163   98    .    3    5    4    5    2    4    5    .    .    .    3   40   31    5    2    5    5    .    .    .    .    3    4    6    3
759  163   99    .    3    5    3    6   11    5    5    .    .    .    3   36   39    5    2    4    5    .    .    .    .    .    .    .    .
760  163  100    .    3    4    3    5    2    5    5    .    .    .    3   40   42    5    .    .    .    .    .    .    1    .    .    .    .
761  163  101    .    2    5    4    5    3    4    6    6    0    0    3   42   55    6    2    6    6    5    0    1    1    3    3    5    3
762  163  102    .    4    4    4    5   11    4    5    .    .    .    3   25   35    4    .    .    .    .    .    .    1    .    .    .    .
763  163  103    .    4    4    3    5    .    .    .    .    .    .    .   30   35    4    .    .    .    .    .    .    1    .    .    .    .
764  163  104    .    3    4    3    7    2    5    6    6    0    0    3   40   40    6    .    .    .    .    .    .    1    .    .    .    .
765  163  105    .    3    3    3    5   17    5    5    .    .    .    3   46   46    6    .    .    .    .    .    .    1    .    .    .    .
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                           L   N       F                                       F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

 766 163 106   .   3   4   4   5   2   4   5   .   .   .   3  27  25   4   .   .   .   .   .   .   1   .   .   .   .
 767 163 107   .   3   4   3   5   2   5   5   .   .   .   2  35  43   5   .   .   .   .   .   .   1   .   .   .   .
 768 163 108   .   3   4   4   5  17   3   7   6   0   1   3  23  25   5  30   4   9   9   0   0   1   3   4   5   2
 769 163 109   .   4   5   3   7   .   .   .   .   .   .   .  24  15   3   .   .   .   .   .   .   1   .   .   .   .
 770 163 110   .   4   4   4   5  14   3   5   .   .   .   3  24  30   4   .   .   .   .   .   .   1   .   .   .   .
 771 163 111   .   3   4   4   5   3   5   8   7   1   0   3  34  35   5   2   5   5   .   .   .   1   3   2   6   3
 772 163 111   .   3   4   3   7  14   5   5   .   .   .   3  28  36   5   2   5   5   .   .   .   1   .   .   .   .
 773 163 112   .   3   5   3   7  19   4   8   7   1   0   3  36  35   5   4   5   5   .   .   .   1   .   .   .   .
 774 163 113   .   3   4   4   6  14   5   6   6   0   0   3  28  46   5   .   .   .   .   .   .   1   .   .   .   .
 775 163 114   .   3   4   4   5  30   5   5   .   .   .   3  25  31   5   .   .   .   .   .   .   1   .   .   .   .
 776 163 115   .   3   3   3   7   3   4   5   .   .   .   3  32  34   5   .   .   .   .   .   .   1   .   .   .   .
 777 163 116   .   3   5   5   6  14   4   5   .   .   .   3  21  19   4   .   .   .   .   .   .   1   .   .   .   .
 778 163 117   .   3   4   4   5  22   4  12   9   3   0   3  40  39   5   3   4  15   8   4   3   1   3   3   5   3
 779 163 118   .   3   4   3   7   .   .   .   .   .   .   .  27  22   4   .   .   .   .   .   .   1   .   .   .   .
 780 163 119   .   3   4   4   5   2   5   5   .   .   .   1  34  46   6   .   .   .   .   .   .   1   .   .   .   .
 781 163 120   .   3   4   3   5   2   5   5   .   .   .   2  44  42   6   3   3   5   .   .   .   1   3   4   5   3
 782 163 121   .   2   4   3   5   3   4   5   .   .   .   3  30  29   5   3   4   5   .   .   .   1   3   5   6   3
 783 163 122   .   3   4   4   6  11   4   5   .   .   .   3  35  24   5   .   .   .   .   .   .   1   .   .   .   .
 784 163 123   .   3   4   4   5  17   5   5   .   .   .   3  32  31   4   .   .   .   .   .   .   1   .   .   .   .
 785 163 125   .   4   4   4   5   2   5   5   .   .   .   3  31  33   5   .   .   .   .   .   .   1   .   .   .   .
 786 166   1   .   2   4   3   6   2   7   5   .   .   .   3  28  45   7   2   7   5   .   .   .   .   3   4   5   5
 787 166   2   .   3   3   4   5   2   4   5   .   .   .   3  12  24   5   2   6   5   .   .   .   .   3   2   5   3
 788 166  10   .   3   4   2   5   2   5   5   .   .   .   3  17  39   5   1   4   5   .   .   .   .   3   4   5   3
 789 166  12   .   3   4   4   5   2   5   5   .   .   .   3  14  31   5   2   6   5   .   .   .   .   3   2   5   3
 790 168 101   .   3   2   3   5   5   5  12  10   1   1   3  50  70   7   3   6  10   8   2   0   1   3   2   5   3
 791 169   1   .   3   4   4   5   2   5   5   .   .   .   3  18   8   4   2   4   5   .   .   .   .   2   4   5   3
 792 169   2   .   3   4   3   5   3   4   5   .   .   .   3  34  41   5   2   3   5   .   .   .   .   1   2   5   3
 793 169   3   .   3   4   3   5   3   4   5   .   .   .   3  36  36   6   2   3   6   5   1   0   .   2   4   5   3
 794 169   5   .   4   4   4   5   3   3   5   .   .   .   3  18  32   4   2   3   5   .   .   .   .   3   4   5   3
 795 169   6   .   3   4   3   6   2   4   5   .   .   .   2  28  30   6   .   .   .   .   .   .   .   .   .   .   .
 796 169   7   .   3   4   3   6   2   4   5   .   .   .   3  40  52   6   2   4   5   .   .   .   .   3   4   5   3
 797 169   8   .   3   4   3   5   2   4   5   .   .   .   3  30  35   5   2   4   5   .   .   .   .   2   4   5   3
 798 169   9   .   2   4   3   5   3   4   5   .   .   .   3  29  24   4   3   3   5   .   .   .   .   3   3   5   3
 799 169  10   .   1   5   3   5   3   4   5   .   .   .   3  40  43   6   .   .   .   .   .   .   .   .   .   .   .
 800 169  11   .   2   4   3   6   3   4   7   7   0   0   3  29  44   5   2   4   6   5   1   0   .   6   6   7   1
 801 169  12   .   3   5   3   5   2   5   5   .   .   .   3  38  34   5   3   5   5   .   .   .   .   3   2   5   3
 802 169  13   .   3   4   3   5   2   4   5   .   .   .   3  38  40   6   .   .   .   .   .   .   .   .   .   .   .
 803 169  14   .   4   4   2   7   3   4   8   8   0   0   3  56  32   7   2   4   5   .   .   .   .   3   3   5   3
 804 169  17   .   8   3   4   5   .   .   .   .   .   .   .  10  21   2   .   .   .   .   .   .   .   .   .   .   .
 805 169  96   .   3   4   3   6  11   5   5   .   .   .   3  34  40   5   3   4   5   .   .   .   .   3   3   5   3
 806 173   1   .   3   4   3   7   2   5   5   .   .   .   2  37  39   5   4   4   5   .   .   .   .   3   4   6   3
 807 173   2   .   3   4   3   5   3   4   8   8   0   0   3  29  23   5   3   6  10   7   2   1   .   1   2   5   3
 808 173   3   .   3   4   3   5  11   4   5   .   .   .   2  38  41   6   .   .   .   .   .   .   .   .   .   .   .
 809 173   4   .   3   4   4   5   4   4   5   .   .   .   3  25  23   5   3   6   5   .   .   .   .   1   4   5   3
 810 173   5   .   3   4   5   5   8   4   5   .   .   .   3  30  33   5   2   6   5   .   .   .   .   3   2   5   3
 811 173   6   .   3   4   3   5  14   4   5   .   .   .   3  27  27   5  11   5  15  11   2   2   .   1   2   5   3
 812 173   7   .   3   4   4   5   2   3   8   8   0   0   3  24  23   5   2   6   6   6   0   0   .   3   4   5   3
 813 173   8   .   2   4   3   5   4   5   6   6   0   0   3  28  35   6   3   5   5   .   .   .   .   3   2   5   3
 814 173   9   .   3   4   3   5   3   5   8   6   2   0   3  35  22   5   .   .   .   .   .   .   .   .   .   .   .
 815 173  10   .   3   4   3   6   5   5   5   .   .   .   3  42  45   6   3   4   5   .   .   .   .   3   5   5   3
 816 173  11   .   4   4   3   5   .   .   .   .   .   .   .  37  29   6   .   .   .   .   .   .   .   .   .   .   .
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                           L   N       F                                       F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

 817 173  12   .   3   3   4   5   3   4   5   .   .   .   3  29  51   5   .   .   .   .   .   .   .   .   .   .   .
 818 173  13   .   1   3   4   7   .   .   .   .   .   .   .  35  21   4   .   .   .   .   .   .   .   .   .   .   .
 819 173  17   .   3   4   4   5   2   5   5   .   .   .   2  27  35   5   2   4   5   .   .   .   .   .   4   5   3
 820 173  18   .   3   4   4   5   2   4   5   .   .   .   3  18  20   4   2   3   5   .   .   .   .   3   3   6   3
 821 173  21   .   3   4   3   5   2   3   5   .   .   .   3  30  44   6   .   .   .   .   .   .   .   .   .   .   .
 822 173  22   .   2   4   3   6   2   4   8   8   0   0   3  36  33   5   3   3  11   6   3   2   .   3   5   5   3
 823 173  23   .   3   4   3   5   3   5  15  15   0   0   3  30  34   6   .   .   .   .   .   .   .   .   .   .   .
 824 173  24   .   3   4   4   5   4   4   5   .   .   .   2  26  26   5   .   .   .   .   .   .   .   .   .   .   .
 825 173  25   .   6   5   4   5  19   4   5   .   .   .   3  23  17   4   .   .   .   .   .   .   .   .   .   .   .
 826 173  26   .   3   4   4   5  17   5   5   .   .   .   3  30  44   5   .   .   .   .   .   .   .   .   .   .   .
 827 173  27   .   3   4   4   5   3   4   5   .   .   .   2  33  35   5   .   .   .   .   .   .   .   .   .   .   .
 828 175   5   .   3   4   3   5   .   .   .   .   .   .   .  28  34   5   .   .   .   .   .   .   .   .   .   .   .
 829 175   6   .   2   4   3   7   .   .   .   .   .   .   .  38  39   5   .   .   .   .   .   .   .   .   .   .   .
 830 175   7   .   2   4   2   5   5   4  13  12   1   0   3  35  42   6   4   4   7   6   1   0   .   3   4   5   3
 831 175   9   .   5   4   4   5   .   .   .   .   .   .   .  13  19   3   .   .   .   .   .   .   .   .   .   .   .
 832 175  10   .   1   4   3   5   .   .   .   .   .   .   .  45  17   5   .   .   .   .   .   .   .   .   .   .   .
 833 175  11   .   3   3   3   5   .   .   .   .   .   .   .  35  26   4   .   .   .   .   .   .   .   .   .   .   .
 834 175  13   .   3   3   2   7  25   5   8   8   0   0   3  38  35   6  25   5   5   .   .   .   .   3   3   5   3
 835 175  14   .   4   4   4   7   .   .   .   .   .   .   .  20  39   4   .   .   .   .   .   .   .   .   .   .   .
 836 175  15   .   5   4   4   5   7   4   5   .   .   .   3  28  25   4   .   .   .   .   .   .   .   .   .   .   .
 837 175  16   .   3   4   3   5   7   5   9   9   0   0   3  37  58   6   7   4  12  10   2   0   .   3   2   5   3
 838 175  17   .   5   3   4   6   .   .   .   .   .   .   .  16  31   3   .   .   .   .   .   .   .   .   .   .   .
 839 175  18   .   3   4   4   7  25   5   5   .   .   .   3  20  28   4   .   .   .   .   .   .   .   .   .   .   .
 840 175  19   .   4   3   3   7   .   .   .   .   .   .   .  42  31   4   .   .   .   .   .   .   .   .   .   .   .
 841 175  20   .   3   4   4   7   6   4   5   .   .   .   3  35  48   5   .   .   .   .   .   .   .   .   .   .   .
 842 175  21   .   3   3   3   5  25   5   6   6   0   0   3  38  61   6   .   .   .   .   .   .   .   .   .   .   .
 843 175  22   .   4   3   3   6   6   5   5   .   .   .   3  12  35   4   .   .   .   .   .   .   .   .   .   .   .
 844 175  24   .   4   3   3   6   .   .   .   .   .   .   .  39  29   5   .   .   .   .   .   .   .   .   .   .   .
 845 175  25   .   4   4   4   5   7   4   5   .   .   .   3  22  33   4   .   .   .   .   .   .   .   .   .   .   .
 846 176   2   .   3   4   4   6  14   4   5   .   .   .   3  39  35   5   3   4   5   .   .   .   .   2   2   5   3
 847 176   3   .   4   4   5   5   .   .   .   .   .   .   .  12  25   2   .   .   .   .   .   .   .   .   .   .   .
 848 176   4   .   3   4   4   5  34   4   5   .   .   .   3  29  43   5  33   4   5   .   .   .   .   5   6   7   3
 849 176   5   .   3   4   4   5   .   .   .   .   .   .   .  30  20   4  33   4   5   .   .   .   .   3   2   7   3
 850 176   6   .   3   3   4   5  11   4   5   .   .   .   3  18  34   3   .   .   .   .   .   .   .   .   .   .   .
 851 176   7   .   4   4   4   5   4   4   5   .   .   .   3  23  44   3   .   .   .   .   .   .   .   .   .   .   .
 852 176   8   .   4   3   4   5   6   3   5   .   .   .   3  26  24   4  24   4   5   .   .   .   .   .   .   .   .
 853 176   9   .   3   4   6   5   .   .   .   .   .   .   .   4   8   1   .   .   .   .   .   .   .   .   .   .   .
 854 176  10   .   3   4   5   5  30   4   5   .   .   .   3  27  38   5  11   4   6   5   1   0   .   4   3   5   3
 855 176  11   .   4   4   5   5   .   .   .   .   .   .   .  15  21   3   .   .   .   .   .   .   .   .   .   .   .
 856 177   1   .   3   4   3   5   3   5   5   .   .   .   3  43  33   7   3   3   5   .   .   .   .   3   4   5   3
 857 177   2   .   4   4   3   5   3   4   5   .   .   .   3  44  43   8   3   5   5   .   .   .   .   3   3   5   3
 858 177   3   .   3   4   4   6   2   4   5   .   .   .   3  41  36   6   .   .   .   .   .   .   .   .   .   .   .
 859 177   4   .   3   4   3   7   3   4   5   .   .   .   3  29  37   5   3   5   5   .   .   .   .   3   4   5   3
 860 177   5   .   3   4   3   5   2   6   5   .   .   .   3  50  57   6   .   .   .   .   .   .   .   .   .   .   .
 861 177   6   .   4   4   3   7   2   5   5   .   .   .   3  42  34   6   .   .   .   .   .   .   .   .   .   .   .
 862 177   7   .   2   4   3   5   2   4   5   .   .   .   3  59  60   7   .   .   .   .   .   .   .   .   .   .   .
 863 177   9   .   8   4   3   7   .   .   .   .   .   .   .  23  21   2   3   4   5   .   .   .   .   3   .   5   3
 864 177  10   .   3   4   4   7   3   4   5   .   .   .   3  45  23   6   2   4   5   .   .   .   .   3   2   7   3
 865 177  11   .   3   3   3   5   2   6   5   .   .   .   3  43  53   5   .   .   .   .   .   .   .   .   .   .   .
 866 177  13   .   3   4   4   5   2   4   5   .   .   .   3  36  34   5   3   3   5   .   .   .   .   3   3   5   3
 867 177  14   .   4   4   3   6   2   4   5   .   .   .   3  34  33   6   3   3   5   .   .   .   .   3   3   5   3
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                           L   N       F                                       F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

 868 177  15   .   3   5   4   6   2   4   5   .   .   .   3  26  24   5   3   4   5   .   .   .   .   3   4   5   .
 869 177  16   .   3   4   3   6   2   5   5   .   .   .   3  47  37   6   .   .   .   .   .   .   .   .   .   .   .
 870 177  17   .   4   2   3   6   3   5   5   .   .   .   3  40  38   6   3   3   9   5   1   3   .   3   2   5   3
 871 177  18   .   2   4   3   5   2   5   5   .   .   .   3  39  40   5   .   .   .   .   .   .   .   .   .   .   .
 872 177  19   .   4   4   3   6   3   5   5   .   .   .   2  32  47   7   3   5   5   .   .   .   .   3   4   5   3
 873 177  20   .   3   4   3   6   2   4   5   .   .   .   3  43  40   6   .   .   .   .   .   .   .   .   .   .   .
 874 177  21   .   2   4   3   6   2   5   5   .   .   .   3  51  45   6   .   .   .   .   .   .   .   .   .   .   .
 875 177  22   .   8   4   3   5   3   4   5   .   .   .   2  31  33   2   2   6   5   .   .   .   .   3   4   5   3
 876 177  24   .   3   4   3   6   2   4   5   .   .   .   3  39  45   6   .   .   .   .   .   .   .   .   .   .   .
 877 177  25   .   3   4   3   5   3   5   5   .   .   .   3  46  44   8   3   6   5   .   .   .   .   3   2   7   5
 878 178   1   .   3   3   3   5  14   4  14  14   0   0   3  30  41   5   3   6  12   7   2   3   .   .   .   .   .
 879 178   2   .   5   3   4   5   4   3   7   5   2   0   3  25  28   3   .   .   .   .   .   .   .   .   .   .   .
 880 178   3   .   3   4   3   6   4   5   5   .   .   .   3  39  34   4   .   .   .   .   .   .   .   .   .   .   .
 881 178   4   .   3   3   2   6   3   3   6   6   0   0   3  46  40   6   3   5   5   .   .   .   .   4   4   7   3
 882 178   5   .   5   3   4   5   4   5   9   7   1   1   3  36  32   4   .   .   .   .   .   .   .   .   .   .   .
 883 178   6   .   5   4   4   5   .   .   .   .   .   .   .  25  31   3   .   .   .   .   .   .   .   .   .   .   .
 884 178   7   .   3   4   4   5   3   4   5   .   .   .   3  26  25   4   .   .   .   .   .   .   .   .   .   .   .
 885 178   8   .   5   3   4   5   3   5   5   .   .   .   3  23  29   3   .   .   .   .   .   .   .   .   .   .   .
 886 178  10   .   5   4   4   5   4   4   5   .   .   .   3  36  33   5   3   6  14  10   2   2   .   5   2   5   3
 887 178  12   .   4   3   3   5   3   4   5   .   .   .   3  35  35   4   .   .   .   .   .   .   .   .   .   .   .
 888 178  13   .   8   4   4   5   .   .   .   .   .   .   .  12  13   2   .   .   .   .   .   .   .   .   .   .   .
 889 178  14   .   5   4   4   5   4   4  12  11   1   0   3  34  39   4   .   .   .   .   .   .   .   .   .   .   .
 890 178  15   .   8   4   5   5   3   4   5   .   .   .   3  20  14   2   .   .   .   .   .   .   .   .   .   .   .
 891 178  16   .   3   5   4   5   2   4   5   .   .   .   3  30  33   5   3   5   5   .   .   .   .   3   2   5   3
 892 178  17   .   3   5   3   5  11   5   5   .   .   .   3  46  40   6   .   .   .   .   .   .   .   .   .   .   .
 893 178  18   .   3   3   3   7   4   4   5   .   .   .   3  39  43   6   3   4   5   .   .   .   .   3   3   5   3
 894 178  20   .   4   4   4   5   2   4   5   .   .   .   3  29  34   5   3   5   5   .   .   .   .   3   4   5   3
 895 178  21   .   4   4   3   5   3   4   5   .   .   .   3  31  34   5   .   .   .   .   .   .   .   .   .   .   .
 896 178  22   .   4   4   3   5   3   4   5   .   .   .   3  17  21   4   3   5   5   .   .   .   .   3   5   5   1
 897 178  25   .   4   4   3   5   3   6   8   8   0   0   3  34  59   4   3   4   6   5   1   0   .   3   2   5   3
 898 178  26   .   4   5   3   5   3   4  13  11   2   0   3  23  38   4   3   5   6   6   1   0   .   3   4   6   3
 899 178  28   .   4   3   4   5   2   5   6   5   1   0   3  35  39   5   .   .   .   .   .   .   .   .   .   .   .
 900 178  30   .   5   4   4   5  14   4  11   9   1   1   3  22  42   4  30   4  10   6   1   3   .   5   2   6   3
 901 178  32   .   4   5   3   6   3   4   6   6   0   0   3  33  30   5   2   4   5   .   .   .   .   .   .   .   .
 902 178  33   .   2   4   3   6   3   4   5   .   .   .   3  29  25   4   3   6   5   .   .   .   .   3   3   5   3
 903 178  34   .   3   4   3   6  14   5   5   .   .   .   3  34  38   5   4   5   5   .   .   .   .   .   .   .   .
 904 178  36   .   3   4   3   6  30   4   5   .   .   .   3  43  39   6   8   5   6   5   0   1   .   3   3   5   3
 905 178  37   .   3   4   3   5   2   5   5   .   .   .   3  24  30   4   .   .   .   .   .   .   .   .   .   .   .
 906 178  38   .   3   3   4   5   3   4  10   9   1   0   3  26  48   5   3   6   9   6   1   2   .   4   3   6   2
 907 178  39   .   4   4   3   6   3   4   5   .   .   .   3  39  42   5   3   5   5   .   .   .   .   3   2   7   3
 908 178  40   .   3   3   3   6   3   5   6   6   0   0   3  48  40   6   3   5   5   .   .   .   .   2   4   5   3
 909 178  45   .   3   .   5   5  11   5   5   .   .   .   3  19  20   2   .   .   .   .   .   .   .   .   .   .   .
 910 178  46   .   4   4   5   5   3   4   5   .   .   .   3  21  15   3   .   .   .   .   .   .   .   .   .   .   .
 911 178  47   .   3   4   4   6   4   4  13  10   0   3   3  24  41   5   3   6   7   6   1   0   .   3   2   7   3
 912 178  48   .   3   4   3   5   3   5   5   .   .   .   3  46  40   7   .   .   .   .   .   .   .   .   .   .   .
 913 178  49   .   3   4   3   5   2   4   5   .   .   .   3  40  46   5   .   .   .   .   .   .   .   .   .   .   .
 914 178  52   .   3   4   4   5  11   4   5   .   .   .   2  29  42   5   .   .   .   .   .   .   .   .   .   .   .
 915 178  53   .   4   4   3   5   8   5   6   6   0   0   3  36  39   5   3   5   5   .   .   .   .   .   .   .   .
 916 178  54   .   4   3   3   5   3   5   5   .   .   .   3  30  35   5   2   5   5   .   .   .   .   .   .   .   .
 917 178  55   .   3   4   3   5  16   4   6   6   0   0   3  35  29   5   2   4   5   .   .   .   .   3   3   5   3
 918 178  56   .   3   3   4   5   3   4  13  11   1   1   3  40  38   5   3   7   6   5   1   0   .   3   2   5   3
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                           L   N       F                                           F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

 919 178  57   .   4   4   3   5   3   5   5   .   .   .   3  30  45   4   .   .   .   .   .   .   .   .   .   .   .
 920 178  58   .   3   4   3   5   3   5   5   .   .   .   3  38  37   5   3   5   5   .   .   .   .   .   .   .   .
 921 178  59   .   2   4   3   5   3   5   5   .   .   .   3  59  47   7   3   5   5   .   .   .   .   2   4   5   3
 922 178  60   .   8   4   3   6   .   .   .   .   .   .   .  12  21   3   .   .   .   .   .   .   .   .   .   .   .
 923 178  61   .   3   4   3   5   4   5   5   .   .   .   2  50  40   6   2   6   7   5   2   0   .   3   3   5   3
 924 178  62   .   5   3   4   5   4   3  15  15   0   0   3  25  30   4   .   .   .   .   .   .   .   .   .   .   .
 925 178  63   .   4   3   3   6   3   4  10  10   0   0   3  35  28   5   3   6   5   .   .   .   .   .   .   .   .
 926 178  65   .   5   4   4   5   .   .   .   .   .   .   .  15  20   2   .   .   .   .   .   .   .   .   .   .   .
 927 178  67   .   4   3   5   5   3   3  14  14   0   0   3  14  20   3   .   .   .   .   .   .   .   .   .   .   .
 928 178  68   .   3   4   3   5  11   5  14  14   0   0   3  36  38   6   3   4  10   6   2   2   .   .   .   .   .
 929 178  69   .   4   4   4   5   2   4   7   7   0   0   3  24  29   4   2   5   5   .   .   .   .   3   3   7   3
 930 178  70   .   2   4   4   5   3   6   7   7   0   0   3  28  33   5   3   6   5   .   .   .   .   .   .   .   .
 931 178  71   .   3   4   3   6   3   3  12  12   0   0   3  32  35   4   .   .   .   .   .   .   .   .   .   .   .
 932 178  72   .   3   4   4   5   3   4   5   .   .   .   3  38  34   5   .   .   .   .   .   .   .   .   .   .   .
 933 178  73   .   4   4   4   7   3   4   5   .   .   .   3  25  29   4   .   .   .   .   .   .   .   .   .   .   .
 934 178  74   .   4   4   3   6  14   5   5   .   .   .   3  33  39   5   3   5   5   .   .   .   .   3   3   6   3
 935 178  75   .   3   4   3   5   .   .   .   .   .   .   .  37  21   5   .   .   .   .   .   .   .   .   .   .   .
 936 178  76   .   5   3   3   5   3   4   6   6   0   0   3  37  46   4   .   .   .   .   .   .   .   .   .   .   .
 937 178  80   .   3   4   3   5  14   5   6   5   1   0   3  37  50   5   .   .   .   .   .   .   .   .   .   .   .
 938 178  81   .   4   3   3   5   3   4   6   6   0   0   3  40  29   5   2   4   5   .   .   .   .   3   3   6   3
 939 178  82   .   5   4   4   5   .   .   .   .   .   .   .  16  17   3   .   .   .   .   .   .   .   .   .   .   .
 940 178  83   .   3   3   3   5   3   4  15  14   1   0   3  32  44   5   3   5  12   6   2   4   .   3   2   5   3
 941 178  83   .   3   4   3   6   3   6  13  12   1   0   3  46  40   6   3   5  12   6   2   4   .   .   .   .   .
 942 178  84   .   3   4   4   5   3   3   5   .   .   .   3  13  12   2   .   .   .   .   .   .   .   .   .   .   .
 943 178  84   .   4   4   3   5   4   4   7   6   1   0   2  32  46   5   .   .   .   .   .   .   .   .   .   .   .
 944 178  85   .   3   4   3   6   3   4  11  10   0   1   3  34  57   6   3   6   8   8   0   0   .   3   5   7   3
 945 178  86   .   3   4   3   6   3   4   6   6   0   0   3  38  35   5   3   4  10   7   2   1   .   .   .   .   .
 946 178  87   .   3   3   3   5  14   4   8   8   0   0   3  39  32   5   3   5   6   5   0   1   .   .   .   .   .
 947 178  88   .   3   4   4   5  11   5   5   .   .   .   3  40  45   6  11   5   5   .   .   .   .   3   4   6   3
 948 178  89   .   3   4   3   6   4   4   5   .   .   .   3  32  31   5   .   .   .   .   .   .   .   .   .   .   .
 949 178  90   .   3   4   4   7   3   4   5   .   .   .   3  20  43   5   3   4   5   .   .   .   .   .   .   .   .
 950 178  91   .   5   3   4   5   .   .   .   .   .   .   .  11  26   3   .   .   .   .   .   .   .   .   .   .   .
 951 178  92   .   3   4   4   5  14   5   7   5   1   1   3  31  39   4   .   .   .   .   .   .   .   .   .   .   .
 952 178  93   .   3   4   3   6   3   4   5   .   .   .   3  38  45   5   3   3   6   5   0   1   .   3   4   5   3
 953 178  94   .   3   4   3   5   .   .   .   .   .   .   .  32  37   5   .   .   .   .   .   .   .   .   .   .   .
 954 178  95   .   3   4   3   5  14   4   6   5   0   1   3  28  38   5  14   5   5   .   .   .   .   .   .   .   .
 955 178  96   .   5   4   3   5   4   4   8   8   0   0   3  30  26   4   .   .   .   .   .   .   .   .   .   .   .
 956 178  97   .   4   3   3   5   2   4   7   7   0   0   3  35  18   5   .   .   .   .   .   .   .   .   .   .   .
 957 178  99   .   8   3   4   5   3   3  10  10   0   0   3  16  28   3   3   4  11  10   0   1   .   .   .   .   .
 958 178 100   .   3   4   3   .  11   4   5   .   .   .   3  51  58   7   2   5   5   .   .   .   1   3   3   5   3
 959 178 101   .   3   4   4   5   .   .   .   .   .   .   .  29  27   5   .   .   .   .   .   .   1   .   .   .   .
 960 178 103   .   3   4   4   5  11   4   5   .   .   .   3  31  28   4   .   .   .   .   .   .   1   .   .   .   .
 961 178 104   .   4   3   4   5   .   .   .   .   .   .   .  20  20   3   .   .   .   .   .   .   1   .   .   .   .
 962 178 105   .   3   4   4   5  14   4   5   .   .   .   3  28  34   5   .   .   .   .   .   .   1   .   .   .   .
 963 178 106   .   3   4   3   5  17   4   5   .   .   .   3  26  36   5   .   .   .   .   .   .   1   .   .   .   .
 964 178 120   .   5   2   4   5   .   .   .   .   .   .   .  20  26   4   .   .   .   .   .   .   1   .   .   .   .
 965 242   1   6   4   3   3   7   4   5   5   .   .   .   3  61  69   6   .   .   .   .   .   .   .   .   .   .   .
 966 242   2   6   4   3   4   7   3   5   5   .   .   .   3  63  71   6   .   .   .   .   .   .   .   .   .   .   .
 967 242   3   6   4   4   3   5   3   5   5   .   .   .   3  58  81   5   .   .   .   .   .   .   .   .   .   .   .
 968 242   4   6   3   4   3   7   2   4   5   .   .   .   2  63  99   6   .   .   .   .   .   .   .   .   .   .   .
 969 242   5   6   4   4   3   7   4   6   5   .   .   .   1  71  99   7   .   .   .   .   .   .   .   .   .   .   .
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                        L  N      F                                F     N  N  N  P  L  L  N
            P     L  L  F  U   F  L      N  N  N  P             F  L  N  L  M  S  E  F  F  M
       C    L     F  F  S  M   L  D   N  L  M  S  E   H   W     L  D  P  P  P  P  T  C  P  L  V
  O    O    N     C  P  I  L   C  I   P  P  P  P  T   G   D  V  C  A  E  E  E  E  O  O  U  F  I
  B    D    U  W  O  U  Z  F   O  A   E  E  E  E  O   H   T  I  O  M  T  T  T  T  V  L  B  L  G
  S    E    M  I  L  B  E  L   L  M   T  T  T  T  V   T   H  G  G  G  G  G  G  G  G  G  G  G  G

 970  242   6  6  3  4  3  6   4  4   5  .  .  .  1  58  99  7  .  .  .  .  .  .  .  .  .  .  .
 971  242   7  6  4  4  3  5   4  6   5  .  .  .  1  66  77  6  .  .  .  .  .  .  .  .  .  .  .
 972  242   8  6  4  4  3  7   2  4   5  .  .  .  1  68  86  6  .  .  .  .  .  .  .  .  .  .  .
 973  242   9  6  3  4  3  7   4  4   5  .  .  .  2  68  76  6  .  .  .  .  .  .  .  .  .  .  .
 974  242  10  6  3  3  4  7   3  5   5  .  .  .  1  68  71  5  .  .  .  .  .  .  .  .  .  .  .
 975  242  11  6  3  4  4  7   2  3   5  .  .  .  3  51  72  5  .  .  .  .  .  .  .  .  .  .  .
 976  242  12  6  3  4  3  7   4  5   5  .  .  .  .  66  96  6  .  .  .  .  .  .  .  .  .  .  .
 977  242  13  4  3  3  4  7   3  4   5  .  .  .  3  49  63  4  .  .  .  .  .  .  .  .  .  .  .
 978  242  14  6  4  4  3  7   3  5   5  .  .  .  1  61  93  6  .  .  .  .  .  .  .  .  .  .  .
 979  242  15  6  4  3  3  5   .  .   .  .  .  .  .  49  32  3  .  .  .  .  .  .  .  .  .  .  .
 980  242  16  1  .  .  .  .   .  .   .  .  .  .  .   .   .  0  .  .  .  .  .  .  .  .  .  .  .
 981  242  17  4  4  4  3  7   2  5   5  .  .  .  2  48  62  5  .  .  .  .  .  .  .  .  .  .  .
 982  242  18  1  .  .  .  .   .  .   .  .  .  .  .   .   .  0  .  .  .  .  .  .  .  .  .  .  .
 983  242  19  1  .  .  .  .   .  .   .  .  .  .  .   .   .  0  .  .  .  .  .  .  .  .  .  .  .
 984  242  20  6  3  4  3  7   2  4   5  .  .  .  2  71  93  5  .  .  .  .  .  .  .  .  .  .  .
 985  243   1  6  3  4  3  6   6  4   5  .  .  .  3  65  99  7  .  .  .  .  .  .  .  .  .  .  .
 986  243   2  6  3  3  3  7   4  5   5  .  .  .  1  64  85  6  .  .  .  .  .  .  .  .  .  .  .
 987  243   3  6  3  3  3  5   6  3  12  5  4  3  3  24  45  4  .  .  .  .  .  .  .  .  .  .  .
 988  243   4  3  4  4  5  .   .  .   .  .  .  .  .  17  36  3  .  .  .  .  .  .  .  .  .  .  .
 989  243   5  4  4  4  3  5   .  .   .  .  .  .  .  42  76  4  .  .  .  .  .  .  .  .  .  .  .
 990  243   6  6  3  3  3  6   4  5   5  .  .  .  3  51  83  6  .  .  .  .  .  .  .  .  .  .  .
 991  243   7  6  3  4  4  5   .  .   .  .  .  .  .  20  59  4  .  .  .  .  .  .  .  .  .  .  .
 992  243   8  1  .  .  .  .   .  .   .  .  .  .  .   .   .  0  .  .  .  .  .  .  .  .  .  .  .
 993  243   9  5  3  4  4  5   .  .   .  .  .  .  .  24  51  4  .  .  .  .  .  .  .  .  .  .  .
 994  243  10  .  3  4  3  5   6  3   5  .  .  .  3  39  76  5  .  .  .  .  .  .  .  .  .  .  .
 995  243  11  .  3  4  4  5   .  .   .  .  .  .  .  38  59  5  .  .  .  .  .  .  .  .  .  .  .
 996  243  12  1  .  .  .  .   .  .   .  .  .  .  .   .   .  0  .  .  .  .  .  .  .  .  .  .  .
 997  255   1  .  4  3  4  5   .  .   .  .  .  .  .  28  41  5  .  .  .  .  .  .  .  .  .  .  .
 998  255   1  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
 999  255   1  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1000  255   1  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1001  255   1  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1002  255   2  .  4  3  4  5  28  5   5  .  .  .  3  34  47  5  .  .  .  .  .  .  .  .  .  .  .
1003  255   2  .  .  .  .  .  28  4   5  .  .  .  3   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1004  255   2  .  .  .  .  .  28  5   5  .  .  .  3   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1005  255   2  .  .  .  .  .  28  5   5  .  .  .  3   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1006  255   2  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1007  255   3  .  4  4  4  5  28  4   5  .  .  .  3  28  28  4  .  .  .  .  .  .  .  .  .  .  .
1008  255   3  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1009  255   3  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1010  255   3  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1011  255   3  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1012  255   4  .  4  3  4  5   .  .   .  .  .  .  .  22  41  5  .  .  .  .  .  .  .  .  .  .  .
1013  255   4  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1014  255   4  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1015  255   4  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1016  255   4  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1017  255   5  .  4  4  4  5  28  5   5  .  .  .  3  25  53  5  .  .  .  .  .  .  .  .  .  .  .
1018  255   5  .  .  .  .  .  28  5   5  .  .  .  3   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1019  255   5  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
1020  255   5  .  .  .  .  .   .  .   .  .  .  .  .   .   .  .  .  .  .  .  .  .  .  .  .  .  .
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                                                          SAS

                                 L    N         F                                                             F         N    N    N    P    L    L    N
             P         L    L    F    U    F    L         N    N    N    P                   F    L    N    L    M    S    E    F    F    M
        C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
   O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
   B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
   S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

1021  255    5    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1022  255    6    .    4    3    4    5   28    4    5    .    .    .    3   34   42    5    .    .    .    .    .    .    .    .    .    .    .
1023  255    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1024  255    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1025  255    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1026  255    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1027  255    7    .    4    3    4    5   28    4    5    .    .    .    3   30   50    6    .    .    .    .    .    .    .    .    .    .    .
1028  255    7    .    .    .    .    .   28    4    6    6    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1029  255    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1030  255    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1031  255    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1032  255    8    .    4    4    4    5   28    4    6    6    0    0    3   25   49    5    .    .    .    .    .    .    .    .    .    .    .
1033  255    8    .    .    .    .    .   28    4    6    6    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1034  255    8    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1035  255    8    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1036  255    8    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1037  256    1    .    3    4    5    5   17    4    5    .    .    .    3   33   45    6    .    .    .    .    .    .    .    .    .    .    .
1038  256    1    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1039  256    1    .    .    .    .    .   30    4    5    .    .    .    1    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1040  256    1    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1041  256    1    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1042  256    2    .    3    5    5    5   17    3    5    .    .    .    3   25   44    6    .    .    .    .    .    .    .    .    .    .    .
1043  256    2    .    .    .    .    .   17    3    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1044  256    2    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1045  256    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1046  256    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1047  256    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1048  256    3    .    3    4    4    5   17    4    5    .    .    .    3   40   52    7    .    .    .    .    .    .    .    .    .    .    .
1049  256    3    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1050  256    3    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1051  256    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1052  256    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1053  256    4    .    3    4    4    5   17    4    5    .    .    .    3   35   48    6    .    .    .    .    .    .    .    .    .    .    .
1054  256    4    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1055  256    4    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1056  256    4    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1057  256    4    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1058  256    5    .    3    4    4    5   17    4    5    .    .    .    3   30   44    6    .    .    .    .    .    .    .    .    .    .    .
1059  256    5    .    3    4    4    5   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1060  256    5    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1061  256    5    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1062  256    5    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1063  256    6    .    3    4    5    6   17    4    5    .    .    .    3   27   34    6    .    .    .    .    .    .    .    .    .    .    .
1064  256    6    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1065  256    6    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1066  256    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1067  256    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1068  256    7    .    3    4    5    5   17    4    5    .    .    .    3   34   45    6    .    .    .    .    .    .    .    .    .    .    .
1069  256    7    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1070  256    7    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1071  256    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
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                                   L    N         F                                                                F         N    N    N    P    L    L    N
              P         L    L    F    U    F    L         N    N    N    P                        F    L    N    L    M    S    E    F    F    M
         C    L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
    O    O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
    B    D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
    S    E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

 1072  256    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1073  256    8    .    3    5    5    5   17    5    5    .    .    .    3   27   40    6    .    .    .    .    .    .    .    .    .    .    .
 1074  256    8    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
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 1076  256    8    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1077  256    8    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1078  256    9    .    3    4    5    5   17    5    5    .    .    .    3   30   51    7    .    .    .    .    .    .    .    .    .    .    .
 1079  256    9    .    .    .    .    .   17    5    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1080  256    9    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1081  256    9    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1082  256    9    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1083  256   10    .    3    5    5    5   17    4    5    .    .    .    3   31   52    6    .    .    .    .    .    .    .    .    .    .    .
 1084  256   10    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1085  256   10    .    .    .    .    .   17    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1086  256   10    .    .    .    .    .   30    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1087  256   10    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1088  257    1    .    3    3    3    5    7    4    7    6    1    0    3   29   48    6    .    .    .    .    .    .    .    .    .    .    .
 1089  257    1    .    .    .    .    .    7    4   11   11    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1090  257    1    .    .    .    .    .    7    5   12   12    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1091  257    1    .    .    .    .    .    7    5   15   15    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1092  257    1    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1093  257    2    .    2    4    3    5    7    5    8    7    1    0    3   50   57    7    .    .    .    .    .    .    .    .    .    .    .
 1094  257    2    .    .    .    .    .    7    4   10    8    2    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1095  257    2    .    .    .    .    .    7    5   14   14    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1096  257    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1097  257    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1098  257    3    .    2    4    3    5    7    4    8    8    0    0    3   39   48    7    .    .    .    .    .    .    .    .    .    .    .
 1099  257    3    .    .    .    .    .    7    4    6    6    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1100  257    3    .    .    .    .    .    7    4    6    6    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1101  257    3    .    .    .    .    .    7    5   14   14    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1102  257    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1103  257    4    .    3    4    3    5    7    5    6    6    0    0    3   46   46    6    .    .    .    .    .    .    .    .    .    .    .
 1104  257    4    .    .    .    .    .    7    5   15   15    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1105  257    4    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1106  257    4    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1107  257    4    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1108  257    5    .    3    4    3    5    7    5    7    7    0    0    3   43   48    7    .    .    .    .    .    .    .    .    .    .    .
 1109  257    5    .    .    .    .    .    7    5   12   11    1    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1110  257    5    .    .    .    .    .    7    5   14   14    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1111  257    5    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1112  257    5    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1113  257    6    .    3    4    2    5    7    5    7    5    1    1    3   40   48    7    .    .    .    .    .    .    .    .    .    .    .
 1114  257    6    .    .    .    .    .    7    4   10   10    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1115  257    6    .    .    .    .    .    7    4    8    7    1    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1116  257    6    .    .    .    .    .    7    5   14   14    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1117  257    6    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1118  257    7    .    2    3    3    5    7    5    7    6    0    1    3   55   55    7    .    .    .    .    .    .    .    .    .    .    .
 1119  257    7    .    2    3    3    5    7    5   13   13    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1120  257    7    .    .    .    .    .    7    5   14   14    0    0    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1121  257    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
 1122  257    7    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
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                           L   N       F                                       F       N   N   N   P   L   L   N
           P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
       C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
   O   O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
   B   D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
   S   E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

1123 257   8   .   2   3   3   5   7   4   6   6   0   0   3  39  49   7   .   .   .   .   .   .   .   .   .   .   .
1124 257   8   .   .   .   .   .   7   5   6   6   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1125 257   8   .   .   .   .   .   7   5   8   8   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1126 257   8   .   .   .   .   .   7   5  14  14   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1127 257   8   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1128 257   9   .   2   4   3   5   7   4   7   7   0   0   3  42  53   7   .   .   .   .   .   .   .   .   .   .   .
1129 257   9   .   .   .   .   .   7   4   6   6   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1130 257   9   .   .   .   .   .   7   4   8   8   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1131 257   9   .   .   .   .   .   7   5  13  13   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1132 257   9   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1133 257  10   .   3   3   3   5   7   4   7   7   0   0   3  46  61   7   .   .   .   .   .   .   .   .   .   .   .
1134 257  10   .   .   .   .   .   7   5  12  12   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1135 257  10   .   .   .   .   .   7   5  15  15   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1136 257  10   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1137 257  10   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1138 258   1   .   3   4   3   5   2   5   5   .   .   .   3  27  55   7   .   .   .   .   .   .   .   .   .   .   .
1139 258   1   .   .   .   .   .   2   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1140 258   1   .   .   .   .   .   2   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1141 258   1   .   .   .   .   .   2   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1142 258   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1143 258   2   .   2   5   3   5   2   6   5   .   .   .   3  29  47   7   .   .   .   .   .   .   .   .   .   .   .
1144 258   2   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1145 258   2   .   .   .   .   .   2   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1146 258   2   .   .   .   .   .   2   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1147 258   2   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1148 258   3   .   2   5   3   5   1   5   5   .   .   .   3  38  49   7   .   .   .   .   .   .   .   .   .   .   .
1149 258   3   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1150 258   3   .   .   .   .   .   2   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1151 258   3   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1152 258   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1153 258   4   .   3   5   3   6   2   6   5   .   .   .   3  34  52   7   .   .   .   .   .   .   .   .   .   .   .
1154 258   4   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1155 258   4   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1156 258   4   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1157 258   4   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1158 258   5   .   3   4   3   5   2   6   5   .   .   .   3  39  61   8   .   .   .   .   .   .   .   .   .   .   .
1159 258   5   .   .   .   .   .   1   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1160 258   5   .   .   .   .   .   1   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1161 258   5   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1162 258   5   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1163 258   6   .   3   5   3   5   1   6   5   .   .   .   3  34  60   7   .   .   .   .   .   .   .   .   .   .   .
1164 258   6   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1165 258   6   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1166 258   6   .   .   .   .   .   2   6   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1167 258   6   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1168 259   1   .   3   4   3   5   3   5   8   5   3   0   3  25  27   6   .   .   .   .   .   .   .   .   .   .   .
1169 259   1   .   .   .   .   .   2   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1170 259   1   .   .   .   .   .   3   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1171 259   1   .   .   .   .   .   3   5   9   7   0   2   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1172 259   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
1173 259   2   .   3   4   3   5   3   4   9   7   2   0   3  34  59   7   .   .   .   .   .   .   .   .   .   .   .
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                               L   N       F                                       F       N   N   N   P   L   L   N
               P       L   L   F   U   F   L       N   N   N   P               F   L   N   L   M   S   E   F   F   M
           C   L       F   F   S   M   L   D   N   L   M   S   E   H   W       L   D   P   P   P   P   T   C   P   L   V
     O     O   N       C   P   I   L   C   I   P   P   P   P   T   G   D   V   C   A   E   E   E   E   O   O   U   F   I
     B     D   U   W   O   U   Z   F   O   A   E   E   E   E   O   H   T   I   O   M   T   T   T   T   V   L   B   L   G
     S     E   M   I   L   B   E   L   L   M   T   T   T   T   V   T   H   G   G   G   G   G   G   G   G   G   G   G   G

  1174   259   2   .   .   .   .   .   3   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1175   259   2   .   .   .   .   .   2   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1176   259   2   .   .   .   .   .   2   5   6   6   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1177   259   2   .   .   .   .   .   2   5  10  10   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1178   259   3   .   3   4   3   5   3   5   5   .   .   .   3  35  50   6   .   .   .   .   .   .   .   .   .   .   .
  1179   259   3   .   .   .   .   .   2   5   6   6   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1180   259   3   .   .   .   .   .   2   5  13  12   0   1   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1181   259   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1182   259   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1183   259   4   .   2   4   3   5   2   4   7   7   0   0   3  36  38   6   .   .   .   .   .   .   .   .   .   .   .
  1184   259   4   .   .   .   .   .   2   4   8   7   0   1   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1185   259   4   .   .   .   .   .   2   5  11  10   1   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1186   259   4   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1187   259   4   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1188   259   5   .   3   4   3   5   2   5  11  10   1   0   3  35  45   6   .   .   .   .   .   .   .   .   .   .   .
  1189   259   5   .   .   .   .   .   2   4   8   7   1   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1190   259   5   .   .   .   .   .   2   5   6   6   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1191   259   5   .   .   .   .   .   2   5   9   9   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1192   259   5   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1193   259   6   .   2   4   3   5   2   5   5   .   .   .   3  32  41   6   .   .   .   .   .   .   .   .   .   .   .
  1194   259   6   .   .   .   .   .   2   5  10   7   3   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1195   259   6   .   .   .   .   .   2   5   9   8   1   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1196   259   6   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1197   259   6   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1198   259   7   .   3   4   3   5   2   5   8   8   0   0   3  37  50   6   .   .   .   .   .   .   .   .   .   .   .
  1199   259   7   .   .   .   .   .   2   5   9   7   2   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1200   259   7   .   .   .   .   .   2   5  12  12   0   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1201   259   7   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1202   259   7   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1203   259   8   .   2   4   3   5   2   5   6   5   0   1   3  28  37   6   .   .   .   .   .   .   .   .   .   .   .
  1204   259   8   .   .   .   .   .   3   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1205   259   8   .   .   .   .   .   2   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1206   259   8   .   .   .   .   .   2   5   9   8   7   0   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1207   259   8   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1208   260   1   .   7   4   3   5   2   3   5   .   .   .   3  44  53   7   .   .   .   .   .   .   .   .   .   .   .
  1209   260   1   .   .   .   .   .   2   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1210   260   1   .   .   .   .   .   2   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1211   260   1   .   .   .   .   .   3   5   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1212   260   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1213   260   2   .   4   5   2   7   2   4   9   8   1   0   3  31  43   5   .   .   .   .   .   .   .   .   .   .   .
  1214   260   2   .   .   .   .   .   2   4   5   .   .   .   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1215   260   2   .   .   .   .   .   2   4   5   .   .   .   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1216   260   2   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1217   260   2   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1218   261   1   .   3   4   4   6  11   4   5   .   .   .   3  30  46   4   .   .   .   .   .   .   .   .   .   .   .
  1219   261   1   .   .   .   .   .  11   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1220   261   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1221   261   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1222   261   1   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
  1223   261   2   .   .   4   4   7  30   4   5   .   .   .   3  30  49   .   .   .   .   .   .   .   .   .   .   .   .
  1224   261   2   .   .   .   .   .  11   4   5   .   .   .   3   .   .   .   .   .   .   .   .   .   .   .   .   .   .
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                                                        SAS

                                  L    N         F                                                         F         N    N    N    P    L    L    N
               P         L    L    F    U    F    L         N    N    N    P                        F    L    N    L    M    S    E    F    F    M
     C         L         F    F    S    M    L    D    N    L    M    S    E    H    W         L    D    P    P    P    P    T    C    P    L    V
   O     O    N         C    P    I    L    C    I    P    P    P    P    T    G    D    V    C    A    E    E    E    E    O    O    U    F    I
   B     D    U    W    O    U    Z    F    O    A    E    E    E    E    O    H    T    I    O    M    T    T    T    T    V    L    B    L    G
   S     E    M    I    L    B    E    L    L    M    T    T    T    T    V    T    H    G    G    G    G    G    G    G    G    G    G    G    G

1225   261    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1226   261    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1227   261    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1228   262    1    .    3    3    4    6   22    4    5    .    .    .    3   38   33    6    .    .    .    .    .    .    .    .    .    .    .
1229   262    2    .    3    3    4    5    4    5    9    9    0    0    3   27   35    5    .    .    .    .    .    .    .    .    .    .    .
1230   262    3    .    3    3    4    6    .    .    .    .    .    .    .   22   35    4    .    .    .    .    .    .    .    .    .    .    .
1231   262    4    .    4    3    4    6   17    4    5    .    .    .    3   15   25    2    .    .    .    .    .    .    .    .    .    .    .
1232   262    5    .    4    4    4    5    4    5   14   10    3    1    3   34   39    5    .    .    .    .    .    .    .    .    .    .    .
1233   262    6    .    4    3    4    5    .    .    .    .    .    .    .   27   23    4    .    .    .    .    .    .    .    .    .    .    .
1234   262    8    .    3    4    5    5    .    .    .    .    .    .    .   11   16    3    .    .    .    .    .    .    .    .    .    .    .
1235   262    9    .    4    4    5    5    .    .    .    .    .    .    .   10   17    3    .    .    .    .    .    .    .    .    .    .    .
1236   262   10    .    3    2    4    5   19    4    6    6    0    0    3   22   34    4    .    .    .    .    .    .    .    .    .    .    .
1237   262   12    .    3    4    4    5    .    .    .    .    .    .    .   24   29    4    .    .    .    .    .    .    .    .    .    .    .
1238   263    2    .    3    5    5    5    2    4    5    .    .    .    3    6   19    3    .    .    .    .    .    .    .    .    .    .    .
1239   263    3    .    3    4    4    5    .    .    .    .    .    .    .    5   13    2    .    .    .    .    .    .    .    .    .    .    .
1240   263    5    .    3    4    3    5    2    4    5    .    .    .    2   33   37    5    .    .    .    .    .    .    .    .    .    .    .
1241   263    7    .    3    4    3    5    2    4    5    .    .    .    3   11   43    3    .    .    .    .    .    .    .    .    .    .    .
1242   263    8    .    3    4    4    5    2    4    5    .    .    .    3   12   17    2    .    .    .    .    .    .    .    .    .    .    .
1243   264    1    .    2    4    3    6    7    4    5    .    .    .    3   48   37    7    .    .    .    .    .    .    .    .    .    .    .
1244   264    1    .    .    .    .    .    7    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1245   264    1    .    .    .    .    .    7    3    5    .    .    .    2    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1246   264    1    .    .    .    .    .    7    4    5    .    .    .    3    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1247   264    1    .    .    .    .    .    7    5    5    .    .    .    1    .    .    .    .    .    .    .    .    .    .    .    .    .    .
1248   453    7    .    4    3    2    6    3    6    5    .    .    .    3   41   49    6    .    .    .    .    .    .    .    .    .    .    .
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C) Experimental taxonomy crosses.

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                                                  SAS                         19:46 MONDAY, JANUARY 6, 1986     1

OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

  1   181     1    6    3      4      3       5       5      4      5     .      .      .      3     38    37    3
  2   181     2    6    3      4      3       5       7      5      7     7      0      0      3     56    80    5
  3   181     3    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
  4   181     4    6    3      4      2       5       5      5      5     .      .      .      3     48    98    6
  5   181     5    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
  6   181     6    6    3      4      3       7       5      4      5     .      .      .      3     35    88    5
  7   181     7    6    4      4      3       5       7      4      5     .      .      .      3     35    31    3
  8   181     8    6    2      4      4       5       4      5      5     .      .      .      3     38    48    4
  9   181     9    6    3      4      3       5       7      5      5     .      .      .      3     45    70    5
 10   181    10    6    2      4      3       5       7      5      5     .      .      .      3     64    87    5
 11   181    11    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 12   181    12    6    4      4      4       5       5      4      5     .      .      .      3     40    52    5
 13   181    13    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 14   181    14    6    3      3      2       5       5      6      5     .      .      .      3     48    99    8
 15   181    15    6    3      4      2       5       7      4      5     .      .      .      3     40    55    7
 16   181    16    6    3      4      3       5       6      4      5     .      .      .      3     40    51    5
 17   181    17    6    3      4      3       5       6      4      5     .      .      .      3     60    74    5
 18   181    18    6    3      4      3       5       7      4      5     .      .      .      3     48    63    5
 19   181    19    6    3      4      3       5       7      4      5     .      .      .      3     46    52    5
 20   181    20    6    4      4      3       7       6      5      5     .      .      .      2     50    83    6
 21   181    21    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 22   181    22    6    2      4      3       7       4      6      5     .      .      .      3     64    76    7
 23   181    23    6    3      4      3       5       6      4      5     .      .      .      3     33    57    5
 24   181    24    6    6      5      3       5       4      4      5     .      .      .      2     37    49    4
 25   181    25    6    3      4      3       5       5      5      5     .      .      .      3     42    57    5
 26   181    26    6    3      3      2       5       7      5      5     .      .      .      2     47    71    5
 27   181    27    5    4      4      3       5       6      4      5     .      .      .      3     35    54    5
 28   181    28    6    3      4      3       7       4      5      5     .      .      .      3     66    91    7
 29   181    29    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 30   181    30    6    3      4      2       7       6      5      5     .      .      .      2     65    98    7
 31   181    31    6    3      4      3       5       5      5      5     .      .      .      3     47    49    5
 32   181    32    6    5      4      3       5       4      5      5     .      .      .      3     60    88    6
 33   181    33    6    4      4      2       7       6      3      5     .      .      .      3     64    65    6
 34   182     1    6    3      3      2       7       3      6      5     .      .      .      3     57    99    6
 35   182     2    6    3      3      3       5       3      5      5     .      .      .      2     48    56    4
 36   182     3    5    3      2      2       7       3      6      5     .      .      .      3     62    76    5
 37   182     4    6    3      4      2       7       3      5      5     .      .      .      3     66    94    7
 38   182     5    6    3      2      2       7       4      5      5     .      .      .      3     65    80    6
 39   182     6    6    3      3      3       5       3      5      5     .      .      .      3     49    90    0
 40   182     7    6    4      4      3       5       3      4      6     6      0      0      3     56    66    5
 41   182     8    6    4      3      3       5       3      5      5     .      .      .      3     58    64    5
 42   182     9    6    3      4      3       5       3      5      5     .      .      .      3     55    80    5
 43   182    10    4    4      4      2       7       3      5      5     .      .      .      3     57    93    5
 44   182    11    6    4      4      2       5       2      5      5     .      .      .      3     55    79    5
 45   182    12    6    3      4      3       5       3      4      5     .      .      .      3     47    70    4
 46   182    13    6    3      4      3       5       4      5      5     .      .      .      3     32    51    4
 47   182    14    6    4      4      3       5       3      4      5     .      .      .      3     32    75    3
 48   182    15    6    4      4      3       7       3      5      5     .      .      .      3     49    47    5
 49   182    16    6    3      4      2       7       3      5      5     .      .      .      3     54    56    5
 50   182    17    6    4      4      2       5       3      5      5     .      .      .      2     66    99    6
 51   182    18    6    3      3      2       7       4      5      5     .      .      .      3     55    55    4
 52   182    19    6    3      4      3       5       4      3      5     .      .      .      3     32    48    3
 53   182    20    6    3      4      3       5       3      4      5     .      .      .      3     46    49    4
 54   182    21    6    3      4      2       6       2      5      5     .      .      .      3     55    58    6
 55   182    22    3    3      3      3       5       3      5      5     .      .      .      3     45    44    4
 56   182    23    6    4      3      2       7       4      4      5     .      .      .      3     53    98    5
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                                                                SAS                                          19:46 MONDAY, JANUARY 6, 1986    2

 OBS   CODE   PLNUM   WI   LFCOL   LFPUB   LFSIZE   NUMLFL   FLCOL   FLDIAM   NPET   NLPET   NMPET   NSPET   PETOV   HGHT   WDTH   VIG

  57   182      24    6      3       4       2        7        2       4       5       .       .       .       3      58     88     5
  58   182      25    6      3       4       2        5        2       4       5       .       .       .       3      46     79     5
  59   182      26    6      3       3       2        7        3       5       5       .       .       .       3      55     72     6
  60   182      27    6      4       2       2        7        3       5       5       .       .       .       3      53     59     6
  61   182      28    6      4       3       3        5        3       5       5       .       .       .       3      65     65     6
  62   182      29    6      3       3       2        7        3       5       5       .       .       .       3      50     99     7
  63   182      30    6      4       4       2        6        4       5       5       .       .       .       3      48     68     5
  64   182      31    6      4       4       2        7        2       4       5       .       .       .       3      51     47     4
  65   182      32    4      3       4       4        5        4       4       5       .       .       .       3      23     51     4
  66   182      33    3      3       4       4        5        3       5       5       .       .       .       3      27     56     4
  67   182      34    6      3       4       4        6        4       4       5       .       .       .       3      58     62     4
  68   182      35    6      3       3       2        7        4       7       5       .       .       .       3      50     52     5
  69   182      36    5      3       3       2        5        2       4       5       .       .       .       3      33     77     5
  70   182      37    5      3       4       3        5        3       3       5       .       .       .       3      26     37     3
  71   182      38    6      3       3       2        5        2       5       5       .       .       .       3      60     88     6
  72   182      39    5      3       3       2        7        2       5       5       .       .       .       3      45     90     5
  73   182      40    6      3       4       3        5        3       4       5       .       .       .       3      30     83     5
  74   182      41    6      4       4       2        6        3       4       5       .       .       .       3      48     54     5
  75   182      42    6      3       4       2        6        3       3       7       7       0       0       3      53     98     7
  76   182      43    6      3       4       2        7        3       5       5       .       .       .       3      81     99     8
  77   182      44    6      3       4       2        7        3       5       5       .       .       .       3      57     98     6
  78   182      45    6      3       3       2        6        3       6       5       .       .       .       3      44     69     6
  79   182      46    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
  80   182      47    6      4       4       3        5        2       7       5       .       .       .       3      62     95     6
  81   182      48    6      4       3       2        5        3       5       5       .       .       .       3      78     99     8
  82   182      49    6      3       4       3        5        3       5       5       .       .       .       3      58     70     6
  83   182      50    6      4       3       2        7        3       7       5       .       .       .       3      57     98     6
  84   182      51    6      4       4       2        5        4       3       5       .       .       .       3      75     99     8
  85   182      52    5      4       3       2        7        3       5       5       .       .       .       3      57     93     5
  86   182      53    6      4       3       3        5        3       4       5       .       .       .       3      59     90     7
  87   182      54    6      3       3       2        5        3       5       5       .       .       .       2      67     93     7
  88   182      55    6      5       4       3        5        3       5       5       .       .       .       3      30     65     4
  89   182      56    5      3       4       3        5        3       5       5       .       .       .       3      62     72     5
  90   182      57    6      3       3       2        7        2       5       5       .       .       .       3      56     96     6
  91   182      58    6      3       4       2        6        3       5       5       .       .       .       3      50     86     5
  92   182      59    6      3       4       2        5        4       4       5       .       .       .       3      47     78     5
  93   182      60    6      4       4       2        7        2       5       5       .       .       .       3      52     93     6
  94   182      61    6      3       4       2        7        3       5       5       .       .       .       3      69     99     7
  95   182      62    6      2       4       2        7        3       4       5       .       .       .       3      75     78     6
  96   182      63    6      2       3       2        5        3       6       5       .       .       .       3      54     69     5
  97   182      64    6      4       5       3        5        3       4       5       .       .       .       3      44     63     5
  98   182      65    .      3       .       2        6        2       4       5       .       .       .       2      49     71     6
  99   182      66    .      3       .       3        7        3       4       5       .       .       .       3      43     61     5
 100   182      67    .      3       .       2        7        4       4       5       .       .       .       3      38     40     5
 101   182      68    .      3       .       3        5        3       5       5       .       .       .       3      30     37     5
 102   182      69    .      3       .       3        7        3       4       5       .       .       .       3      34     59     4
 103   183       1    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
 104   184       1    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
 105   184       2    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
 106   184       3    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
 107   185       1    6      3       3       3        7        4       3       5       .       .       .       2      66     81     6
 108   185       2    6      4       2       2        7        7       4       6       6       0       0       3      70     76     6
 109   185       3    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
 110   185       4    6      4       3       3        5        3       5       5       .       .       .       3      50     88     6
 111   185       5    6      3       2       2        7        7       5       5       .       .       .       6      54     74     5
 112   185       6    6      4       3       2        5        6       4       5       .       .       .       3      46     61     5
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 OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

 113   185     7    6    3      4      3       5       6      4      5      .      .      .      3     54    75    5
 114   185     8    6    3      4      3       5       6      3      5      .      .      .      3     28    71    5
 115   185     9    6    3      4      3       5       6      4      5      .      .      .      3     50    54    5
 116   185    10    6    4      3      3       7       7      5      5      .      .      .      3     68    84    7
 117   185    11    6    4      2      2       7       3      3      5      .      .      .      1     70    81    6
 118   185    12    6    3      2      2       7       6      4      5      .      .      .      3     66    86    6
 119   185    13    6    3      4      2       7       3      5      5      .      .      .      2     65    83    6
 120   185    14    6    3      4      3       5       6      4      5      .      .      .      3     46    77    5
 121   185    15    6    3      3      2       7       5      4      5      .      .      .      1     61    99    7
 122   185    16    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 123   185    17    6    4      2      2       7       3      5      5      .      .      .      3     65    75    6
 124   185    18    6    3      3      3       5       7      4      5      .      .      .      3     55    58    5
 125   185    19    6    4      3      3       7       7      4      5      .      .      .      3     69    76    7
 126   185    20    6    4      3      3       5       7      5      6      6      0      0      3     47    78    5
 127   185    21    6    4      4      2       7       3      2      5      .      .      .      3     60    75    6
 128   185    22    6    4      3      2       7       7      3      5      .      .      .      3     59    79    6
 129   185    23    6    3      4      2       5       7      5      5      .      .      .      3     47    99    6
 130   186     1    6    2      5      3       5       4      4      5      .      .      .      3     56    78    5
 131   186     2    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 132   186     3    6    3      4      2       5       4      4      5      .      .      .      1     51    90    5
 133   186     4    6    3      5      3       5       7      4      5      .      .      .      3     29    40    5
 134   186     5    6    3      4      3       5       7      3      5      .      .      .      2     39    73    5
 135   186     6    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 136   186     7    6    3      4      3       5       3      5      5      .      .      .      1     34    77    5
 137   186     8    6    3      5      3       5       6      .      .      .      .      .      .     35    45    4
 138   186     9    6    3      4      3       5       6      5      6      6      0      0      3     47    76    5
 139   186    10    6    3      4      3       5       4      4      5      .      .      .      3     37    40    4
 140   186    11    6    3      4      3       5       .      .      .      .      .      .      .     28    54    4
 141   186    12    6    3      5      3       5       4      4      5      .      .      .      1     28    34    3
 142   186    13    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 143   186    14    6    4      4      3       5       7      4      5      .      .      .      3     42    84    5
 144   186    15    6    3      4      3       5       .      .      .      .      .      .      .     26    22    1
 145   186    16    6    3      4      2       5       7      4      5      .      .      .      3     37    70    5
 146   186    17    6    3      4      3       5       7      4      5      .      .      .      3     32    37    5
 147   186    18    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 148   186    19    6    4      5      2       5       4      5      5      .      .      .      3     41    65    5
 149   186    20    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 150   186    21    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 151   186    22    6    4      4      2       5       6      4      5      .      .      .      3     35    53    5
 152   186    23    6    3      4      2       5       6      5      5      .      .      .      1     34    51    2
 153   186    24    6    3      4      3       5       3      5      5      .      .      .      3     26    60    4
 154   186    25    6    3      4      3       5       4      4      5      .      .      .      3     35    60    5
 155   186    26    5    3      3      2       6       6      4      5      .      .      .      3     45    64    5
 156   186    27    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 157   186    28    6    3      3      3       5       3      4      5      .      .      .      3     20    75    5
 158   186    29    6    3      4      3       5       5      5      5      .      .      .      3     41    71    5
 159   187     1    6    3      4      4       5       3      5      5      .      .      .      3     62    62    5
 160   187     2    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 161   187     3    6    3      4      4       5       6      4      5      .      .      .      2     65    76    5
 162   187     4    6    3      4      2       7       6      5      5      .      .      .      3     64    99    6
 163   187     5    6    4      3      3       7       6      3      5      .      .      .      3     61    87    5
 164   187     6    6    4      4      2       6       7      4      5      .      .      .      3     60    84    6
 165   187     7    6    3      4      5       5       .      .      .      .      .      .      .     17    19    2
 166   187     8    6    4      4      3       7       7      4      5      .      .      .      2     58    89    6
 167   187     9    6    3      4      4       5       7      3      5      .      .      .      3     44    49    3
 168   187    10    5    4      3      3       7       7      3      5      .      .      .      3     77    65    6
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 OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

 169   187    11    6    4      4      3       5       6      4      5      .      .      .      1     64    70    6
 170   187    12    6    3      4      3       5       6      4      5      .      .      .      1     54    55    5
 171   187    13    6    3      4      3       7       5      4      5      .      .      .      3     69    83    6
 172   187    14    4    4      3      3       5       5      4      5      .      .      .      3     77    90    7
 173   187    15    6    3      4      3       5       6      4      5      .      .      .      3     37    54    4
 174   187    16    6    3      4      3       5       7      4      5      .      .      .      3     63    74    5
 175   187    17    6    3      4      3       5       5      3      5      .      .      .      3     41    52    5
 176   187    18    6    4      4      3       5       6      4      5      .      .      .      3     70    52    5
 177   187    19    6    4      3      3       5       5      5      5      .      .      .      2     86    75    7
 178   187    20    6    3      4      3       5       6      4      5      .      .      .      2     56    58    5
 179   187    21    6    4      4      2       7       6      5      5      .      .      .      3     58    75    6
 180   187    22    6    4      3      3       5       5      3      5      .      .      .      3     64    52    5
 181   187    23    6    3      2      3       7       6      4      6      6      0      0      3     80    67    6
 182   187    24    6    3      4      3       5       6      4      5      .      .      .      3     52    51    5
 183   187    25    6    3      3      3       5       6      3      5      .      .      .      2     52    45    5
 184   187    26    6    3      4      3       5       6      4      5      .      .      .      3     58    68    5
 185   187    27    6    4      4      3       5       4      5      5      .      .      .      2     78    99    8
 186   187    28    6    3      5      3       5       6      3      5      .      .      .      2     48    45    4
 187   187    29    6    3      4      3       5       5      4      5      .      .      .      3     66    83    6
 188   187    30    6    4      3      3       5       5      4      5      .      .      .      3     87    95    8
 189   187    31    6    3      3      3       5       7      5      5      .      .      .      3     72    72    7
 190   187    32    6    3      3      3       5       6      5      5      .      .      .      3     75    61    6
 191   187    33    6    3      4      4       5       5      3      5      .      .      .      2     60    80    6
 192   187    34    6    3      4      3       7       7      5      5      .      .      .      3     55    66    5
 193   187    35    6    3      4      4       5       6      3      5      .      .      .      3     52    45    5
 194   187    36    6    3      3      3       7       6      4      5      .      .      .      3     75    54    5
 195   187    37    6    4      4      3       5       7      4      5      .      .      .      3     73    67    5
 196   187    38    6    4      4      3       5       5      5      5      .      .      .      3     78    90    6
 197   187    39    6    4      4      4       5       4      4      5      .      .      .      3     66    99    7
 198   187    40    6    4      4      4       7       7      4      5      .      .      .      3     31    56    5
 199   187    41    6    3      4      3       5       7      4      5      .      .      .      3     56    67    5
 200   187    42    6    3      4      4       5       5      5      5      .      .      .      3     49    69    5
 201   187    43    6    3      5      4       5       5      4      5      .      .      .      3     55    98    5
 202   187    44    6    4      3      3       7       7      3      5      .      .      .      3     63    59    5
 203   187    45    6    3      4      3       5       5      4      5      .      .      .      3     55    84    5
 204   187    46    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 205   188     1    6    3      3      2       5       1      6      5      .      .      .      3     59    65    6
 206   188     2    6    3      4      2       7       3      5      5      .      .      .      3     68    82    6
 207   188     3    6    3      4      2       7       3      4      5      .      .      .      3     67    64    6
 208   188     4    6    3      4      2       7       4      6      5      .      .      .      3     75    79    6
 209   188     5    6    3      4      2       7       2      4      5      .      .      .      3     79    58    6
 210   188     6    6    3      4      3       6       2      6      5      .      .      .      3     68    69    5
 211   188     7    6    4      4      2       7       2      4      5      .      .      .      3     77    73    6
 212   188     8    6    3      4      2       7       2      4      5      .      .      .      3     65    99    7
 213   188     9    6    3      4      1       7       2      4      5      .      .      .      3     85    89    7
 214   188    10    6    3      4      3       5       2      6      5      .      .      .      3     56    60    6
 215   188    11    6    4      4      2       7       3      5      5      .      .      .      3     86    75    6
 216   188    12    6    3      4      3       5       2      5      5      .      .      .      3     66    79    6
 217   189     1    6    3      4      3       5       3      5      5      .      .      .      3     34    32    4
 218   189     2    6    4      3      3       5       3      6      5      .      .      .      3     58    80    6
 219   189     3    6    3      3      3       5       3      6      5      .      .      .      1     48    46    4
 220   189     4    6    4      4      2       7       3      5      5      .      .      .      3     75    99    7
 221   189     5    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
 222   189     6    6    3      3      3       5       4      5      5      .      .      .      3     65    85    6
 223   189     7    6    2      4      3       5       3      5      5      .      .      .      1     45    33    4
 224   189     8    6    3      3      3       6       3      5      5      .      .      .      3     61    61    5
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                                                          SAS                        19:46 MONDAY, JANUARY 6, 1986    5

 OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

 225   189     9    6    3      2      2       5       3      5      5     .      .      .      3     69    58    5
 226   189    10    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 227   189    11    6    4      4      3       5       3      5      5     .      .      .      3     57    85    5
 228   189    12    6    3      3      3       5       3      5      5     .      .      .      3     49    56    5
 229   189    13    5    3      3      3       5       3      3      5     .      .      .      1     57    58    5
 230   189    14    5    3      3      3       7       4      4      5     .      .      .      3     47    75    5
 231   189    15    6    3      4      2       5       4      5      5     .      .      .      3     62    99    6
 232   189    16    6    3      4      3       5       3      5      5     .      .      .      3     62    95    6
 233   189    17    6    4      3      3       5       3      5      5     .      .      .      3     60    93    6
 234   189    18    6    4      4      4       5       .      .      .     .      .      .      .     28    44    3
 235   189    19    6    3      3      2       7       3      5      5     .      .      .      3     53    69    5
 236   189    20    6    3      3      2       7       4      5      5     .      .      .      3     63    95    6
 237   189    21    6    4      4      2       5       3      6      5     .      .      .      3     58    88    7
 238   189    22    6    3      4      2       7       2      4      5     .      .      .      3     55    54    6
 239   189    23    6    4      4      3       5       2      6      5     .      .      .      3     65    78    7
 240   189    24    6    3      3      1       7       3      5      5     .      .      .      3     76    99    8
 241   189    25    4    4      4      3       7       2      3      5     .      .      .      3     50    38    4
 242   189    26    6    3      4      2       7       3      4      5     .      .      .      3     62    70    5
 243   189    27    6    4      4      2       7       3      6      5     .      .      .      3     59    89    7
 244   189    28    6    4      4      1       7       3      6      5     .      .      .      3     68    98    6
 245   189    29    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 246   189    30    6    3      4      2       6       2      5      5     .      .      .      2     48    99    5
 247   189    31    6    5      3      2       7       3      4      5     .      .      .      3     55    89    6
 248   189    32    6    5      4      3       5       3      4      5     .      .      .      3     22    50    3
 249   189    33    6    4      4      3       5       3      4      5     .      .      .      3     61    83    6
 250   189    34    6    3      4      2       7       3      5      5     .      .      .      3     46    44    4
 251   189    35    6    3      4      2       7       3      6      5     .      .      .      3     60    92    5
 252   189    36    6    4      4      2       5       3      5      5     .      .      .      3     48    68    4
 253   189    37    6    3      4      2       5       3      5      5     .      .      .      3     44    67    4
 254   189    38    6    3      4      2       7       3      6      5     .      .      .      3     56    79    5
 255   189    39    6    4      3      2       6       3      6      5     .      .      .      3     71    80    6
 256   189    40    6    4      3      2       7       2      5      5     .      .      .      3     62    78    6
 257   189    41    6    4      4      2       5       3      5      5     .      .      .      3     54    71    5
 258   189    42    6    3      4      2       5       3      5      5     .      .      .      3     70    89    7
 259   189    43    6    3      4      2       5       3      5      5     .      .      .      3     58    99    6
 260   189    44    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 261   189    45    6    3      2      3       5       3      4      5     .      .      .      3     49    52    5
 262   189    46    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 263   189    47    6    4      4      2       5       3      4      5     .      .      .      3     24    55    4
 264   189    48    6    4      4      2       7       3      5      5     .      .      .      3     50    89    4
 265   190     1    6    6      4      2       7       2      2      5     .      .      .      1     32    46    4
 266   190     2    6    3      5      3       7       .      .      .     .      .      .      .     29    31    4
 267   190     3    6    3      4      5       5       .      .      .     .      .      .      .     16    30    2
 268   190     4    6    3      5      3       7       2      3      5     .      .      .      3     29    44    3
 269   190     5    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 270   191     1    6    4      4      2       7       5      5      5     .      .      .      3     38    85    5
 271   191     2    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 272   191     3    1    .      .      .       .       .      .      .     .      .      .      .      .     .    0
 273   191     4    6    4      5      5       5       .      .      .     .      .      .      .      7    15    2
 274   191     5    6    2      5      4       5       7      3      5     .      .      .      3     35    80    5
 275   191     6    6    3      4      3       5       5      3      5     .      .      .      3     39    79    4
 276   191     7    6    3      5      4       5       .      .      .     .      .      .      .     15    40    3
 277   191     8    6    3      4      3       5       5      4      5     .      .      .      2     25    62    5
 278   191     9    6    3      4      3       5       5      5      5     .      .      .      3     30    65    5
 279   191    10    6    3      4      3       5       6      4      5     .      .      .      3     44    58    5
 280   191    11    6    2      5      3       5       7      6      5     .      .      .      3     48    96    6
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

281   191    12    4    3      4      2       5       6      5      5      .      .      .      3     38    65    4
282   191    13    6    5      4      3       5       6      4      5      .      .      .      3     50    82    5
283   191    14    6    3      4      2       5       4      5      5      .      .      .      3     38    50    5
284   191    15    6    3      4      2       7       5      4      5      .      .      .      3     39    86    6
285   191    16    6    3      5      2       5       7      5      5      .      .      .      3     39    69    5
286   191    17    6    3      4      2       5       6      5      5      .      .      .      3     54    85    6
287   191    18    6    3      4      2       5       4      6      5      .      .      .      3     45    81    5
288   191    19    6    2      4      2       7       5      8      5      .      .      .      2     46    99    7
289   191    20    6    3      5      3       5       3      5      5      .      .      .      3     10    41    3
290   191    21    6    3      5      3       5       7      5      5      .      .      .      3     14    26    2
291   191    22    6    3      4      3       7       6      5      5      .      .      .      3     53    98    7
292   191    23    6    3      4      3       5       5      4      5      .      .      .      1     24    37    3
293   191    24    6    4      4      2       5       5      4      5      .      .      .      3     51    83    5
294   191    25    6    2      4      2       7       7      5      5      .      .      .      3     60    91    6
295   191    26    6    3      4      2       5       5      4      5      .      .      .      3     50    83    5
296   191    27    6    3      4      3       5       6      5      5      .      .      .      3     47    96    5
297   191    28    6    3      4      2       5       6      5      5      .      .      .      3     47    77    6
298   191    29    6    3      3      3       5       5      5      5      .      .      .      3     42    66    5
299   191    30    6    4      4      3       5       5      5      5      .      .      .      3     25    38    4
300   191    31    6    3      4      3       5       7      4      5      .      .      .      3     39    62    5
301   191    32    6    4      4      4       5       6      3      5      .      .      .      3     34    44    4
302   191    33    6    3      5      3       5       7      4      5      .      .      .      3     32    55    4
303   191    33    6    3      5      3       5       6      4      5      .      .      .      2     31    66    4
304   191    34    6    3      4      3       5       .      .      .      .      .      .      .     14    37    2
305   191    34    6    6      4      2       5       5      4      5      .      .      .      3     34    42    3
306   191    35    6    3      5      3       5       4      5      5      .      .      .      2     30    63    3
307   191    35    6    6      5      3       5       .      .      .      .      .      .      .     25    33    2
308   191    36    6    3      4      2       7       3      7      5      .      .      .      1     62    97    6
309   191    36    6    3      4      2       5       5      5      5      .      .      .      3     34    72    5
310   191    37    6    3      4      2       7       7      5      5      .      .      .      3     48    99    7
311   191    37    6    3      4      3       5       6      4      5      .      .      .      3     30    43    4
312   191    38    6    4      4      3       5       7      4      5      .      .      .      3     34    61    5
313   191    38    6    6      4      3       5       6      4      5      .      .      .      3     35    38    4
314   191    39    6    3      4      3       5       6      4      5      .      .      .      3     42    65    5
315   191    39    6    6      4      3       5       5      5      5      .      .      .      3     32    67    5
316   191    40    5    4      4      3       5       3      5      5      .      .      .      3     40    69    5
317   191    40    6    4      4      3       5       6      4      5      .      .      .      3     28    34    4
318   191    41    6    3      3      2       7       6      6      5      .      .      .      3     40    99    7
319   191    41    6    6      4      4       5       6      4      5      .      .      .      1     28    44    3
320   191    42    6    3      4      2       5       7      4      5      .      .      .      3     45    74    6
321   191    42    6    6      4      3       5       2      4      5      .      .      .      3     35    37    4
322   191    43    6    3      4      3       5       7      4      5      .      .      .      3     42    69    5
323   191    43    6    6      4      3       5       2      5      5      .      .      .      3     24    61    5
324   191    44    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
325   191    44    6    3      4      2       5       4      5      6      6      0      0      3     33    77    7
326   191    45    6    3      3      3       7       4      6      5      .      .      .      4     28    93    7
327   191    45    6    6      4      3       5       3      5      5      .      .      .      3     30    69    6
328   191    46    6    3      5      2       5       4      4      5      .      .      .      3     30    90    6
329   191    46    6    3      4      3       5       3      4      5      .      .      .      3     32    63    5
330   191    47    6    4      4      3       5       6      4      5      .      .      .      3     33    84    5
331   191    47    6    6      5      2       5       2      5      5      .      .      .      1     40    48    3
332   191    48    2    4      4      3       5       .      .      .      .      .      .      .      6     4    1
333   191    48    6    6      5      4       5       .      .      .      .      .      .      .     15    31    3
334   191    49    6    3      4      3       5       5      5      5      .      .      .      3     35    87    6
335   191    49    6    3      4      2       5       5      4      5      .      .      .      3     25    33    4
336   191    50    6    4      3      3       5       6      4      6      6      0      0      3     38    84    6
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                                              SAS                          19:46 MONDAY, JANUARY 6, 1986     7

OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

337   191     50   6      3      5       2       5      4       5     5      .      .      .      3    31    68    5
338   191     51   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
339   191     51   6      3      4       2       5      6       5     5      .      .      .      3    46    51    4
340   191     52   6      4      3       3       5      5       5     5      .      .      .      3    49    66    6
341   191     52   6      4      3       3       5      4       3     5      .      .      .      2    37    47    4
342   191     53   6      3      4       3       5      6       5     5      .      .      .      2    18    56    4
343   191     54   6      6      5       3       5      .       .     .      .      .      .      .    32    48    4
344   191     55   6      3      4       5       5      .       .     .      .      .      .      .    10    17    2
345   191     56   6      3      4       2       5      3       4     5      .      .      .      3    36    69    4
346   191     57   6      6      5       3       5      .       .     .      .      .      .      .    23    38    4
347   191     58   6      6      5       3       5      5       4     5      .      .      .      3    24    58    4
348   191     59   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
349   191     60   6      4      4       3       5      7       5     5      .      .      .      3    42    70    5
350   191     61   6      4      4       4       5      2       2     5      .      .      .      1    17    18    1
351   191     62   6      3      4       3       5      6       3     5      .      .      .      3    36    44    5
352   191     63   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
353   191     64   6      3      4       3       5      4       5     5      .      .      .      3    30    54    4
354   191     65   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
355   191     66   6      4      4       2       7      6       5     5      .      .      .      2    42    41    5
356   191     67   6      4      4       2       7      3       5     5      .      .      .      2    31    66    6
357   191     68   6      3      4       3       7      7       5     5      .      .      .      3    43    68    6
358   191     69   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
359   191     70   6      3      4       2       7      3       5     5      .      .      .      3    43    88    6
360   191     71   6      3      4       3       7      4       6     5      .      .      .      3    52    62    5
361   191     72   6      3      4       3       5      6       5     5      .      .      .      3    41    71    5
362   191     73   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
363   191     74   6      4      4       4       5      .       .     .      .      .      .      .     9    26    2
364   191     75   6      2      4       2       5      5       5     5      .      .      .      2    41    66    7
365   191     76   6      4      4       3       5      6       4     5      .      .      .      3    30    48    5
366   191     77   6      4      5       3       5      3       4     5      .      .      .      3    24    53    4
367   191     78   6      3      4       2       5      4       5     5      .      .      .      3    36    66    5
368   191     79   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
369   191     80   6      3      5       3       5      7       4     5      .      .      .      1    39    65    4
370   191     81   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
371   191     82   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
372   191     83   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
373   191     84   6      3      4       2       7      7       4     5      .      .      .      3    62    91    7
374   191     85   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
375   191     86   6      4      4       3       5      4       3     5      .      .      .      3    28    41    3
376   191     87   6      3      4       2       5      6       5     5      .      .      .      3    49    81    4
377   191     88   4      3      4       3       5      .       .     .      .      .      .      .    22    30    3
378   191     89   6      3      5       2       5      5       4     5      .      .      .      3    40    52    4
379   191     90   6      2      5       3       5      6       4     5      .      .      .      3    37    99    6
380   191     91   6      4      5       2       5      6       4     5      .      .      .      3    42    47    6
381   191     92   6      2      5       3       5      6       4     5      .      .      .      3    37    55    5
382   191     93   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
383   191     94   6      3      3       2       5      4       6     5      .      .      .      3    46    94    5
384   191     95   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
385   191     96   6      3      4       2       5      6       5     5      .      .      .      2    48    79    5
386   191     97   6      3      4       3       5      7       6     6      6      0      0      3    46    86    6
387   191     98   6      4      4       2       7      7       4     5      .      .      .      3    37    64    5
388   191     99   6      4      3       3       6      3       4     5      .      .      .      3    39    48    4
389   191    100   1      .      .       .       .      .       .     .      .      .      .      .     .     .    0
390   191    101   6      3      5       3       5      4       4     5      .      .      .      3    25    54    5
391   191    102   6      3      5       3       5      6       4     5      .      .      .      3    32    61    5
392   191    103   6      3      4       4       5      6       4     5      .      .      .      3    31    70    5
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

393   191    104   6    3      4      3       5       4      4      5      .      .      .      3     41    47    3
394   191    105   6    3      5      3       5       6      6      5      .      .      .      3     35    54    5
395   191    106   6    2      5      3       5       6      5      5      .      .      .      1     45    99    7
396   191    107   4    4      4      2       7       6      5      5      .      .      .      3     37    97    6
397   191    108   6    3      5      4       5       4      5      5      .      .      .      3     15    36    3
398   191    109   1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
399   191    110   6    3      4      2       7       6      5      5      .      .      .      1     40    84    4
400   191    111   6    3      4      2       7       7      4      5      .      .      .      3     53    91    6
401   191    112   6    3      4      3       5       6      5      5      .      .      .      3     47    68    5
402   191    113   6    5      5      4       5       3      4      5      .      .      .      3     11    11    2
403   191    114   6    4      4      4       5       .      .      .      .      .      .      .     16    37    4
404   191    115   6    4      4      3       5       .      .      .      .      .      .      .     11    38    4
405   191    116   6    3      4      3       5       5      5      5      .      .      .      3     24    52    5
406   191    117   1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
407   191    118   6    3      4      4       5       6      4      5      .      .      .      3     28    32    5
408   191    119   6    4      4      3       5       3      4      5      .      .      .      1     14    45    5
409   191    120   6    3      5      3       5       3      5      5      .      .      .      3     22    42    6
410   191    121   6    3      4      3       5       3      5      5      .      .      .      3     20    41    5
411   191    122   6    3      5      4       5       .      .      .      .      .      .      .     29    21    4
412   191    123   6    3      4      3       5       .      .      .      .      .      .      .     22    33    4
413   191    124   6    3      4      3       5       5      4      5      .      .      .      3     37    40    5
414   191    125   6    3      4      4       7       .      .      .      .      .      .      .     22    34    4
415   191    126   6    3      3      3       5       4      5      5      .      .      .      2     20    73    6
416   191    127   1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
417   191    128   6    3      4      3       5       2      4      5      .      .      .      3     27    51    6
418   191    129   6    3      4      2       5       3      4      5      .      .      .      2     31    29    4
419   191    130   6    4      3      3       5       7      4      5      .      .      .      3     32    60    6
420   191    131   6    2      5      3       7       .      .      .      .      .      .      .     26    71    5
421   191    132   6    4      4      3       5       5      4      5      .      .      .      3     39    51    5
422   191    133   6    2      4      2       5       4      5      5      .      .      .      3     25    52    5
423   191    134   6    4      4      3       5       6      4      5      .      .      .      3     20    42    5
424   191    135   6    3      5      4       5       .      .      .      .      .      .      .     17    18    3
425   191    136   6    4      4      3       5       .      .      .      .      .      .      .     15    24    3
426   191    137   6    4      4      3       6       3      4      5      .      .      .      3     24    39    5
427   191    138   6    8      4      3       5       4      5      5      .      .      .      3     30    41    5
428   191    139   1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
429   191    140   1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
430   191    141   6    3      5      3       5       .      .      .      .      .      .      .     27    43    4
431   191    142   6    4      5      3       5       7      4      5      .      .      .      2     41    52    4
432   191    143   6    4      5      3       5       4      5      5      .      .      .      3     33    50    5
433   191    144   6    3      5      3       5       6      5      5      .      .      .      3     31    70    6
434   191    145   6    3      4      3       5       7      4      5      .      .      .      3     36    67    6
435   191    146   6    3      4      3       5       7      4      5      .      .      .      3     46    53    5
436   191    147   6    3      5      3       5       7      5      5      .      .      .      3     35    68    6
437   192      1   6    3      4      3       7       5      5      5      .      .      .      3     27    73    5
438   192      2   6    3      4      2       5       4      5      5      .      .      .      2     37    87    5
439   193      1   6    3      4      3       5       6      4      5      .      .      .      3     25    63    5
440   193      2   6    3      4      3       5       7      4      5      .      .      .      3     23    48    4
441   193      3   6    3      5      3       5       .      .      .      .      .      .      .     25    46    4
442   193      4   1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
443   193      5   6    3      4      3       5       4      4      5      .      .      .      3     34    55    5
444   194      1   6    3      5      2       5       .      .      .      .      .      .      .     24    40    3
445   194      2   6    4      4      2       5       3      6      5      .      .      .      3     32    49    4
446   194      3   6    3      4      2       7       2      5      5      .      .      .      3     42    57    5
447   194      4   6    3      4      2       5       4      5      5      .      .      .      3     42    69    5
448   194      5   6    3      5      3       5       5      3      5      .      .      .      2     33    68    4
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

449   194     6    6    3      5      3       5       4      4      5      .      .      .      3     39    76    6
450   194     7    6    4      5      4       5       4      3      5      .      .      .      2     24    57    5
451   194     8    6    3      4      3       5       .      .      .      .      .      .      .     20    36    3
452   194     9    6    3      4      4       5       5      4      5      .      .      .      1     23    67    3
453   194    10    5    3      4      4       5       .      .      .      .      .      .      .      9    24    2
454   194    11    6    3      4      2       5       5      5      5      .      .      .      3     27    72    5
455   194    12    6    3      4      3       5       3      4      5      .      .      .      3     46    61    5
456   194    13    6    3      5      3       5       3      4      5      .      .      .      3     41    65    5
457   194    14    6    3      4      3       5       .      .      .      .      .      .      .     16    27    4
458   194    15    6    3      5      2       5       5      5      5      .      .      .      2     42    51    5
459   194    16    6    3      5      3       5       4      6      5      .      .      .      3     32    80    5
460   194    17    6    4      4      4       5       .      .      .      .      .      .      .     20    35    4
461   194    18    6    3      4      3       5       .      .      .      .      .      .      .     20    32    4
462   194    19    6    4      4      3       5       6      4      7      7      0      0      3     30    40    5
463   194    20    6    5      4      3       5       .      .      .      .      .      .      .     11    38    3
464   194    21    6    3      4      3       5       .      .      .      .      .      .      .     18    48    3
465   194    22    6    4      4      2       5       .      .      .      .      .      .      .     21    51    3
466   194    23    6    4      4      3       5       6      5      5      .      .      .      3     34    55    5
467   194    24    6    3      4      3       5       .      .      .      .      .      .      .     15    34    3
468   194    25    6    3      5      3       5       .      .      .      .      .      .      .     18    38    4
469   194    26    6    3      4      3       5       3      4      5      .      .      .      3     24    41    4
470   194    27    6    3      4      3       5       4      5      5      .      .      .      2     31    65    6
471   194    28    6    3      5      3       5       .      .      .      .      .      .      .     26    71    6
472   194    29    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
473   194    30    6    3      4      4       5       6      4      5      .      .      .      3     29    45    5
474   194    31    6    6      5      3       7       .      .      .      .      .      .      .     22    31    3
475   194    32    6    4      3      3       5       5      4      4      .      .      .      3     21    39    5
476   194    33    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
477   194    34    6    3      4      3       5       6      5      5      .      .      .      3     30    55    5
478   194    35    6    4      5      3       5       5      5      5      .      .      .      3     40    85    5
479   194    36    6    3      4      3       5       3      5      5      .      .      .      3     39    82    5
480   194    37    6    3      5      2       5       5      5      5      .      .      .      3     22    51    3
481   194    38    6    3      5      3       5       5      5      5      .      .      .      3     39    77    5
482   194    39    6    3      5      2       5       4      5      5      .      .      .      3     41    74    5
483   194    40    6    3      5      3       5       4      4      5      .      .      .      3     38    81    6
484   194    41    6    3      5      3       5       2      3      5      .      .      .      3     28    63    4
485   194    42    6    3      5      2       5       6      7      5      .      .      .      3     57    93    6
486   194    43    6    3      5      3       5       6      5      5      .      .      .      3     36    62    5
487   195     1    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
488   195     2    6    3      4      3       5       2      4      5      .      .      .      1      8    35    2
489   195     3    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
490   195     4    6    3      5      3       5       .      .      .      .      .      .      .     19    10    1
491   195     5    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
492   195     6    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
493   195     7    6    3      4      3       5       5      6      5      .      .      .      2     17    87    6
494   195     8    6    3      5      3       5       3      3      5      .      .      .      3     13    49    4
495   195     9    6    3      4      3       5       .      .      .      .      .      .      .     12    36    3
496   195    10    6    3      4      3       5       3      4      5      .      .      .      3     17    75    4
497   195    11    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
498   195    12    6    3      5      4       5       .      .      .      .      .      .      .     12    37    3
499   195    13    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
500   195    14    6    3      4      4       5       .      .      .      .      .      .      .     13    41    4
501   195    15    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
502   195    16    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
503   195    17    6    3      5      5       5       .      .      .      .      .      .      .      7    14    2
504   195    18    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

505  195    19    6     3      5      4       5       3      3      5     .      .      .      3     11    21    3
506  195    20    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
507  195    21    6     3      4      3       5       .      .      .     .      .      .      .     12    55    4
508  195    22    6     3      4      3       5       5      3      5     .      .      .      3     11    47    4
509  195    23    6     3      4      3       5       .      .      .     .      .      .      .     12    36    3
510  195    24    6     3      4      2       5       .      .      .     .      .      .      .     20    37    2
511  195    25    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
512  195    26    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
513  195    27    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
514  195    28    6     4      5      3       5       3      3      5     .      .      .      3     25    50    5
515  195    29    6     2      4      3       5       4      5      5     .      .      .      3     12    57    4
516  195    30    6     3      5      5       5       3      3      5     .      .      .      3      9    18    2
517  195    31    6     3      5      4       5       .      .      .     .      .      .      .      9    31    3
518  195    32    6     3      5      3       5       .      .      .     .      .      .      .      8    42    3
519  195    33    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
520  195    34    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
521  195    35    6     6      5      4       5       .      .      .     .      .      .      .     14    10    2
522  195    36    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
523  195    37    6     6      5      4       5       .      .      .     .      .      .      .     11    27    3
524  195    38    6     6      5      5       5       .      .      .     .      .      .      .      4    18    2
525  195    39    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
526  195    40    5     6      5      5       5       .      .      .     .      .      .      .     17    13    2
527  195    41    6     6      5      4       5       5      4      5     .      .      .      3     25    55    5
528  195    42    5     6      5      3       5       .      .      .     .      .      .      .     23    27    4
529  195    43    6     6      5      3       5       .      .      .     .      .      .      .     22    34    3
530  195    44    6     6      5      3       5       .      .      .     .      .      .      .     11    37    3
531  195    45    6     6      5      3       5       3      4      5     .      .      .      3     17    36    3
532  196     1    6     3      4      2       5       6      5      5     .      .      .      3     69    99    8
533  196     2    6     4      4      2       5       4      4      5     .      .      .      1     72    80    7
534  196     3    6     3      4      3       5       6      4      5     .      .      .      1     57    84    6
535  196     4    6     3      4      2       5       6      5      5     .      .      .      3     59    70    6
536  196     5    6     3      4      1       5       5      4      5     .      .      .      2     99    99    9
537  196     6    6     4      4      3       5       4      5      5     .      .      .      3     90    80    8
538  196     7    6     2      4      2       5       6      4      5     .      .      .      1     78    83    7
539  196     8    6     4      3      3       5       4      3      5     .      .      .      3     77    95    7
540  196     9    6     4      4      2       6       4      5      5     .      .      .      2     80    99    7
541  196    10    6     2      4      3       5       5      4      5     .      .      .      2     65    99    8
542  196    11    6     3      5      3       7       4      5      5     .      .      .      2     85    99    8
543  196    12    6     2      4      3       7       6      5      5     .      .      .      3     87    76    7
544  196    13    6     4      4      3       5       6      4      5     .      .      .      2     83    97    8
545  196    14    6     4      4      2       6       5      5      5     .      .      .      3     80    97    8
546  196    15    6     3      4      3       5       6      5      5     .      .      .      3     74    95    8
547  196    16    6     3      4      3       5       6      5      5     .      .      .      3     75    81    7
548  196    17    6     3      4      3       5       5      3      5     .      .      .      3     71    99    8
549  196    18    6     3      4      3       5       7      5      5     .      .      .      3     62    80    7
550  196    19    6     2      4      3       5       6      4      5     .      .      .      3     55    84    5
551  196    20    6     3      4      3       5       3      4      5     .      .      .      1     48    63    5
552  196    21    6     3      3      3       7       7      5      5     .      .      .      3     55    62    5
553  196    22    6     3      4      3       5       5      4      5     .      .      .      1     68    85    6
554  196    23    6     3      4      3       5       5      5      5     .      .      .      3     47    55    5
555  196    24    6     4      4      2       7       7      6      5     .      .      .      3     60    99    7
556  196    25    6     3      4      3       5       4      3      5     .      .      .      1     84    75    7
557  196    26    6     4      4      2       5       4      5      5     .      .      .      2     55    79    6
558  196    27    6     3      4      2       7       4      6      5     .      .      .      3     72    88    7
559  196    28    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
560  196    29    6     3      4      2       5       4      4      5     .      .      .      3     64    68    5
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

561   196    30    6    3      4      2       5       4      2      5      .      .      .      3     60    61    5
562   196    31    6    4      3      3       5       6      4      5      .      .      .      3     50    67    5
563   196    32    6    3      4      2       5       5      4      5      .      .      .      3     57    99    6
564   197     1    6    3      3      2       5       5      4      5      .      .      .      2     68    62    7
565   197     2    6    3      4      2       5       3      5      5      .      .      .      3     57    99    7
566   197     3    6    2      3      2       5       5      5      5      .      .      .      3     70    98    8
567   197     4    6    3      2      3       5       7      5      5      .      .      .      3     73    78    7
568   197     5    6    3      3      3       5       3      5      5      .      .      .      3     62    78    6
569   197     6    6    3      3      3       5       6      5      5      .      .      .      3     49    64    5
570   197     7    6    3      4      2       5       3      6      5      .      .      .      3     70    79    6
571   197     8    6    3      3      2       5       5      5      5      .      .      .      1     78    77    6
572   197     9    6    3      4      3       5       7      5      5      .      .      .      1     45    60    5
573   197    10    6    3      3      3       5       6      4      5      .      .      .      3     58    66    6
574   197    11    6    4      3      2       5       4      6      5      .      .      .      3     77    79    7
575   197    12    6    4      4      3       5       7      5      5      .      .      .      3     54    49    4
576   197    13    6    4      3      3       5       6      4      5      .      .      .      2     60    90    6
577   197    14    6    3      4      2       5       3      5      5      .      .      .      3     46    65    4
578   197    15    6    3      4      1       5       4      5      5      .      .      .      3     70    99    7
579   197    16    6    3      4      2       5       6      4      5      .      .      .      2     50    77    5
580   197    17    6    3      4      3       5       4      4      5      .      .      .      3     50    57    5
581   197    18    6    3      3      1       5       5      5      5      .      .      .      3     76    96    6
582   197    19    6    3      3      1       5       6      5      5      .      .      .      3     88    93    7
583   197    20    6    3      3      3       5       7      4      5      .      .      .      3     71    75    6
584   197    21    6    4      3      2       5       6      5      5      .      .      .      3     77    83    6
585   197    22    6    3      3      2       5       6      3      5      .      .      .      3     59    99    5
586   197    23    6    3      4      4       5       .      .      .      .      .      .      .     36    22    2
587   197    24    6    4      4      3       5       6      5      5      .      .      .      3     70    60    5
588   198     1    6    3      3      2       5       3      5      5      .      .      .      3     97    99    9
589   198     2    6    3      3      2       5       3      5      5      .      .      .      2     75    80    8
590   198     3    6    3      3      2       5       3      6      5      .      .      .      3     85    90    9
591   199     1    5    2      4      4       5       6      4      5      .      .      .      3     50    59    4
592   199     2    6    4      3      3       5       4      5      5      .      .      .      3     50    87    5
593   199     3    6    3      4      3       5       4      5      5      .      .      .      1     55    92    6
594   199     4    6    4      4      3       5       5      3      5      .      .      .      3     17    24    2
595   199     5    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
596   200     1    6    4      2      1       7       7      6      5      .      .      .      3     74    78    7
597   200     2    6    4      3      3       5       6      3      5      .      .      .      3     62    83    6
598   201     1    6    4      4      4       5       .      .      .      .      .      .      .     17    47    2
599   201     2    5    3      4      3       5       4      4      5      .      .      .      3     45    62    4
600   201     3    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
601   201     4    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
602   201     5    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
603   201     6    5    3      4      3       5       5      4      5      .      .      .      2     41    79    5
604   201     7    6    3      4      3       5       3      4      5      .      .      .      1     18    43    4
605   201     8    6    3      4      3       5       3      4      5      .      .      .      3     24    54    4
606   201     9    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
607   201    10    6    4      4      4       5       .      .      .      .      .      .      .     15    27    1
608   201    11    6    3      5      3       5       3      4      5      .      .      .      3     20    33    4
609   202     1    6    6      6      4       5       .      .      .      .      .      .      .     23    26    2
610   202     2    6    3      5      3       5       3      4      5      .      .      .      3     39    88    5
611   202     3    6    3      4      2       5       3      4      5      .      .      .      3     40    51    6
612   202     4    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
613   202     5    6    3      4      2       5       2      4      5      .      .      .      1     42    52    5
614   202     6    6    3      4      2       5       5      5      5      .      .      .      3     34    77    6
615   202     7    6    6      5      3       5       .      .      .      .      .      .      .     32    69    5
616   202     8    1    .      .      .       .       .      .      .      .      .      .      .      .     .    0
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

617  202     9    6     6      5      4       5       .      .      .     .      .      .      .      23    33    3
618  202    10    6     2      4      2       5       3      5      5     .      .      .      3      41    47    4
619  202    11    6     4      5      4       5       6      4      5     .      .      .      2      55    77    5
620  202    12    6     2      4      2       5       6      5      5     .      .      .      3      33    73    5
621  202    13    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
622  202    14    6     3      4      3       5       6      4      5     .      .      .      2      48    97    6
623  203     1    6     5      3      3       5       2      3      5     .      .      .      1      15    34    2
624  203     2    2     3      4      5       5       .      .      .     .      .      .      .      15    16    1
625  203     3    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
626  203     4    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
627  203     5    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
628  203     6    6     3      4      3       5       2      5      5     .      .      .      1      33    77    6
629  203     7    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
630  203     8    6     3      4      3       5       3      3      5     .      .      .      3      30    55    5
631  203     9    6     5      4      4       5       .      .      .     .      .      .      .      12    12    1
632  203    10    6     2      4      2       7       2      4      5     .      .      .      3      36    75    6
633  203    11    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
634  203    12    6     3      4      4       5       2      4      5     .      .      .      3      17    41    4
635  203    13    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
636  203    14    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
637  203    15    6     3      4      3       6       2      3      5     .      .      .      3      24    59    5
638  203    16    6     4      4      3       5       .      .      .     .      .      .      .       9    42    3
639  203    17    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
640  203    18    6     3      4      3       5       2      4      5     .      .      .      3       6    32    4
641  203    19    6     6      4      3       5       .      .      .     .      .      .      .      30    27    4
642  204     1    4     3      2      3       5       .      .      .     .      .      .      .      32    42    5
643  204     2    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
644  204     3    6     2      4      4       5       5      3      5     .      .      .      2      51    58    5
645  204     4    6     4      4      3       5       .      .      .     .      .      .      .      33    33    3
646  204     5    6     4      4      2       5       6      5      7     7      0      0      3      50    58    6
647  204     6    6     3      4      3       5       3      5      7     7      0      0      3      44    68    5
648  204     7    6     2      4      2       5       5      4      5     .      .      .      1      59    79    6
649  204     8    6     3      4      4       5       3      3      5     .      .      .      3      43    61    5
650  204     9    6     2      4      3       5       7      5      5     .      .      .      1      68    76    6
651  204    10    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
652  205     1    6     3      4      3       5       2      5      5     .      .      .      3      43    99    6
653  205     2    5     4      4      4       5       .      .      .     .      .      .      .      15    38    3
654  205     3    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
655  205     4    4     3      4      3       5       3      5      5     .      .      .      2      29    49    4
656  205     5    6     3      3      3       5       2      5      5     .      .      .      3      33    66    5
657  205     6    6     3      3      2       7       2      4      5     .      .      .      3      41    67    5
658  205     7    6     3      3      2       5       2      5      5     .      .      .      3      44    77    7
659  205     8    6     4      4      4       7       .      .      .     .      .      .      .      12    56    3
660  205     9    6     2      5      2       7       4      5      5     .      .      .      2      70    99    7
661  205    10    6     4      4      3       5       2      4      5     .      .      .      3      34    62    5
662  205    11    6     3      4      3       5       2      5      5     .      .      .      3      54    75    5
663  205    12    6     3      4      3       7       2      4      5     .      .      .      3      54    75    5
664  205    13    6     4      4      2       7       2      5      5     .      .      .      3      70    94    7
665  205    14    6     2      4      2       7       2      6      5     .      .      .      3      58    98    7
666  205    15    6     3      4      3       5       2      7      5     .      .      .      3      53    99    8
667  205    16    3     4      4      3       5       .      .      .     .      .      .      .      16    13    2
668  205    17    1     .      .      .       .       .      .      .     .      .      .      .       .     .    0
669  205    18    6     3      4      2       5       2      5      5     .      .      .      3      40    99    6
670  205    19    6     3      4      2       7       3      6      5     .      .      .      3      57    60    5
671  205    20    6     3      4      2       5       3      6      5     .      .      .      3      43    80    5
672  205    21    6     3      4      3       7       2      5      5     .      .      .      3      38    99    7
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                                                        SAS                          19:46 MONDAY, JANUARY 6, 1986   13

OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

673  205    22    6     4      5      3       5       3      5      5     .      .      .      3     29    55    4
674  205    23    6     3      4      3       6       2      6      5     .      .      .      3     70    76    6
675  205    24    5     4      4      3       5       2      5      5     .      .      .      3     35    50    4
676  206     1    6     6      5      3       7       3      4      5     .      .      .      3     68    89    7
677  207     1    6     3      4      1       6       5      6      5     .      .      .      1     76    99    7
678  207     2    6     3      4      2       7       6      4      5     .      .      .      1     64    57    5
679  207     3    6     3      4      3       5       4      3      5     .      .      .      3     56    81    7
680  207     4    6     3      4      3       5       3      4      5     .      .      .      3     41    40    3
681  207     5    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
682  207     6    6     3      4      2       5       .      .      .     .      .      .      .     37    26    4
683  207     7    6     3      4      2       5       4      4      5     .      .      .      3     44    93    5
684  208     1    6     5      3      4       5       4      4      5     .      .      .      3     44    83    6
685  208     2    6     5      4      3       7       4      4      5     .      .      .      3     65    86    7
686  208     3    6     4      4      3       7       3      4      5     .      .      .      1     77    73    7
687  209     1    6     3      4      3       5       4      5      5     .      .      .      3     84    74    7
688  209     2    6     3      4      2       7       3      4      5     .      .      .      3     67    95    7
689  209     3    6     4      4      2       5       3      6      5     .      .      .      3     76    71    7
690  209     4    6     2      4      1       7       3      6      5     .      .      .      3     68    80    7
691  209     5    6     3      4      2       5       3      5      5     .      .      .      3     75    87    7
692  209     6    6     4      4      3       5       4      5      5     .      .      .      2     77    67    7
693  209     7    6     2      4      2       7       4      5      5     .      .      .      3     82    77    7
694  209     8    6     2      4      3       5       3      6      5     .      .      .      2     60    56    7
695  209     9    6     3      3      1       5       4      3      5     .      .      .      3     85    78    7
696  209    10    6     3      4      3       5       3      5      5     .      .      .      3     80    99    7
697  209    11    6     4      4      2       7       3      5      5     .      .      .      3     85    95    7
698  209    12    6     3      4      2       7       2      5      5     .      .      .      3     82    88    7
699  209    13    6     2      5      3       7       3      4      5     .      .      .      3     71    92    7
700  209    14    6     4      4      2       7       3      4      5     .      .      .      3     59    85    6
701  209    15    6     3      4      2       7       5      5      5     .      .      .      2     80    99    8
702  209    16    6     3      4      2       5       3      4      5     .      .      .      3     66    58    5
703  209    17    6     3      4      2       7       3      4      5     .      .      .      2     78    98    8
704  209    18    6     3      4      2       6       2      4      5     .      .      .      3     66    75    7
705  209    19    6     3      5      2       5       2      3      5     .      .      .      2     59    86    5
706  209    20    6     2      5      3       6       3      4      5     .      .      .      3     47    59    5
707  209    21    6     4      4      2       5       5      4      5     .      .      .      3     95    99    9
708  209    22    6     5      3      3       5       3      3      5     .      .      .      2     44    57    5
709  209    23    6     3      4      2       7       3      5      5     .      .      .      3     78    99    8
710  209    24    6     3      4      3       5       3      5      5     .      .      .      3     58    99    8
711  209    25    6     3      5      3       5       3      4      5     .      .      .      3     64    98    7
712  209    26    6     3      4      2       6       3      5      5     .      .      .      3     67    67    6
713  209    27    6     3      4      3       5       3      4      5     .      .      .      3     61    77    6
714  209    28    6     4      5      3       5       3      5      5     .      .      .      1     62    77    6
715  209    29    6     2      4      2       7       2      6      5     .      .      .      3     61    99    7
716  209    30    1     .      .      .       .       .      .      .     .      .      .      .      .     .    0
717  209    31    6     3      5      2       7       4      5      5     .      .      .      3     69    70    6
718  209    32    6     3      4      3       5       3      4      5     .      .      .      1     59    99    5
719  210     1    3     3      4      3       5       3      4      5     .      .      .      3     36    49    3
720  210     2    6     4      4      3       5       3      4      5     .      .      .      3     44    99    7
721  210     3    6     3      4      3       5       3      4      5     .      .      .      3     46    89    7
722  210     4    6     4      4      4       5       2      4      5     .      .      .      2     18    32    3
723  210     5    6     3      4      3       5       3      4      5     .      .      .      3     46    87    6
724  210     6    6     3      4      3       5       3      4      5     .      .      .      3     35    70    5
725  210     7    6     2      4      3       5       .      .      .     .      .      .      .     31    29    4
726  210     8    6     4      4      3       5       3      5      5     .      .      .      3     47    71    6
727  210     9    6     4      3      2       5       2      5      5     .      .      .      3     63    96    6
728  210    10    6     3      4      3       5       2      4      5     .      .      .      3     22    23    3
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                                                   SAS                        19:46 MONDAY, JANUARY 6, 1986   14

 OBS  CODE  PLNUM   WI  LFCOL  LFPUB LFSIZE NUMLFL  FLCOL FLDIAM   NPET  NLPET  NMPET  NSPET  PETOV   HGHT   WDTH    VIG

 729   210     11    6      2      5      3      5      3      5      5      .      .      .      3     89     99      8
 730   210     12    6      3      4      3      5      3      4      5      .      .      .      3     23     48      3
 731   210     13    6      3      4      2      5      3      4      5      .      .      .      3     73     87      7
 732   210     14    6      3      4      4      5      3      4      5      .      .      .      3     39     54      3
 733   210     15    6      3      4      2      5      3      4      5      .      .      .      2     76     99      7
 734   210     16    6      4      4      2      5      2      4      5      .      .      .      3     50     46      5
 735   210     17    1      .      .      .      .      .      .      .      .      .      .      .      .      .      0
 736   210     18    6      4      4      3      5      2      6      5      .      .      .      3     46     77      5
 737   210     19    6      3      5      3      7      2      5      5      .      .      .      3     66     71      6
 738   210     20    6      3      4      3      5      2      4      5      .      .      .      3     30     28      3
 739   210     21    6      4      4      3      5      3      6      5      .      .      .      3     68     89      7
 740   210     22    6      6      5      4      5      3      3      5      .      .      .      3     44     77      5
 741   210     23    4      3      4      3      5      3      4      5      .      .      .      3     29     61      4
 742   210     24    4      3      4      3      7      3      4      5      .      .      .      3     48     71      5
 743   210     25    6      3      4      4      5      2      4      5      .      .      .      3     22     72      4
 744   210     26    6      3      4      4      5      .      .      .      .      .      .      .     20     35      3
 745   210     27    4      4      4      4      5      2      4      5      .      .      .      3     25     53      5
 746   210     28    3      3      5      4      7      2      4      5      .      .      .      3     34     48      4
 747   210     29    3      3      4      3      7      2      3      5      .      .      .      3     33     32      4
 748   211      1    6      4      2      2      5      7      3      5      .      .      .      3     51     45      5
 749   211      2    6      4      4      4      5      .      .      .      .      .      .      .     35     29      4
 750   211      3    6      4      4      3      5      7      4      5      .      .      .      3     33     46      4
 751   212      1    6      3      5      3      5      4      4      5      .      .      .      1     50     78      6
 752   212      2    6      3      4      2      7      4      6      5      .      .      .      3     68     99      7
 753   213      1    6      6      5      4      7      2      4      5      .      .      .      2     24     42      5
 754   213      2    1      .      .      .      .      .      .      .      .      .      .      .      .      .      0
 755   213      3    6      6      5      5      7      .      .      .      .      .      .      .     33     18      2
 756   213      4    2      6      5      5      7      .      .      .      .      .      .      .     11     12      1
 757   213      5    1      .      .      .      .      .      .      .      .      .      .      .      .      .      0
 758   213      6    5      3      5      4      9      2      4      5      .      .      .      3     43     71      6
 759   213      7    6      3      5      4      7      2      2      5      .      .      .      1     19     35      4
 760   213      8    6      6      5      4      7      .      .      .      .      .      .      .     26     11      2
 761   214      1    6      3      4      3      7      2      4      5      .      .      .      3     43     90      6
 762   214      2    6      2      3      3      5      2      5      5      .      .      .      3     46     97      7
 763   214      3    6      5      3      3      7      2      4      5      .      .      .      3     59     99      7
 764   214      4    6      4      3      3      7      2      5      5      .      .      .      3     63     63      6
 765   214      5    6      2      3      3      7      3      5      5      .      .      .      3     60     99      7
 766   214      6    6      5      2      3      5      3      4      7      6      1      0      3     50     70      5
 767   214      7    6      4      3      3      5      2      5      5      .      .      .      3     20     33      4
 768   214      8    6      3      4      3      7      2      6      5      .      .      .      3     76     99      7
 769   214      9    6      3      3      3      6      2      5      5      .      .      .      1     59     98      6
 770   214     10    1      .      .      .      .      .      .      .      .      .      .      .      .      .      0
 771   214     11    .      3      .      4      5      3      5      5      .      .      .      3     31     43      5
 772   214     12    .      3      .      4      6      3      4      5      .      .      .      3     45     47      5
 773   215      1    6      3      4      2      5      3      6      5      .      .      .      1     68     99      8
 774   215      2    6      3      4      3      7      3      4      5      .      .      .      3     30     55      5
 775   215      3    6      3      5      2      5      2      4      5      .      .      .      3     55     80      5
 776   215      4    6      4      4      4      5      3      6      5      .      .      .      3     40     64      4
 777   215      5    1      .      .      .      .      .      .      .      .      .      .      .      .      .      0
 778   215      6    6      3      4      3      5      2      4      5      .      .      .      3     51     72      6
 779   215      7    6      4      3      3      5      2      4      5      .      .      .      3     47     94      5
 780   215      8    5      4      4      2      5      2      5      5      .      .      .      3     57     82      6
 781   215      9    4      3      4      2      7      2      6      5      .      .      .      3     59     65      5
 782   215     10    6      4      4      2      5      2      4      5      .      .      .      3     60     99      5
 783   215     11    6      3      4      5      5      .      .      .      .      .      .      .     10      7      1
 784   215     12    6      4      4      2      5      1      6      5      .      .      .      3     49     79      6
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

785  215    13    6     2      4      2       5       2      7      5      .      .      .      3     52    82    6
786  215    14    6     2      5      3       7       3      6      5      .      .      .      3     66    85    6
787  215    15    6     4      5      2       5       2      5      5      .      .      .      3     51    79    5
788  215    16    6     4      3      2       7       3      7      5      .      .      .      1     71    90    6
789  215    17    6     3      4      2       7       3      7      5      .      .      .      2     72    99    7
790  216     1    6     3      5      3       5       4      3      5      .      .      .      1     28    50    4
791  216     2    5     3      4      2       5       6      4      5      .      .      .      2     56    75    5
792  216     3    6     6      5      3       5       5      5      5      .      .      .      3     47    88    6
793  216     4    6     6      5      3       5       3      5      5      .      .      .      3     28    85    5
794  216     5    6     3      5      3       5       2      5      5      .      .      .      3     51    96    6
795  216     6    6     3      5      4       5       .      .      .      .      .      .      .     29    40    2
796  216     7    6     3      4      2       5       3      4      5      .      .      .      3     47    60    4
797  216     8    6     3      4      3       5       3      5      5      .      .      .      3     48    68    5
798  216     9    6     3      4      3       6       5      5      5      .      .      .      3     41    85    5
799  216    10    6     3      4      3       5       4      4      5      .      .      .      1     47    80    5
800  217     1    6     3      4      3       5       4      5      5      .      .      .      3     61    94    7
801  217     2    1     .      .      .       .       .      .      .      .      .      .      .      .     .    0
802  217     3    6     5      2      3       5       .      .      .      .      .      .      .     24    39    2
803  217     4    6     1      4      3       5       .      .      .      .      .      .      .     25    45    3
804  217     5    6     2      4      2       5       7      6      5      .      .      .      3     71    99    7
805  217     6    1     .      .      .       .       .      .      .      .      .      .      .      .     .    0
806  217     7    6     4      4      2       7       5      7      6      6      0      0      3     77    99    7
807  217     8    6     3      4      2       7       5      5      5      .      .      .      3     76    99    7
808  218     1    6     7      5      3       7       2      5      5      .      .      .      1     52    49    4
809  219     1    1     .      .      .       .       .      .      .      .      .      .      .      .     .    0
810  220     1    6     3      2      1       5       5      4      5      .      .      .      3     61    99    7
811  221     1    6     3      6      2       5       .      .      .      .      .      .      .     27    48    4
812  221     2    6     3      5      3       5       2      3      5      .      .      .      3     32    50    5
813  221     3    6     4      4      3       5       2      4      5      .      .      .      3     41    71    5
814  221     4    6     3      5      3       5       .      .      .      .      .      .      .     41    48    4
815  221     5    6     3      5      4       5       3      5      5      .      .      .      3     31    58    4
816  221     6    1     .      .      .       .       .      .      .      .      .      .      .      .     .    0
817  221     7    6     3      4      2       5       4      4      5      .      .      .      2     63    81    6
818  221     8    6     3      5      4       5       .      .      .      .      .      .      .     22    48    4
819  221     9    6     6      5      4       5       .      .      .      .      .      .      .     15    20    2
820  221    10    1     .      .      .       .       .      .      .      .      .      .      .      .     .    0
821  221    11    6     3      5      3       5       3      4      5      .      .      .      3     24    42    5
822  222     1    6     3      3      2       5       6      5      5      .      .      .      3     40    71    6
823  222     2    6     3      4      4       5       5      5      5      .      .      .      1     23    40    3
824  222     3    6     4      3      2       5       6      5      5      .      .      .      3     85    99    8
825  223     1    6     3      4      3       5       .      .      .      .      .      .      .      5    29    2
826  224     1    6     2      4      3       7       6      5      6      6      0      0      3     68    96    8
827  224     2    6     4      4      2       5       6      5      5      .      .      .      3     65    77    7
828  224     3    6     3      4      3       5       7      5      5      .      .      .      3     75    81    6
829  224     4    1     .      .      .       .       .      .      .      .      .      .      .      .     .    0
830  224     5    6     4      3      3       7       6      4      5      .      .      .      3     70    95    7
831  224     6    6     3      4      3       5       5      5      5      .      .      .      3     72    80    7
832  224     7    6     3      4      2       7       7      5      5      .      .      .      3     80    92    7
833  224     8    6     3      4      3       7       6      4      5      .      .      .      2     69    93    7
834  224     9    6     3      3      4       5       5      5      5      .      .      .      2     70    99    7
835  224    10    6     3      3      3       6       6      4      5      .      .      .      2     83    99    8
836  224    11    6     3      4      2       7       5      4      5      .      .      .      2     75    99    8
837  224    12    6     3      4      4       5       6      5      5      .      .      .      3     75    99    8
838  224    13    6     3      4      2       5       6      5      5      .      .      .      1     83    99    8
839  224    14    6     3      5      3       5       5      4      5      .      .      .      1     73    95    8
840  224    15    6     3      3      2       7       7      5      5      .      .      .      3     76    99    8
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OBS  CODE  PLNUM  WI  LFCOL  LFPUB  LFSIZE  NUMLFL  FLCOL  FLDIAM  NPET  NLPET  NMPET  NSPET  PETOV  HGHT  WDTH  VIG

841   224    16    6    4      3        3        5      3        4      5     .      .      .      1     67    99    8
842   225     1    6    2      3        3        7      6        4      5     .      .      .      2     98    98    8
843   226     1    6    7      5        3        5      3        4      5     .      .      .      3     32    50    4
844   226     2    6    7      5        2        7      4        5      5     .      .      .      3     55    59    5
845   227     1    6    6      4        3        7      5        5      5     .      .      .      2     75    99    8
846   227     2    6    4      4        3        7      6        5      5     .      .      .      3     51    98    7
847   227     3    6    3      3        3        5      4        5      5     .      .      .      1     55    99    6
848   227     4    6    3      4        3        5      4        4      5     .      .      .      3     50    56    4
849   227     5    4    4      4        4        5      4        5      5     .      .      .      3     51    99    6
850   227     6    6    4      4        3        6      4        5      5     .      .      .      3     55    92    6
851   227     7    6    4      4        3        7      5        6      5     .      .      .      3     41    94    5
852   227     8    .    3      .        3        5      3        3      5     .      .      .      1     35    57    5
853   228     1    4    3      4        3        5      2        5      5     .      .      .      3     39    75    6
854   228     2    .    3      .        2        5      6        5      5     .      .      .      3     43    62    6
855   229     1    6    3      4        3        7      2        5      5     .      .      .      3     51    95    6
856   229     2    6    3      4        3        5      1        6      5     .      .      .      3     39    80    5
857   229     3    .    3      .        4        5      2        4      5     .      .      .      3     12    44    4
858   229     4    .    2      .        3        6      2        4      5     .      .      .      3     20    65    4
859   229     5    .    2      .        4        5      3        4      5     .      .      .      3     31    64    5
860   229     6    .    2      .        4        7      2        4      5     .      .      .      1     21    36    3
861   230     1    6    4      3        3        7      4        3      5     .      .      .      1     56    90    7
862   230     2    6    4      3        3        7      7        5      5     .      .      .      2     73    65    6
863   230     3    6    4      3        3        5      5        3      5     .      .      .      1     62    71    5
864   230     4    6    4      3        3        5      6        5      5     .      .      .      1     69    83    5
865   230     5    6    3      3        4        5      5        5      5     .      .      .      1     49    54    4
866   230     6    6    4      3        3        6      .        .      .     .      .      .      .     55    46    4
867   230     7    6    4      3        2        7      7        5      5     .      .      .      3     81    99    7
868   230     8    6    4      2        3        6      5        5      5     .      .      .      3     63    74    6
869   230     9    6    3      3        4        5      7        4      5     .      .      .      3     58    73    5
870   230    10    6    3      4        3        7      .        .      .     .      .      .      .     40    44    4
871   230    11    6    3      4        4        5      5        3      5     .      .      .      2     49    60    5
872   230    12    6    3      4        3        7      6        4      5     .      .      .      3     69    93    7
873   230    13    6    4      2        3        7      7        5      5     .      .      .      3     61    91    6
874   230    14    6    3      3        3        5      6        3      5     .      .      .      2     49    77    4
875   230    15    6    3      3        3        7      4        4      5     .      .      .      2     59    83    5
876   230    16    5    4      3        3        7      5        4      5     .      .      .      2     59    56    5
877   230    17    6    4      3        4        5      7        4      5     .      .      .      2     39    51    4
878   230    18    6    4      3        3        5      5        3      5     .      .      .      3     42    48    5
879   230    19    6    3      3        3        6      6        4      5     .      .      .      1     66    87    7
880   230    20    3    3      3        3        5      7        2      5     .      .      .      3     33    40    3
881   230    21    6    4      2        3        7      6        5      5     .      .      .      2     62    66    6
882   230    22    6    4      3        3        7      4        4      5     .      .      .      1     76    99    7
883   230    23    6    3      3        3        5      6        4      5     .      .      .      2     57    60    5
884   230    24    6    4      3        3        5      5        3      5     .      .      .      2     53    73    5
885   230    25    6    3      3        3        5      5        3      5     .      .      .      3     52    64    5
886   230    26    6    4      3        3        6      5        4      5     .      .      .      2     71    79    5
887   231     1    6    4      3        3        7      6        5      5     .      .      .      3     72    68    6
888   231     2    6    5      4        3        5      4        4      5     .      .      .      3     61    86    6
889   231     3    6    4      3        3        5      4        4      5     .      .      .      3     56    81    5
890   231     4    4    4      3        2        5      7        3      5     .      .      .      3     58    54    4
891   231     5    6    4      4        2        5      6        4      5     .      .      .      3     59    93    6
892   231     6    6    4      4        2        5      6        4      5     .      .      .      3     52    61    4
893   231     7    4    5      3        3        5      5        4      5     .      .      .      3     53    63    5
894   231     8    5    3      4        3        5      7        4      5     .      .      .      3     23    59    5
895   231     9    6    4      4        3        5      5        4      5     .      .      .      1     53    66    5
896   232     1    6    6      5        3        5      3        4      5     .      .      .      3     36    44    3
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OBS   CODE   PLNUM   WI   LFCOL   LFPUB   LFSIZE   NUMLFL   FLCOL   FLDIAM   NPET   NLPET   NMPET   NSPET   PETOV   HGHT   WDTH   VIG

897   232       2    6      6       5       3        5        6       5       5       .       .       .       3      41     44     4
898   232       3    6      6       5       4        5        6       4       5       .       .       .       3      25     31     3
899   232       4    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
900   232       5    6      3       3       2        5        4       5       5       .       .       .       3      59     86     6
901   232       6    6      3       3       2        5        .       .       .       .       .       .       .      42     39     4
902   232       7    6      3       4       3        5        3       3       5       .       .       .       2      39     86     5
903   232       8    6      3       3       3        5        3       3       5       .       .       .       3      29     43     4
904   232       9    6      3       4       3        5        3       3       5       .       .       .       3      32     43     4
905   232      10    6      3       4       3        5        6       4       5       .       .       .       3      31     52     5
906   232      11    6      3       4       2        5        5       4       5       .       .       .       1      40     51     5
907   232      12    6      3       4       3        5        5       3       5       .       .       .       3      35     53     4
908   232      13    6      2       4       4        5        3       2       5       .       .       .       3      30     53     4
909   232      14    4      3       4       3        5        6       4       5       .       .       .       3      31     55     5
910   232      15    6      3       5       3        5        3       3       5       .       .       .       3      26     47     4
911   232      16    6      3       4       3        5        5       4       5       .       .       .       1      28     53     4
912   232      17    6      3       4       3        5        7       4       5       .       .       .       3      36     61     5
913   232      18    6      3       4       2        7        6       4       5       .       .       .       2      69     90     7
914   232      19    6      3       4       3        5        6       4       5       .       .       .       2      51     50     5
915   232      20    6      3       4       2        5        7       3       5       .       .       .       3      56     99     7
916   232      21    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
917   232      22    6      4       4       3        5        3       3       5       .       .       .       3      44     49     5
918   232      23    6      3       4       3        5        .       .       .       .       .       .       .      23     37     3
919   232      24    6      3       4       3        5        6       4       5       .       .       .       2      42     50     5
920   232      25    6      3       4       2        6        6       5       5       .       .       .       3      49     65     5
921   232      26    6      3       4       2        5        .       .       .       .       .       .       .      32     40     4
922   232      27    6      3       4       2        6        5       5       5       .       .       .       3      33     58     5
923   232      28    6      3       4       3        5        4       5       5       .       .       .       3      35     56     5
924   232      29    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
925   232      30    6      4       4       3        5        6       5       5       .       .       .       3      58     65     5
926   232      31    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
927   232      32    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
928   232      33    6      3       4       3        5        6       3       5       .       .       .       3      30     29     4
929   232      34    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
930   232      35    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
931   232      36    6      3       4       2        5        3       5       5       .       .       .       3      37     72     6
932   232      37    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
933   232      38    6      4       4       4        5        .       .       .       .       .       .       .      23     31     3
934   232      39    6      3       5       3        5        6       4       5       .       .       .       3      36     47     5
935   232      40    6      3       5       3        5        7       4       5       .       .       .       3      28     35     4
936   232      41    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
937   232      42    6      4       4       3        5        .       .       .       .       .       .       .      29     25     4
938   232      43    1      .       .       .        .        .       .       .       .       .       .       .       .      .     0
939   233       1    6      4       4       2        7        3       6       5       .       .       .       3      57     93     7
940   233       2    6      4       4       2        7        3       6       5       .       .       .       3      59     98     7
941   233       3    3      4       3       4        6        3       4       5       .       .       .       3      33     50     4
942   233       4    4      4       4       3        5        3       3       5       .       .       .       3      19     33     2
943   233       5    6      4       4       2        7        3       5       5       .       .       .       3      40     99     6
944   233       6    .      4       .       3        5        3       4       5       .       .       .       3      40     40     5
945   233       7    .      4       .       3        5        3       4       5       .       .       .       3      36     62     4
946   233       8    .      3       .       3        5        2       4       5       .       .       .       3      50     84     6
947   233       9    .      3       .       3        5        2       4       5       .       .       .       3      45     58     5
948   234       1    .      4       .       4        7        .       .       .       .       .       .       .      30     46     5
949   235       1    .      4       .       4        6        .       .       .       .       .       .       .      37     35     5
950   237       1    .      4       .       3        7        4       5       5       .       .       .       3      30     35     4
951   238       1    .      3       .       3        6        1       6       5       .       .       .       2      20     44     5
952   239       1    .      3       .       4        5        2       4       5       .       .       .       3      21     36     5
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 OBS   CODE   PLNUM   WI   LFCOL   LFPUB   LFSIZE   NUMLFL   FLCOL   FLDIAM   NPET   NLPET   NMPET   NSPET   PETOV   HGHT   WDTH   VIG

 953   239      2     .      3       .       3        6        2       5       5      .       .       .       3      56     70     6
 954   240      1     .      3       .       4        6        3       3       5      .       .       .       1      40     55     5
 955   241      1     1      .       .       .        .        .       .       .      .       .       .       .       .      .     0
 956   241      2     3      3       5       6        5        .       .       .      .       .       .       .      17     29     2
 957   241      3     3      3       4       5        5        .       .       .      .       .       .       .      27     41     3
 958   241      4     6      3       4       5        5        2       5       5      .       .       .       1      29     38     4
 959   241      5     4      3       5       5        5        2       4       5      .       .       .       3      28     32     4
 960   241      6     6      3       4       4        5        2       4       5      .       .       .       3      38     47     5
 961   241      7     4      3       4       4        5        3       4       5      .       .       .       3      49     57     5
 962   241      8     6      3       4       4        6        2       6       5      .       .       .       3      49     73     6
 963   241      9     6      3       4       4        6        2       6       5      .       .       .       3      48     86     6
 964   241     10     3      3       5       4        5        3       5       5      .       .       .       2      31     47     3
 965   241     11     6      3       4       4        5        2       5       5      .       .       .       2      44     69     6
 966   241     12     5      3       4       4        5        2       5       5      .       .       .       3      52     62     5
 967   241     13     6      3       4       4        6        2       5       5      .       .       .       2      68     66     7
 968   241     14     3      3       4       4        7        2       6       5      .       .       .       3      45     77     4
 969   241     15     6      3       4       4        7        2       4       5      .       .       .       3      41     62     6
 970   241     16     3      3       4       4        7        2       3       5      .       .       .       2      37     66     5
 971   241     17     6      3       3       4        7        2       5       5      .       .       .       3      65     90     6
 972   241     18     5      2       4       4        6        2       5       5      .       .       .       2      52     55     6
 973   241     19     6      2       4       4        5        2       5       5      .       .       .       3      47     53     6
 974   241     20     1      .       .       .        .        .       .       .      .       .       .       .       .      .     0
 975   241     21     3      3       5       4        5        2       5       5      .       .       .       3      21     51     4
 976   241     22     3      3       4       4        7        2       5       5      .       .       .       3      30     56     5
 977   241     23     4      3       4       4        6        2       5       5      .       .       .       2      46     46     6
 978   241     24     4      3       5       5        5        2       4       5      .       .       .       3      29     41     6
 979   241     25     1      .       .       .        .        .       .       .      .       .       .       .       .      .     0
 980   241     26     6      3       3       3        7        3       5       5      .       .       .       3      51     98     8
 981   241     27     2      6       4       5        5        .       .       .      .       .       .       .      24     17     3
 982   241     28     6      3       4       4        7        2       5       5      .       .       .       3      64     80     6
 983   241     29     1      .       .       .        .        .       .       .      .       .       .       .       .      .     0
 984   241     30     6      3       4       4        7        2       4       5      .       .       .       2      45     93     6
 985   241     31     6      2       4       4        7        2       6       5      .       .       .       3      52     71     6
 986   241     32     3      3       4       4        7        2       5       5      .       .       .       3      42     53     4
 987   241     33     3      2       4       4        7        3       5       5      .       .       .       3      33     41     5
 988   241     34     5      2       4       3        7        2       5       5      .       .       .       3      59     60     6
 989   241     35     6      3       3       3        6        2       5       5      .       .       .       3      50     90     7
 990   241     36     5      3       4       4        7        3       4       5      .       .       .       2      43     62     6
 991   241     37     6      3       3       3        5        3       5       5      .       .       .       3      36     70     6
 992   241     38     6      3       4       4        7        3       5       5      .       .       .       2      34     61     5
 993   241     39     5      3       4       4        6        2       5       5      .       .       .       3      47     63     6
 994   241     40     6      3       4       4        5        2       3       5      .       .       .       3      36     62     5
 995   242      1     6      4       3       3        7        4       5       5      .       .       .       3      61     69     6
 996   242      2     6      4       3       4        7        3       5       5      .       .       .       3      63     71     6
 997   242      3     6      4       4       3        5        3       5       5      .       .       .       3      58     81     5
 998   242      4     6      3       4       3        7        3       4       5      .       .       .       2      63     99     6
 999   242      5     6      4       4       3        7        4       6       5      .       .       .       1      71     99     7
1000   242      6     6      3       4       3        6        4       4       5      .       .       .       1      58     99     7
1001   242      7     6      4       4       3        5        4       6       5      .       .       .       1      66     77     6
1002   242      8     6      4       4       3        7        2       4       5      .       .       .       1      68     86     6
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