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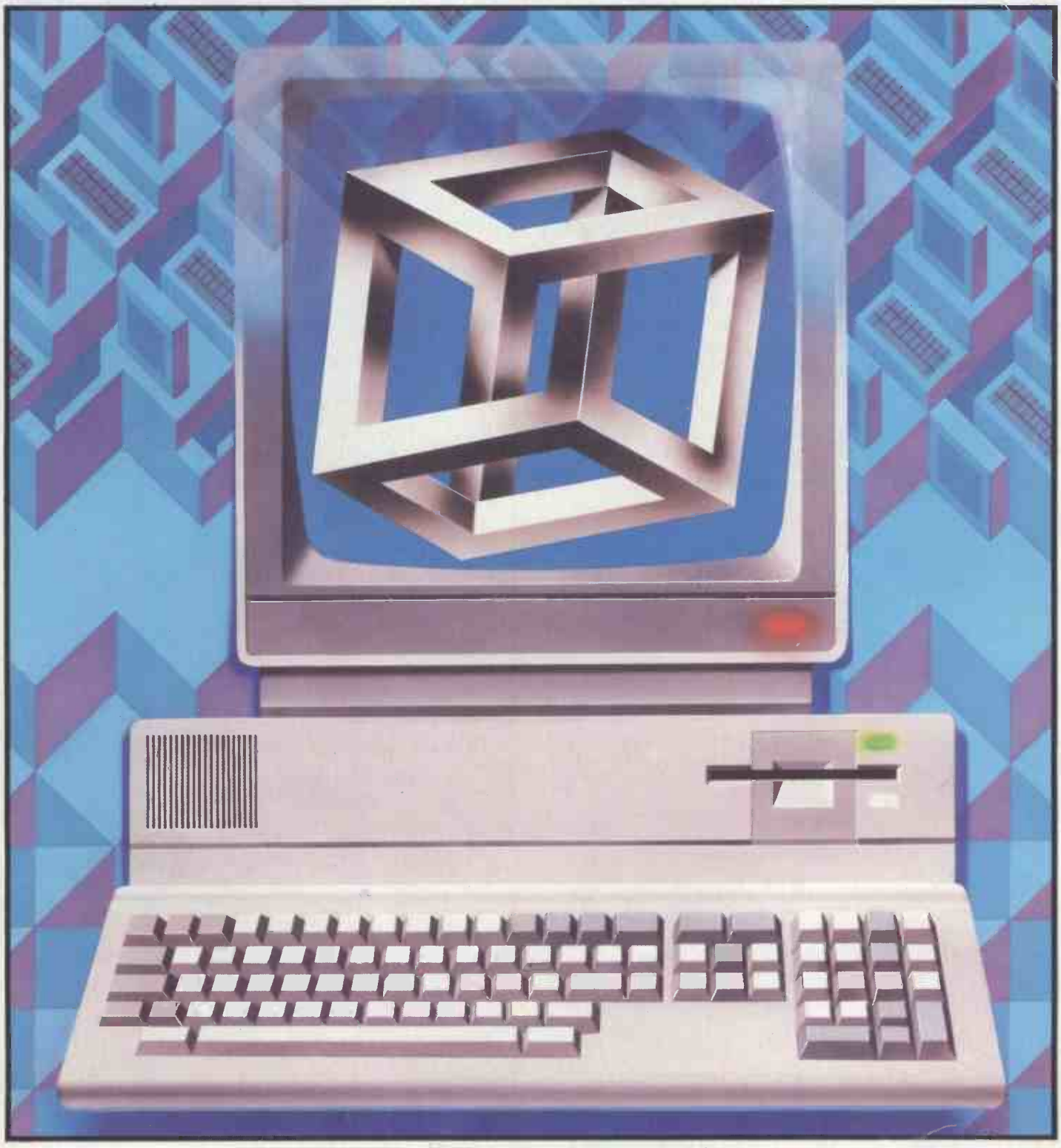

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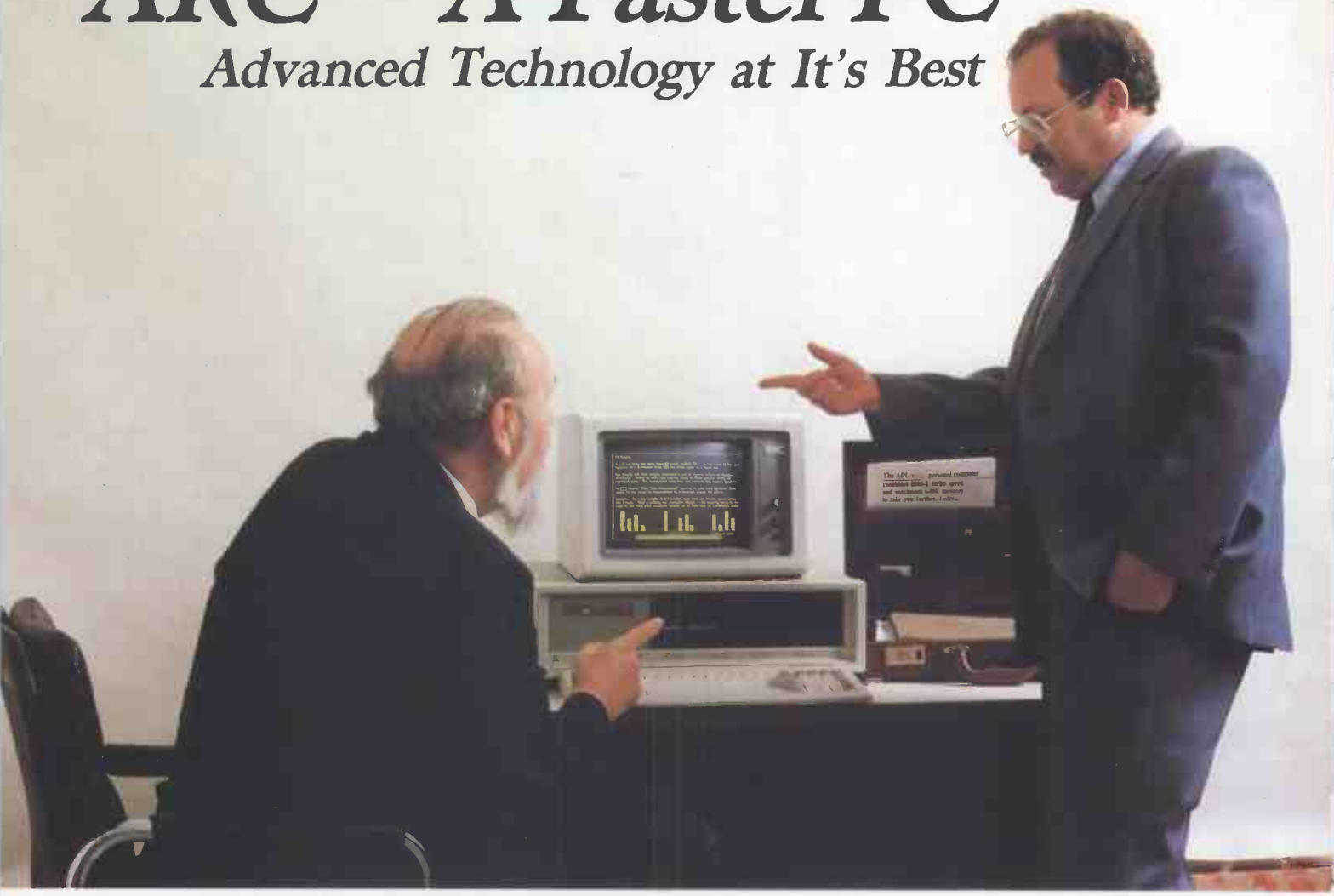

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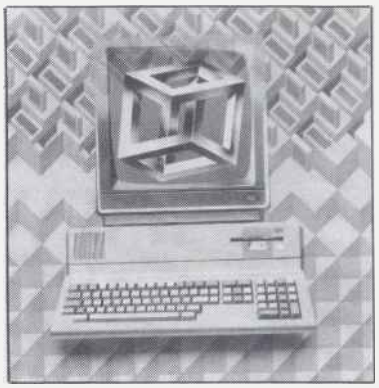

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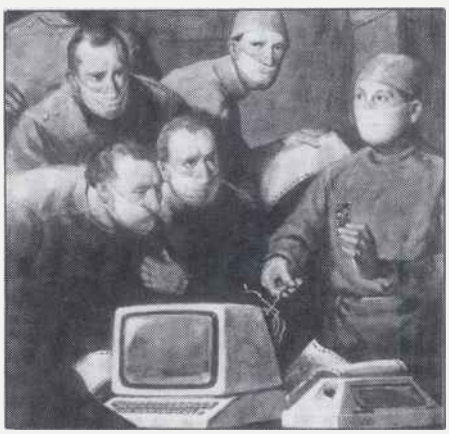

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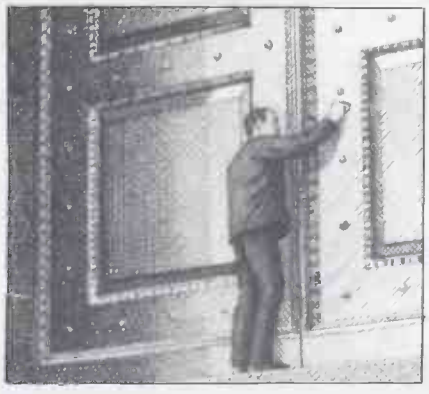

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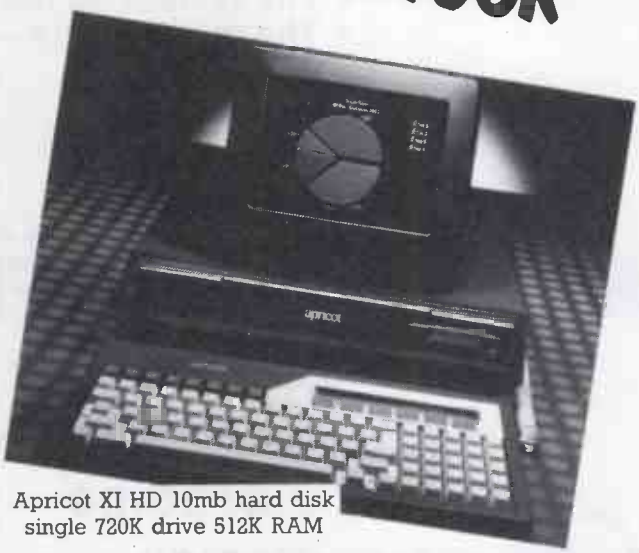

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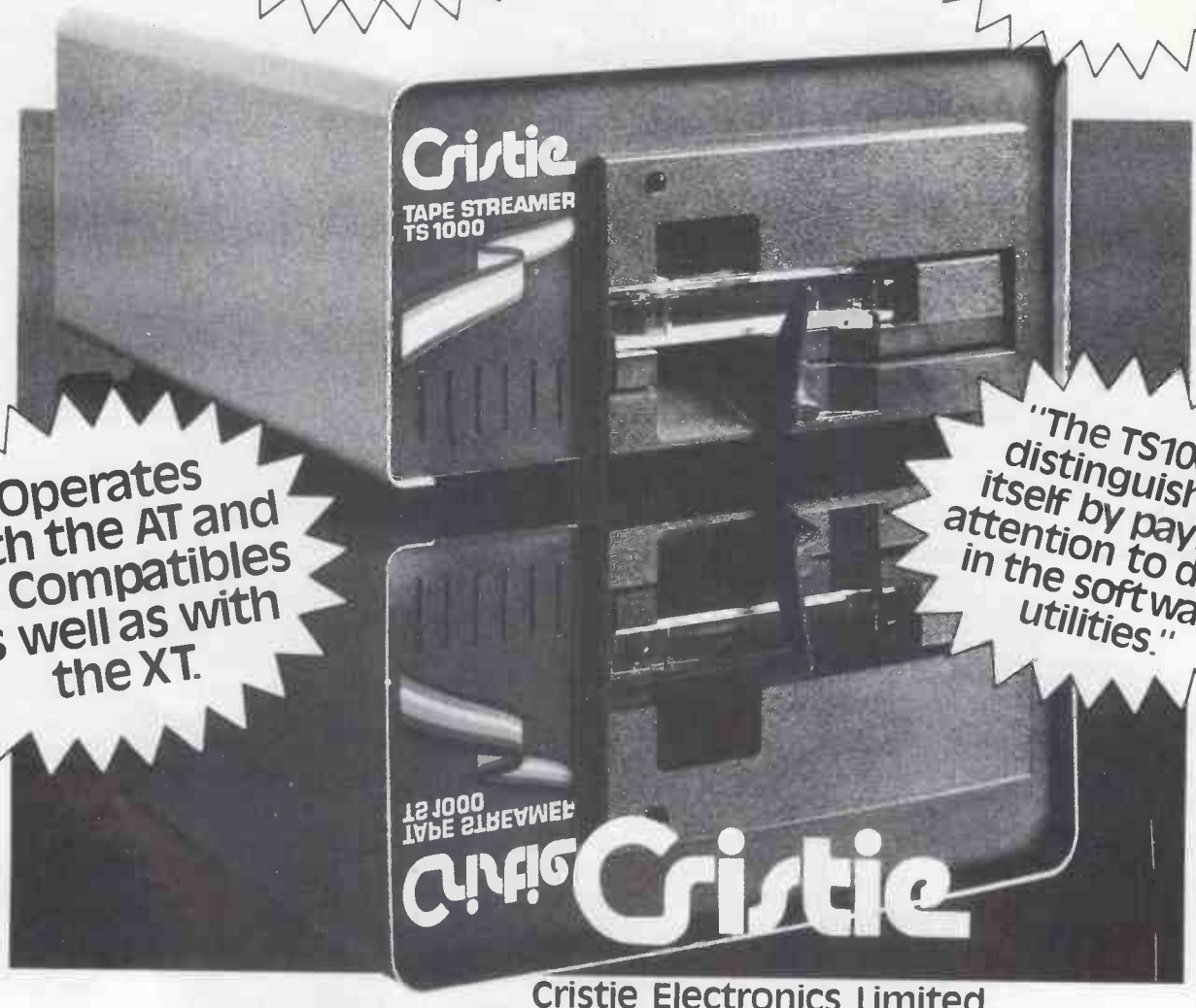

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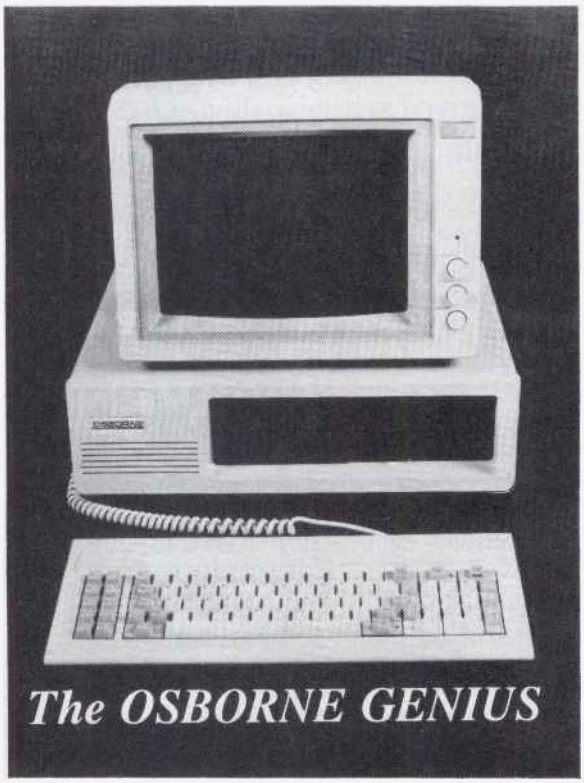

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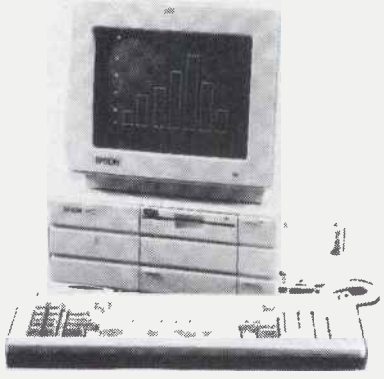

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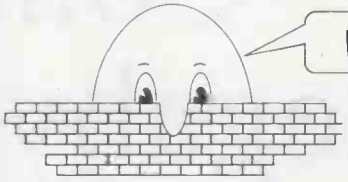

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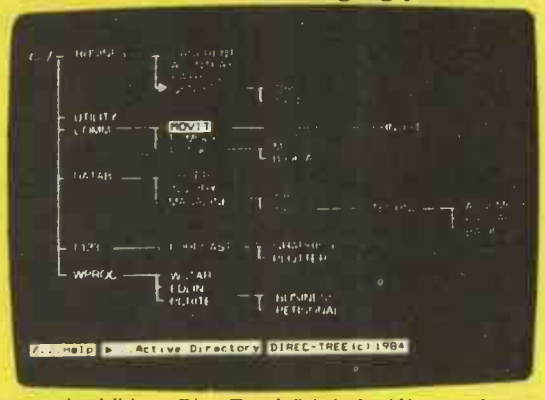

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Once switched on, these appliances can generate a continual level of interference known as 'powerline noise', also harmful to your computer.

When you've spent time and effort programming data into your micro, to suddenly lose it all in a fraction of a second, or see it corrupted to the degree that you have to start all over again, can be extremely frustrating!

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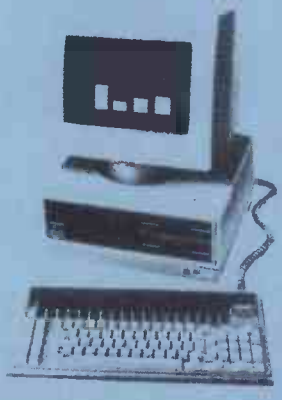

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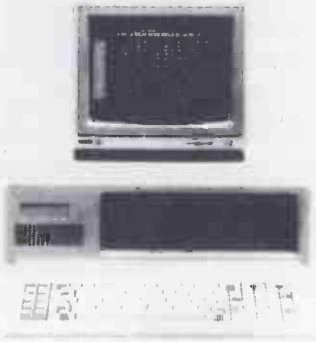

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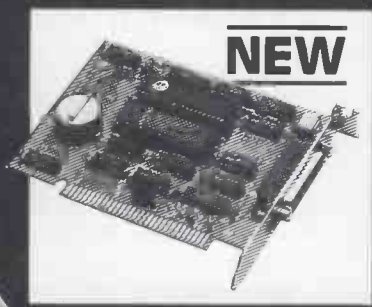

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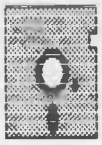

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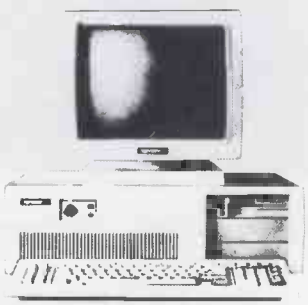

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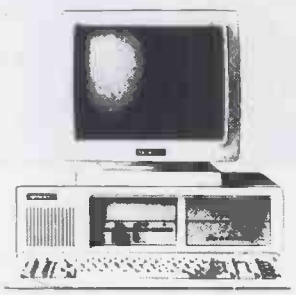

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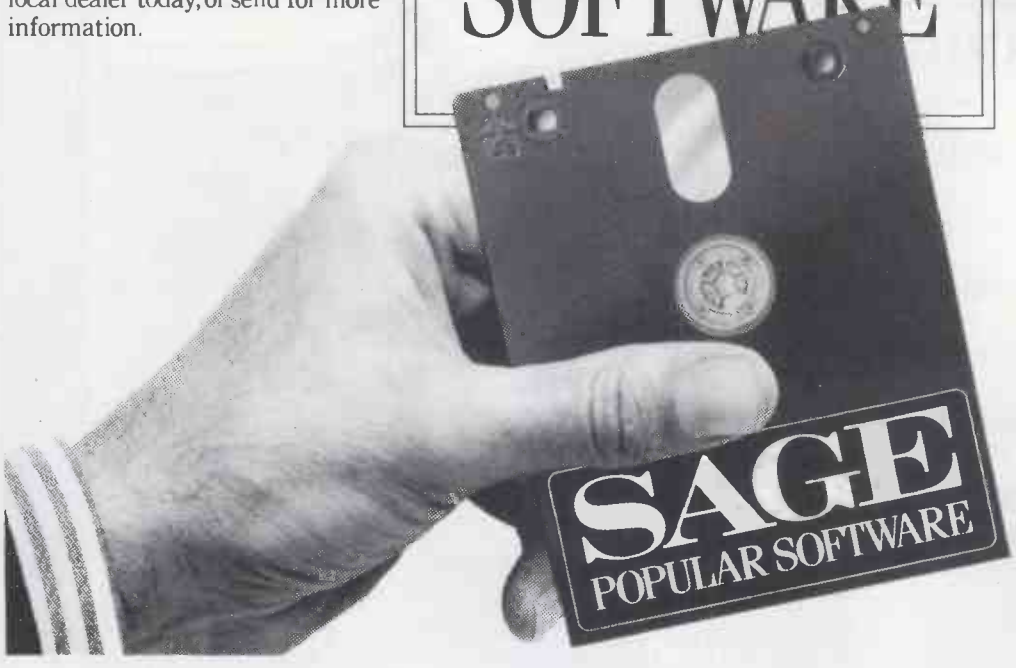

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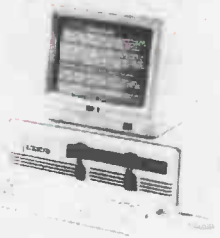

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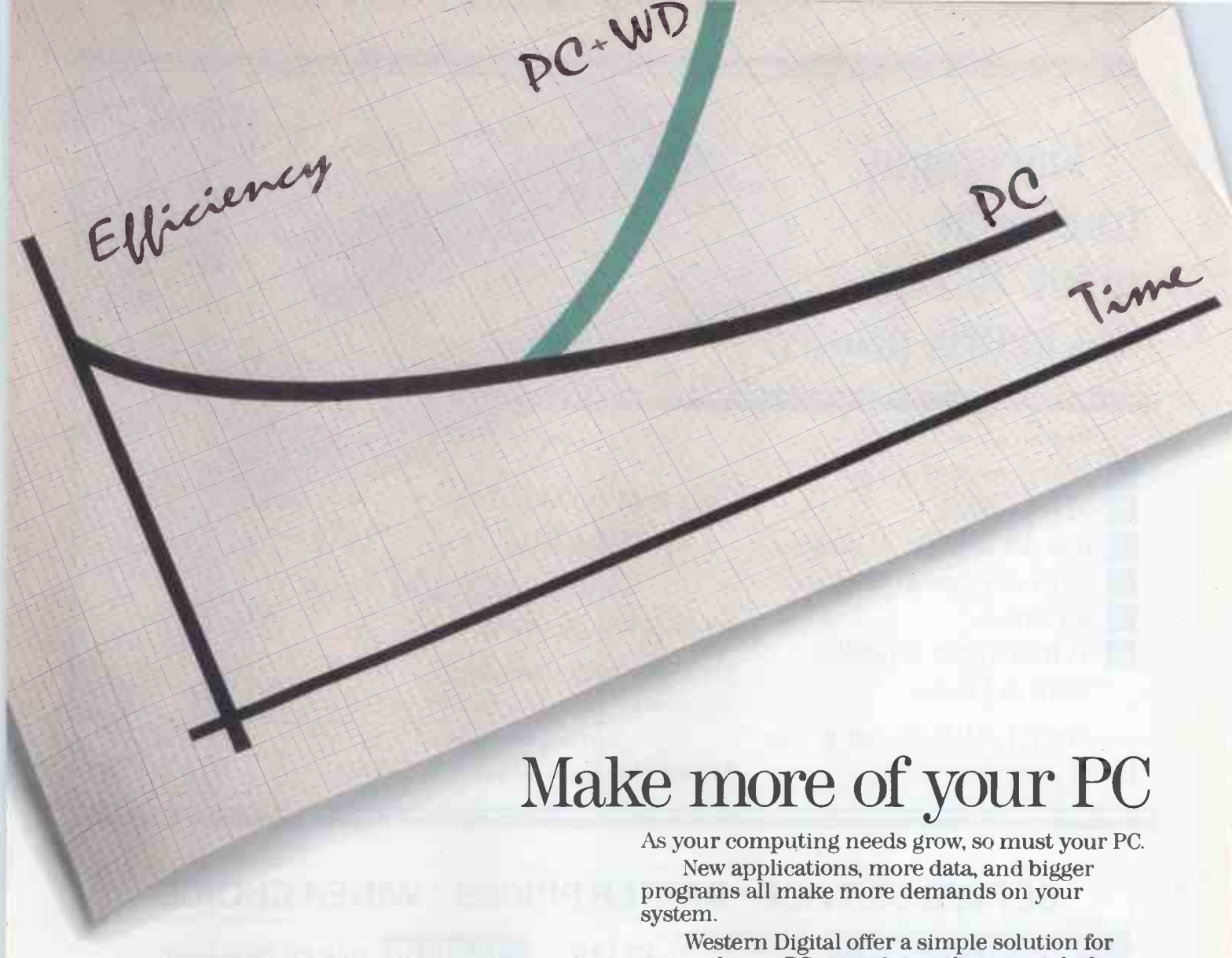

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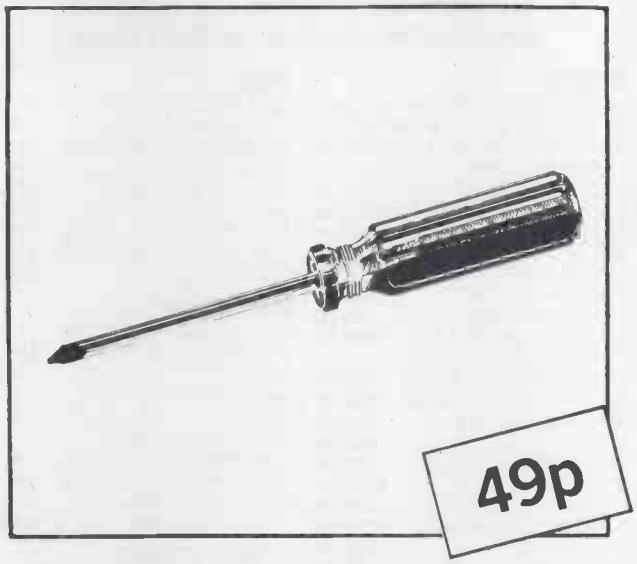

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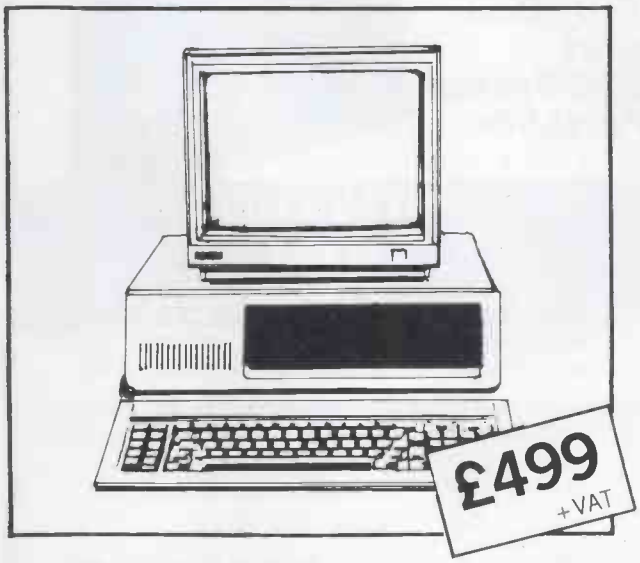

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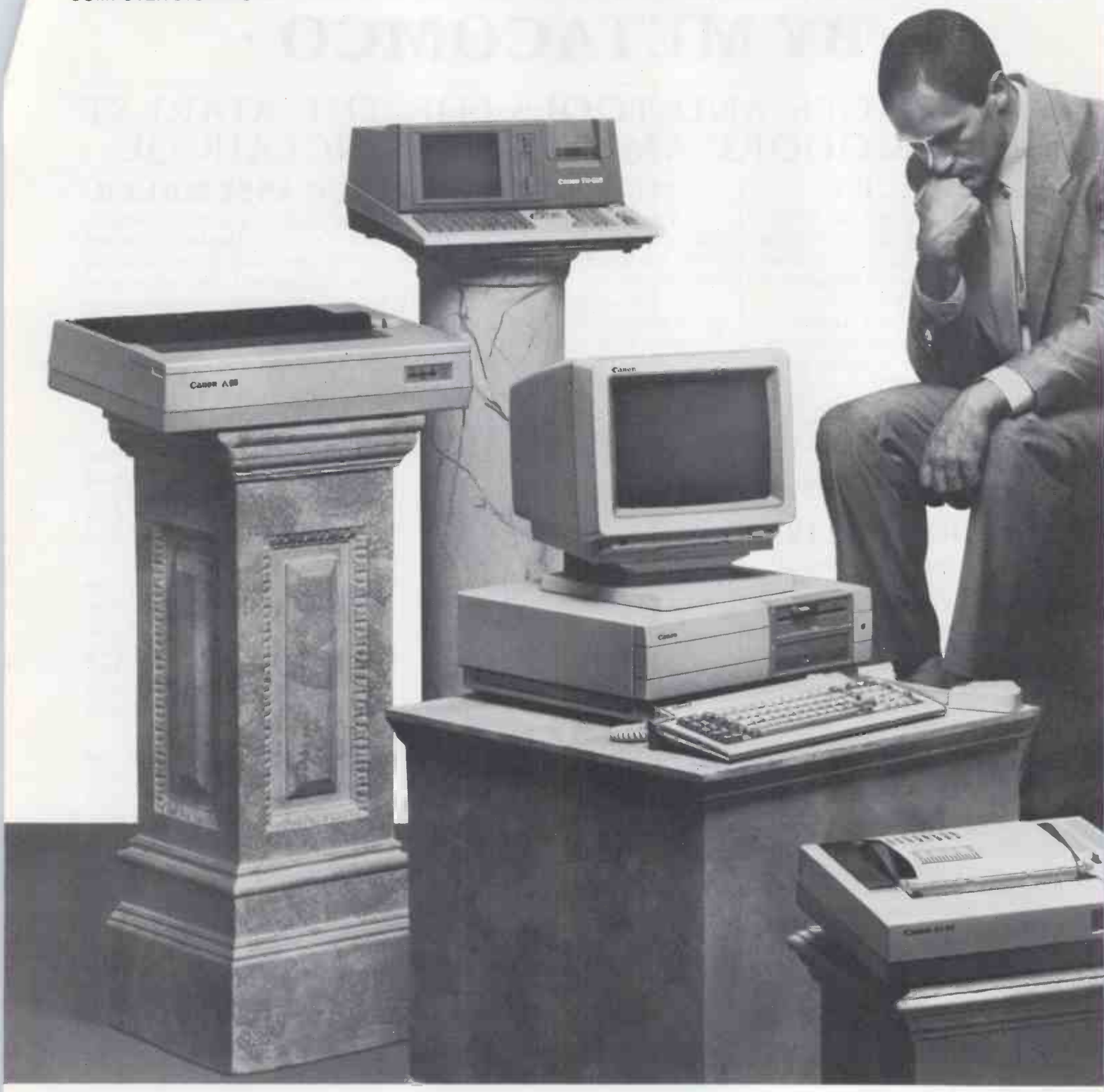

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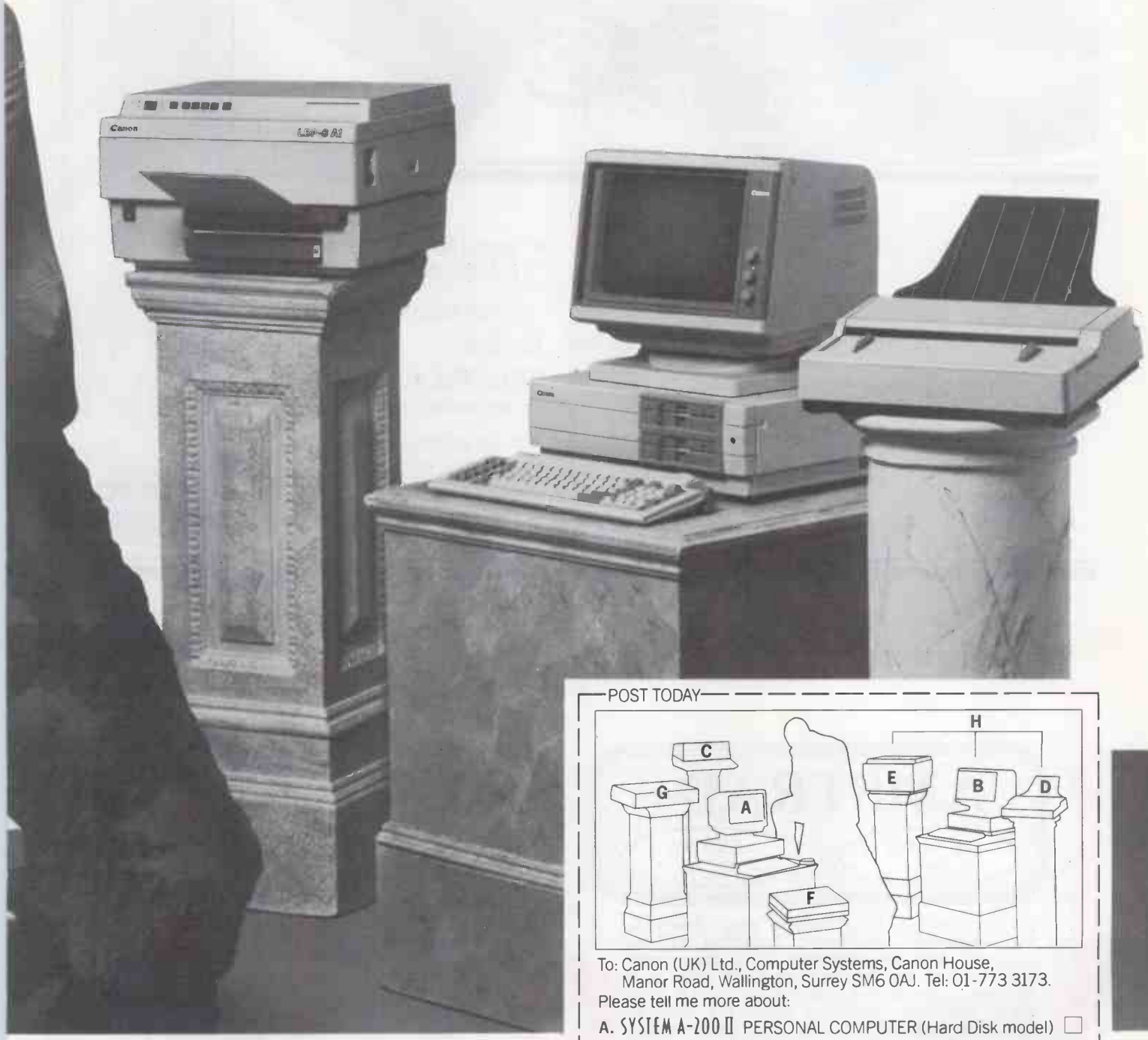

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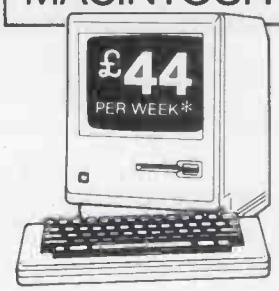

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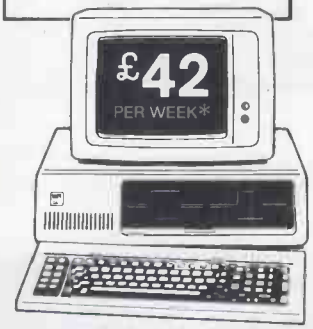

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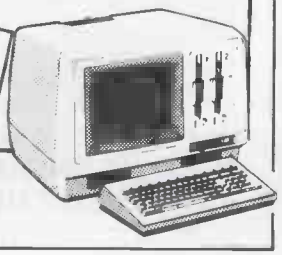

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CUSTOMER STATEMENTS — SUPPLIER CHECK STATEMENTS
CASH BOOK (RECEIPTS) — CASH BOOK (PAYMENTS)
INDIVIDUAL FIXED ASSET ITEMS — FIXED ASSET LIST
SALES DAY BOOK — PURCHASE DAY BOOK
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ATARI ST

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FREE SOFTWARE

When you buy one of the new Atari ST computers from Silica Shop, you will receive a large and varied software package free of charge. This package covers several applications and comprises a total of nine titles. All ST's now have TOS/GEM on ROM, and the total list of free software is as follows:

1) GEM - *DR Desktop environment with WIMP (in ROM)*
2) TOS - *Tramiel Operating System (in ROM)*
3) 1st WORD - *Word Processor by GST using the GEM environment and multiple windows*
4) BASIC - *Personal Basic by DR (with manual)*
5) LOGO - *Logo language by DR (with manual)*
6) DOODLE - *Simple paint/doodle drawing package (works on mono or colour systems)*
7) MEGAROIDS - *Asteroids type game by Megamax*
8) NEOCHROME - *A powerful colour paint and graphics package (only useable with colour systems)*
9) CP/M EMULATOR - *Allows the use of DR's Z80 C/PM software to run on any ST system*

3rd PARTY SUPPORT

The power and potential of the ST range of computers is causing a flood of new software titles, peripherals and accessories from third party manufacturers. Titles range from word processing to spreadsheet programs, from graphics and games to database management - all with those easy drop-down menus and windows. With the list of companies producing ST software including dozens of top names, you can expect some first class titles for the new ST range. The following includes a selection of the third party manufacturers who have developed, or are working on, products for the ST range:

ABACUS	EXTENDED S/W	MICRO-ED INC	ROBINSON SYS
ACADEMY	FIDELITY	MICROPRO	SCARBOROUGH
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ANTIC	GST SYSTEMS	MIRACLE	SOFTLOGIK
AMERICAN COVERS	HABA	MIRAGE	SOFTWARE COMS
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ASHTON TATE	HIPPO	MONARCH DEV	SOFTWARE PUNCH
ATI	HISOFT	MOSAIC	SOFTWORKS
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AZTEC	INSIGHT	MULTIMATE	SPINNAKER
BATTERIES INC	INSOFT	OCEAN	SST SYSTEMS
BAYVIEW	ISLAND LOGIC	ODIN	STONEWARE
BECKEMEYER	KNOWLEDGWARE	OMNITREND	SUBLOGIC
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DILITHIUM PRESS	MEGAMAX	PSYGNOSIS	WASON MICROCHIP
DRAGON GROUP	MEMOREX	QUICKVIEW SYS	WHITENDALE
DUFOSE PUBNG	METACOMCO	RAINBIRD	WINDHAM CLASSICS
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520ST-M

NEW 512K 520ST-M KEYBOARD: The new 520ST-M keyboard costs only £346.96 (+VAT=£399) and is yet another price breakthrough for Atari Corporation. The keyboard now includes both an RF modulator and cable, allowing you to connect it to an ordinary domestic television set. In addition, the keyboard is supplied with 512K RAM, a mouse and a free set of 3½" disks containing applications software. The TOS operating system and the GEM graphics package are now supplied on 192K ROM chips which are already installed in the keyboard. This means that the operating system will automatically boot in when you switch the power on. In addition to the keyboard, you will also need to purchase either a ½Mbyte disk drive (RRP £130+VAT) or a 1Mbyte disk drive (RRP £174+VAT). Either disk drive will provide you with fast information retrieval and a vast amount of storage space. If you prefer not to use your own TV set, you may connect your ST to a monitor. You may purchase the Atari SM124 monochrome monitor (RRP £130+VAT), or one of Atari's two Thomson colour monitors. Alternatively, you may choose one of the many third party colour monitors which are available.

NEW 1024K 520ST-M+ KEYBOARD: In addition to the standard 520ST-M, we have a new keyboard which we are calling the Atari 520ST-M+. The M+ is a 520ST-M keyboard which has been enhanced by a third party RAM upgrade to 1 megabyte of memory. The 520ST-M+ is available from Silica at a retail price of only £433.91 (+VAT=£499). This product will provide you with an alternative to the 1040ST-F, but at a lower price. Additionally, it features the advantage of the 520ST-M's built in modulator.

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1040ST-F

For the businessman and the more serious home user, Atari have introduced the 1040ST-F, a low cost powerhouse which can be introduced to a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The new one megabyte 1040ST-F enhances Atari's 'value for money' reputation in the marketplace as it is the first personal computer available with one megabyte of memory for less than £800. You can purchase the 1040ST-F as a monochrome or colour system. The price of the monochrome system is £799 (+VAT = £918.85), with the colour system at only £999 (+VAT = £1148.85). The new 1040ST-F not only features twice as much memory as the 520ST-M, but also includes a one megabyte double sided disk drive and mains transformer, both built into the console to give a compact and stylish unit with only one mains lead. The 1040ST-F is also supplied with a free software package. Unlike the 520ST-M, the 1040ST-F was manufactured solely with business use in mind and as such is supplied with a monitor. It does not include the RF modulator or lead. We now have stock of the 1040ST-F at all four branches of Silica Shop. Call into your nearest branch for a demonstration.

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THE ATARI EXPLOSION!

If you read the specialist computer press, you will have noticed that there is one company which is getting a large slice of editorial space at the moment, that company is Atari Corporation. Atari have been making the news since the launch of their new 16/32 bit range of ST computers. Led by the powerful figure of Jack Tramiel and under the banner 'Power Without The Price', Atari are manufacturing new computers at unheard of prices, with the power to challenge firmly established market leaders. With the introduction of IBM compatibility, a CP/M emulator, a powerful networking system and a communications package for their new low cost powerhouses, it doesn't look as if it will be long before there is an explosion of the magnitude which will see Atari placed firmly besides such names as IBM and Olivetti in the personal computer marketplace. Read on for more details of what Atari are doing, and how they are putting their 'Power Without The Price' computers beyond the reach of the competition.

FREE CP/M EMULATOR

This newly annouced CP/M Emulation Package, will enable software written under Digital Research's Z80 CP/M operating system to be run on the ST family of computers. There are several thousand applications written for CP/M in the UK alone, and several of the major CP/M software development houses may convert their programs to 3½" disk format for the ST range. The CP/M emulation package is supplied FREE OF CHARGE by Silica Shop with all ST computers.

IBM COMPATIBILITY

To make the ST available to those businesses who currently run IBM systems and are looking for a low cost expansion method, Atari have announced a co-processing unit for ST computers. This processor will open the ST range to all IBM or IBM compatible software applications. The unit, which attaches to the ST computers via the DMA (Direct Memory Access) port, contains an Intel 8088 processor with 512K of RAM and will accept a 5¼" disk drive. In it's ST mode, the unit will also act as a second disk drive, offering the user an additional 500K of memory. The IBM co-processing unit should be available in late Summer 1986. If you would like to be informed when it is released, please complete and return the coupon below. We will send you further details as soon as we have them.

20Mbyte HARD DISK £739

The new Atari hard disk for the ST range has just been released. All ST computers already have a hard disk interface built into them so there is no external interface required. The memory size of the disk is a massive 20 megabytes (unformatted) with a data transfer rate of 1.33 Mbytes per second. At a price of £739 (+VAT=£849), the 5¼" hard disk offers massive storage with fast access at a very reasonable price.

NEW ST SOFTWARE PACKAGES

There are now hundreds of software packages which have been announced for the Atari ST range. Titles available now include DB Man, a DBase 3 clone as well as H & D Base, a DBase 2 clone. In addition, PC Intercomm is a VT100 emulator which enables you to use any ST keyboard as a terminal connected to a mainframe or mini. Other programs include a Lotus 1-2-3 clone (see paragraph below).

VIP PROFESSIONAL - LOTUS 1-2-3™ CLONE

This is probably the most impressive program to have been released so far for the ST range. VIP Professional is an extremely easy to use, integrated spreadsheet, database and graphics program which is identical both in features and commands to Lotus 1-2-3™. The same spreadsheet analysis, information management and extraordinary business graphics are all combined in one easy to learn, affordable package. What's more, VIP Professional not only has all the features of 1-2-3™, you can also type the same commands to do the same things. Probably the most surprising feature of VIP Professional is not its total compatibility with Lotus 1-2-3™, nor its ease of use, but its price. Lotus 1-2-3™ for the IBM PC/AT costs £395 (+VAT=£454.25), whereas VIP Professional for the ST is a mere £169 (+VAT=£194.35). That's less than half the price! If you would like further details, of VIP Professional, please return the coupon below.

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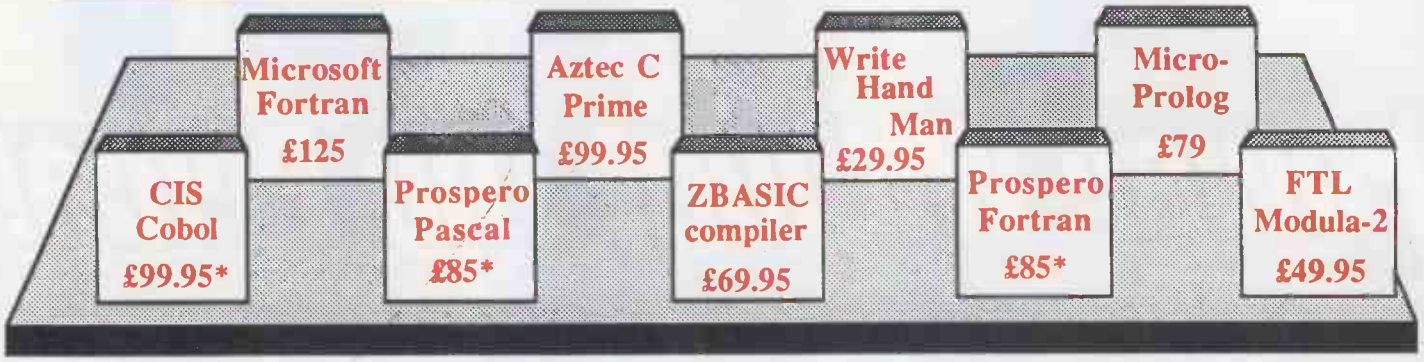

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Send for our free catalogue that lists many more products than we have space for here. We also have detailed factsheets on most of the popular languages giving benchmark timings and specifications; see the box opposite for an example.

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Factsheet Focus

The following is an extract from our factsheet on Pascal compilers available on CP/M-80 computers. Firstly, the PCW benchmark timings and then some facts about each compiler in turn.

	Pascal80	Turbo Pascal	DR MT+	ProPascal
1	??.? 1920	??.? 8320	??.? 3328	??.? 2304
2	3.8 1920	4.2 8320	6.5 3328	4.8 2560
3	6.2 1920	10.78320	10.33328	15.4 2560
4	5.3 1920	9.8 8320	9.4 3328	12.8 2560
5	4.8 1920	5.3 8320	7.5 3328	8.1 2560
6	5.1 1920	5.5 8320	7.7 3328	7.4 2560
7	25.3 3584	67.98448	68.1 7296	16.0 3584
8	20.3 3584	55.68448	54.3 7296	32.0 3584
9	11.6 1920	13.8 8448	14.2 3456	21.9 2816
10	8.5 1920	11.7 8320	15.1 3328	16.3 2816
11	4.3 2048	1.8 8320	1.2 3328	7.7 2560
12	8.5 1920	11.8 8320	15.0 3328	16.32816
13	5.3 2048	2.5 8448	4.5 3456	11.02816
14	5.2 2048	2.7 8448	4.7 3456	8.4 2560
15	8.6 4864	66.3 8320	57.5 9984	20.94096

The HiSoft Pascal80 compiler includes disc-file random access routines in source, along with GSX graphics and Turtle Graphics on Amstrad computers. Pascal80 provides a pre-declared identifier, CHAIN, which allows any CP/M prorgram to be run from a Pascal80-compiled program.

Borland's Turbo Pascal has a fully-interactive editor and memory-to-memory compilation. It also has overlaying and the ability to chain from one program to another. Expensive on Amstrads.

Pascal/MT+ from Digital Research incorporates the ability to generate code which will run on 8080-based microcomputers and also has facilties for generating code destined for EPROM. It comes with its own linker and debugger and is fairly close to the ISO standard.

Prospero ProPascal is fully validated by the ISO and comes with a linker and a librarian. The code-generation stage of this compiler produces excellent, efficient code. Unlike the other compilers here, it has powerful 32-bit integers.

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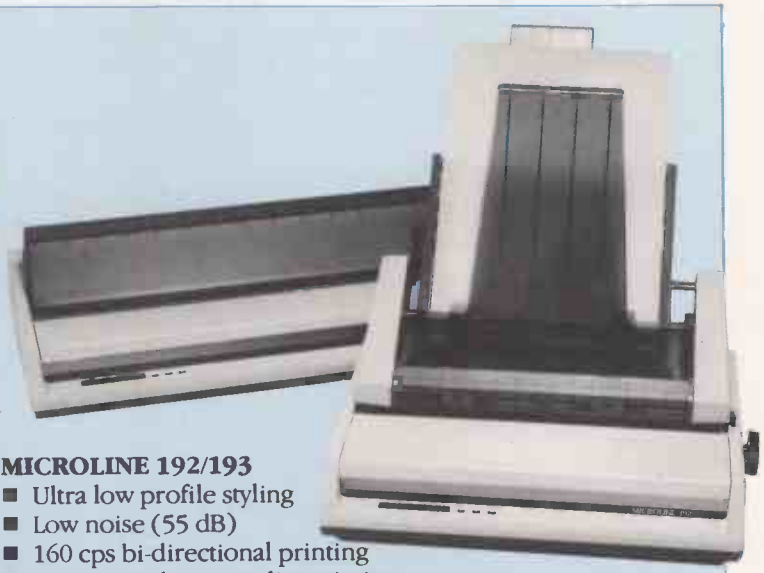

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- Automatic cut sheet feeder option

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PCW JULY 1986

OKI

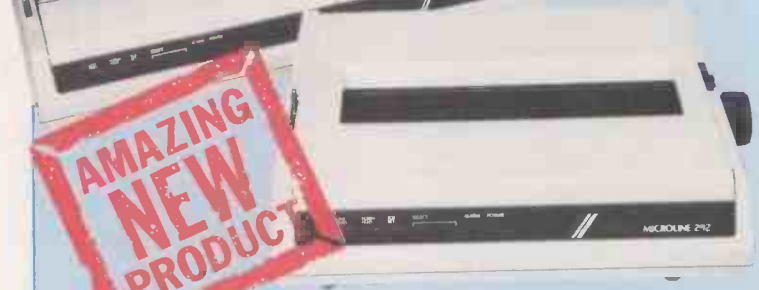
and Choice...

AMAZING NEW PRODUC

MICROLINE 293

- Advanced staggered 18 pin head
- 100 cps single pass correspondence quality
- 200 cps utility mode
- Plug in personality I/F modules
- Versatile paper handling
- Full menu selection of all features
- Colour capability as standard
- Ultra low noise –57dB

MICROLINE 292



AMAZING NEW PRODUCT

MICROLINE 294

- Advanced parallel. 18 pin head
- 400 cps utility mode
- 100 cps near letter quality
- Plug in personality interface modules
- Versatile paper handling
- Full menu selection of all features
- Colour capability as standard
- Ultra low noise – 57 dB

OKI 2350

- 350 cps, bi-directional printing
- Two colour printing
- Condensed and double width printing
- Up to six part stationery
- Pin addressable graphics
- IBM and Microline compatible options
- Parallel or serial interfaces

OKI 2410

- 350 cps bi-directional printing
- 87 cps correspondence quality
- Two colour printing
- Automatic cut sheet feeder option
- High resolution graphics
- Parallel, RS232, IBM versions

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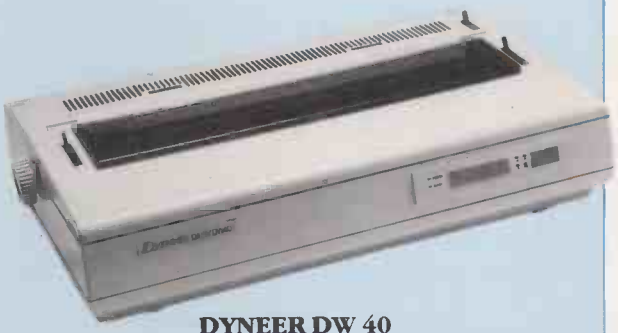
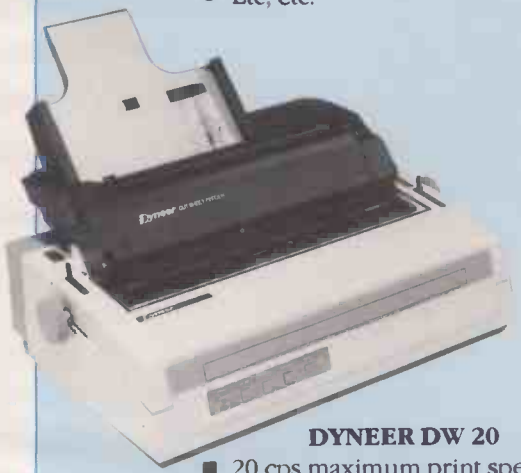
MICROLINE 84 XS

- All Microline 84 features plus...
- Plug in feature modules offering a vast range of advanced features eg:
  - Daisy wheel emulation
  - Bar code generation
  - Sophisticated graphics/labelling
  - Multiple character fonts
  - Etc, etc.



DYNEER DW 40

- High speed bi-directional printing 40 cps
- Three built in interfaces, RS232, Parallel, IEEE
- Multi copy mode
- Cut sheet feeder option
- 3K buffer expandable to 9K or 40K
- Selectable character pitches from the operator panel
- Compatible with most major WP packages



DYNEER DW 20

- 20 cps maximum print speed
- Bi-directional printing
- 10/12/15 character pitches
- Optional cut sheet feeder
- Original plus three copies
- Parallel or serial interfaces
- Compatible with most WP packages

DYNEER DW 16

- 16 cps maximum print speed
- Bi-directional printing
- 10/12/15 character pitches
- Original plus three copies
- Parallel or serial interfaces
- Tractor feed option

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- High definition with 16 colour capability
- Modern ergonomic styling with tilt and swivel option
- Scan rate 15.75 Khz

DYNEER 12 MHI

- IBM Monochrome monitor with 12 inch anti-glare CRT
- No ghosting when scrolling
- Character height adjustable up to 5 mm
- High resolution for high quality graphics
- Scan rate 18.43 Khz

DYNEER 14 CHI-1

- 14 inch high resolution colour monitor
- 16 colour capability
- High resolution anti-glare CRT
- Tilt and swivel option maximising operator comfort
- High scan rate – 25 Khz

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The video range of adaptors from STB provide something to suit all requirements, from the Mono Plus through to boards capable of full screen mono graphics and word processing quality text on colour monitors, all with no software modifications plus switch selectable printer ports and clock/calendar option.

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Multifunction and I/O boards complete the range from Printer Plus II to Rio Grande 1.5 Mbyte with parallel and serial ports included.

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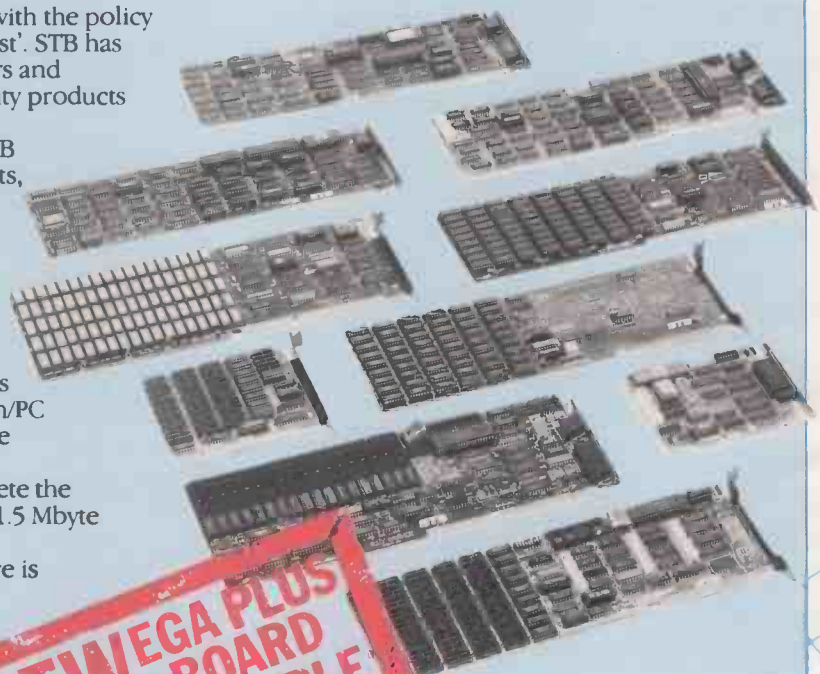

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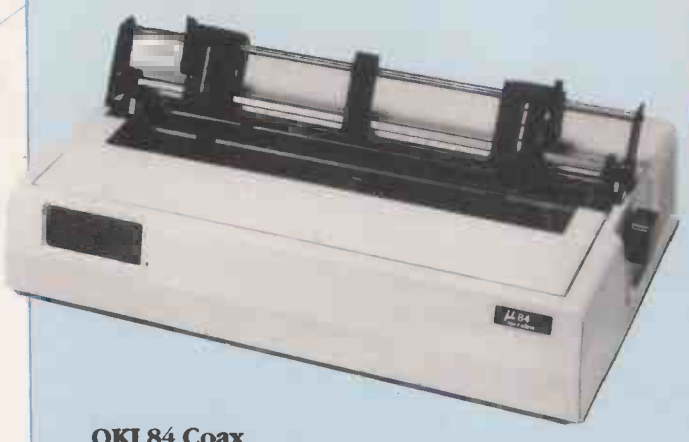
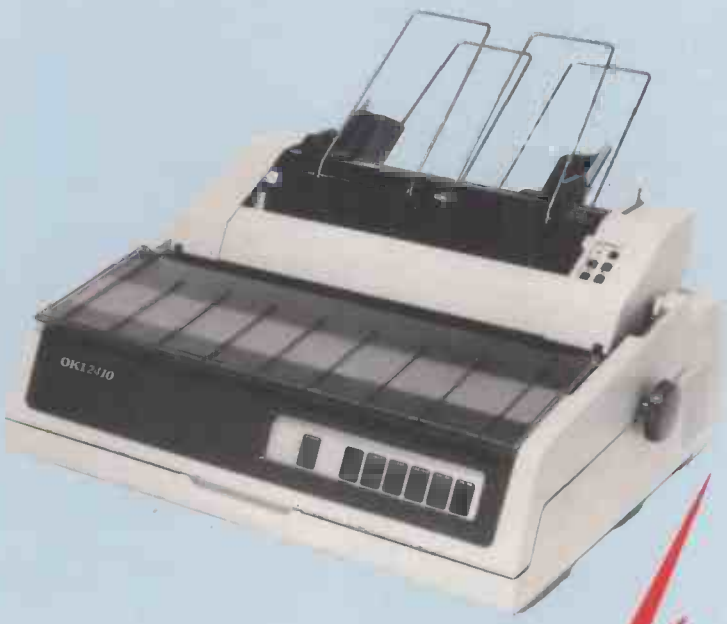


OKI 84 Coax
- Emulates a 3287 with a 3247/76 attachment
- 200 cps (DP Mode)
- 55 cps (CQ Mode)
- 136 column tractor feed
- Up to four part stationery
- Automatic Cut Sheet Feeder Option

OKI 84 Twinax
- Emulates a 5256 or 5225 printer
- 200 cps (DP Mode)
- 55 cps (CQ Mode)
- 136 col tractor feed
- Up to 4 part stationery
- Automatic Cut Sheet Feeder



OKI 2410 Twinax
- Emulates 5256/24/25 Printer
- 350 cps (DP Mode)
- 87 cps (CQ Mode)
- 136 column tractor feed
- Up to 6 part stationery
- Two colour printing

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PC2000 System with CPM Etc. COST OVER £1400
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PCW SHOW FOCUS

The 1986 PCW Show at Olympia in September will be Britain's biggest personal computing event, with twice as much floor space and many more exhibitors than last year. Here's a first look at some of the attractions and special features.

3-7 SEPTEMBER 1986
OLYMPIA LONDON
Sponsored by Personal Computer World

Product line-up looks impressive

For enthusiasts, professionals and business users alike, the 1986 PCW Show is the main event of the year. Last year the show attracted a 63,158 visitors, a new record for the industry, with more than 100 new products being launched.

The new product line-up this year looks to be even more impressive – with everything from games at under £5 to business systems at more than £5,000. Even though most manufacturers say their plans for the show are still officially under wraps, expect announcements from companies such as Atari, Apricot, Olivetti, Amstrad and Sinclair. other big attractions include the unrivalled PCW Show help features: whether you're a home or a business user, these special areas will help you make the most of your system.

This year's show is the 9th event in the series, taking place at London's Olympia from Wednesday to Sunday, 3-7 September. The first two days are once again reserved for business, trade and professioal visitors, with the general public not admitted until the Friday.

There's more space in both Olympia 2, the specialist business area, and in the National hall, which features products with more general appeal to both home and small business users. Opening off the gallery level of the National hall is the Apex Suite where one of the show's new areas, the PCW Show Education Centre is located. This will be of interest to parents, teacher and others involved in education.

Both Olympia 2 and the Education Centre have their own separate entrances and ticketing arrangements; public entrances are at the front of the National hall.

Admission to the PCW Show costs £2.00 at the door, but you can save time on arrival by sending for tickets in advance, using the coupon on the back page of this PCW Show Focus.

Help for business visitors

There's an extensive range of help services for business visitors to the PCW Show, starting even before you arrive at the door.

Business, trade and professional visitors can save time on arrival by registering in advance to receive a VIP visitor pass for easy admission on any day of the show, including the first two days when the general public will not be admitted.

Inside the show, our product locator service is the easy way to find the stands with the products in which you are particularly interested; ask at the special product locator desks to receive an immediate print-out showing their location.

The applications software advisory service in Olympia 2, introduced last year, enables business visitors to identify all of the software which is currently available for their particular business application – whether or not it is being offered at the show. Also in this area are the consultancy services, which bring together specialists in different applications and types of system, ready to give advice and discuss specific problems.

If you are over 18 and qualify as a trade or business visitor, apply for advance registration. Write on company letterhead to: PCW Show Registration Office, 11 Manchester Square, London W1M 5AB.

Olympia's National hall: where the action is for home computer enthusiasts. Look out for attractions like the Association of Computer Clubs and the giant Chartbusters video screen.

Chartbusters

The top 40 games of 1986 will be seen in Olympia's National hall, projected in full colour on a giant video screen on the gallery level.

This Chartbusters feature, which is also expected to include some video clips linked with the leading games, will cover all the major machines. It will be sponsored by MicroScope, the industry weekly which publishes the authoritative Gallup software chart.

A more serious attraction for enthusiasts will also be found on the gallery of the National hall. This is the regular PCW Show gathering of the Association of Computer Clubs. More than 30 clubs are expected to take part, both those from particular areas of the country and those which are machine specific – offering help and advice for users of almost every type of machine and system.

New rail links to Olympia

The PCW Show is now more accessible than ever before with new direct rail services from the Midlands, Northwest, South London, Kent and Sussex, straight to the British Rail's newly-modernised Kensington Olympia station.

The platforms are just three minutes walk from the doors of the exhibition centre, so from many InterCity and South London suburban destinations you can now spend much more time at the show.

By Underground, use the Piccadilly or District Line services to Earls Court and change there for the special PCW Show service to Olympia.

If you are coming to the show by road, Olympia is easily accessible from all main routes to London and has plenty of parking space on site. If you are using the M25, follow the M4 route into London and follow the signs from Hammersmith.

Anyone planning to stay overnight in London can take advantage of the special PCW

PCW SHOW FOCUS

Show hotel and entertainment packages at a wide range of prices – from budget to five star. For details and reservations phone ExpOtel on 01-741 4411.

Making more impact

The use of simple graphics such as pie charts and graphs has already transformed business reports for many organisations – providing much greater impact and ease of understanding. The next big step comes with the integration of text and graphics into high-quality printed documents, which can be designed and produced on the screen at low cost using the latest "computer-aided publishing" techniques.

These will be demonstrated in a special feature area of PCW Show's Olympia 2 business hall, which is expected to include a complete publishing package from a major manufacturer. Systems of this kind can be used for the production of reports, proposals, newsletters and bulletins – for companies, public organisations, associations and voluntary bodies.

Organisations can now develop and operate complete computerised information gathering, presentation and reproduction systems. For example, staff out in the field can enter text and data, such as sales reports, using lap-helds or low-cost home computers with electronic mail links to their base. These reports can then be edited and "packaged" at head office using a word processor. Graphics and illustrations can then be added on screen and the whole designed, typeset and laid-out ready for printing.

Advantages of this approach, to be spelled out at the show, include more effective communication, achieved through greater impact and improved presentation, as well as the savings of time and cost compared with traditional methods.

In addition to the main feature presentation, it's planned that individual companies will demonstrate desktop graphics and publishing packages for a number of machines including the IBM, Mac and Atari. These include Mirrorsoft's Fleet Street Editor, which was launched at the 1985 PCW Show on the BBC and will appear at this year's event in various 16-bit versions.

After Atari's large-scale launch of the 520ST at last year's PCW Show, the company is now planning to make a big impact once again at this year's September event.

An Atari "village" on the first floor of Olympia will bring together more than 60 companies – mainly software houses, but also including some suppliers of peripherals and a number of specialist dealers – as well, of course, as the company's own display and demonstration area. Atari has not yet finalised its autumn product plans, but the show is likely to see the debut of at least one new machine, plus a number of software and peripherals packages.

In a reflection of the broad appeal of the product range, the area will have entrances both to the Olympia 2 business and professional centre and to the general-appeal National hall.

Atari's Robert Harding says one of the aims will be to show the variety of software which is already available: "The emphasis will be on capability. We want people to see products which they know will be right for the job and which they will be able to buy – either right there at the show or from their own suppliers soon afterwards."

It is not yet known if Jack Tramiel will take part in the show as he did last year, but other senior management such as software chief Sig Hartmann are almost certain to be present.

Expert systems for the 'real world'

Practical applications for expert systems in British industry are featured in a special area planned for Olympia 2, PCW Show's business area. The aim will be to show such systems in "real-world" situations and emphasise their value to an increasing number of companies.

A number of organisations will take part, and a special Open University presentation will include a new video on the subject, produced as part of the Alvey programme designed to increase awareness of artificial intelligence and intelligent knowledge-based systems.

This illustrates a number of systems which are in daily use, for such diverse applications as fault location in steelworks and telecommunications equipment, analysis of vibration in helicopter drive systems, alarm monitoring and interpretation on oil platforms and advice to industrial chemists in research laboratories.

This variety of examples will enable PCW Show visitors from many different types of business to identify possible applications for expert systems within their own organisations. Developers talk about the methods employed in system building, highlighting some of the problems encountered in construction and implement-ation, and some of the solutions they have found.

Multi-user challenge from Apricot

By 1990, 35-40% of all business machines sold will be for use in multi-user systems, according to the latest forecasts. Apricot is staking its claim to a large slice of this market with the recently-introduced Xen system. This will be demonstrated for various applications at the show alongside the rest of the Apricot range.

Apricot traditionally uses PCW Show as opportunity for new product introductions, but there is so far no confirmation of what else will be seen this September.

On both price and performance, Apricot says it has the edge over the competition with the new Xen network, which runs the same MS Networks software as the earlier Point 32 system – but with much faster operating speeds. The new system is said to be the fastest and probably the cheapest available. Up to 60 of the disk-less workstation, which sell at £999, can be connected, as of course can other existing Apricot models.

The "mainframe" fileservers are priced from £5,000 for a machine with a 20Mb hard disk to £8,000 for a 100Mb version – providing, says Apricot, much of the capability of a small mini at a fraction of the cost.

Several hundred MS Net software packages have either already been introduced or are now under development. These are for accounting and database operations and for vertical market applications. More than 250 systems are already on order from a wide variety of users, and the first of these were shipped during May.

Amstrad stays silent on launch plans

Amstrad is gearing up for a major new product launch aimed at the business market at PCW Show, but will still neither confirm nor deny that this is the PC compatible machine which is widely expected.

PCW SHOW FOCUS

For the home market, the show is expected to see the debut of the new version of the 128 Spectrum, complete with its own tape drive, which was foreshadowed by Alan Sugar at the time the Sinclair deal was announced.

The London Standard Micro-Business Awards

For the fourth year in succession, the London Standard Micro-Business Awards are being organised in association with the Personal Computer World Show.

These prestige Awards give recognition to innovations in hardware and software which "offer an outstanding contribution to business profitability and efficiency", and attract an increasing number of entries each year.

Products which have previously received one of these awards include the Apricot PC, the highly-successful Torus Icon network system, ICL's One Per Desk, Priority Decision System and Cash Trader, the highly-successful low-cost accounting software for small firms.

The judging panel is a cross-section of specialists with an in-depth knowledge of personal computing and business needs under the chairmanship of Anthony Hilton, City Editor of the London Standard. A new member of the judging panel this year is Ian Fraser, a chartered accountant who is the founder and chairman of the IBM PC User Group which now has some 5,000 members.

The other judges include Michael Jones, a director of the London Standard controlling financial and administrative matters who has been involved with computers since the mid-1960s; Eric Bagshaw, a senior consultant with the NCC Microsystems Centre who has been working with micros since they were first invented – as user, programmer, analyst and most recently as a selection/evaluation specialist, and Warren Werblow, chief executive of the leading computing services company, Scicon. Completing the line-up are Peter Jackson and David Tebbutt of PCW.

There are two separate Award categories, for the best hardware and for the best software products for business applications. In each category, four entries are shortlisted for final judging. The Awards are open to any company in the industry, whether or not it is taking part in the show.

Entry forms are available from: Roger De'Ath, PCW Show, 11 Manchester Square, London W1M 5AB.

Presentation of the annual London Standard Awards is always one of the highlights of the show's opening day. Pictured receiving their award for the most innovative and useful business software from Standard City Editor Anthony Hilton are the management team from Work Sciences Associates, publishers of Priority Decision System.

Miracle Technolgy began with Jeremy Rodwell making pcbs on the kitchen table of his Ipswich home. Today, only six years later, the company is one of Britain's leading data communications specialists, with a workforce of 40.

For PCW Show, the company expects to introduce a range of modern/software packages for business and home users. These will build on the strengths of award-winning modems, WS2000 which was one of the big attractions at last year's show, the new WS3000 which was recently named Peripheral of the Year, and the 64 Multimodem for Commodore 64 and 128 users. This provides autodial and autoanswer, with all software in ROM, giving access to Prestel, Micronet, Microlink and other viewdata services, electronic mail and other comms services.

American newcomer offers high performance

American Research Corporation, newcomers to the PC market on this side of the Atlantic, plan a rolling programme of new product introductions, starting at PCW Show.

The first two products already on offer are the ARC Turbo and 286 Turbo, fast PC and XT compatibles; additions to the range being launched at the show include another machine, a number of add-on boards and peripheral devices.

The company is keen to make the point that it is not another contender in the cut-price Taiwan clones market. Although some products and components are sourced from there, others are manufactured in the US, and the final assembly and testing of equipment for the European market is undertaken here in Britain.

"We have developed our own approach which we consider to be a logical extension of the technology in line with the needs of the market" says a spokeswoman. The 286 Turbo, for example, which is already being shipped, is an 8MHz 80286-based machine that is faster than most competing products on the market, with 640k of on-board memory, while the new hard disk controller is expected to outperform all the available alternatives.

American Research UK has already established a distribution and technical centre in Croydon, South London. It is here that final assembly and test is undertaken for both the UK and European markets.

Education Centre

Successful school computing projects and applications ranging from primary school maths to satellite tracking and history research are expected to be featured in the PCW Show Education Centre – a new addition to the Olympia September scene.

This new area of the show is intended to appeal to parents and teachers alike, and should be of particular interest to

PCW SHOW FOCUS

The Olympia 2 business area at PCW Show: admission is for business and professional users only. Complimentary tickets with advance registration are available from the organisers.

parent-teacher associations involved in fund-raising and support for school computing projects.

The centre will build on the success of the computers in education feature at last year's event, but on a considerably larger scale. More than 50 organisations including schools and colleges, software publishers and hardware suppliers are expected to take part, demonstrating their projects and products.

The aim is to give teachers and others in the education world the opportunity to see and assess the widest possible range of software and equipment – including both commercial products and those developed by individual schools.

For parents, there will be the opportunity to obtain some expert help and advice from a wide variety of sources.

A programme of demonstrations is being drawn up by the organisers; this is intended to cover a wide range of subjects and applications and teachers or specialist advisers with projects which could be suitable for inclusion are asked to phone Alison Black on 01-486 1951.

This new centre will be located in the Apex Suite, which is accessible from the gallery of the National hall. Teachers and other professional educational visitors will be able to use the suite's own entrance, at the corner of Hammersmith Road and Olympia Way, leading to the station and car parks.

Making music the Cheetah way

Home micro users are now developing their hidden talents as musicians, says Howard Jacobsen of Cheetah Marketing. After the success of the SpecDrum digital drum package – sales have now passed the 20,000 mark – September's show sees the launch of a similar kit for Amstrad users.

Also to be unveiled at the show is a digital sound sampler for special effects, expected to sell for less than £50, and a MIDI music keyboard for both Amstrad and Spectrum – to give a complete music-making capability.

The SpecDrum, says Jacobsen, is one of the best-selling peripherals on the market. Customers range from 10-year-old enthusiasts to pop groups and serious musical users, and the Amstrad kit is expected to have similarly wide appeal, with various drum tapes available for less than £5.

Continuous demonstration of the complete music line-up is promised for the show, but Jacobsen makes the point that for home use, the keyboard and drum kits can be played with headphones.

Meet the PCW team

The Show provides your opportunity to meet members of the Personal Computer World team face to face. The PCW stand will form the centrepiece of Olympia's National hall, and it's there that you'll be able to meet some of the specialist writers and reviewers who give the magazine its unique content, authority and style.

Look out for more details of how and when you can come along to the stand, and bring your questions and problems for the experts to answer, in next month's issue of PCW.

In addition to sponsorship by PCW, the show is also supported by other titles from VNU Publications, including PC Week, PC Magazine, MicroDecision, Apricot User and What Micro.

The organisers

The Personal Computer World Show is organised by Montbuild Limited, 11 Manchester Square, London W1M 5AB. Phone 01-486 1951.

PCW SHOW TICKETS READERS' PRIORITY ORDER FORM

Use this coupon to order your tickets (£2.00 each) for the PCW Show in advance and save time on arrival at Olympia.

Complete and return with your remittance to:
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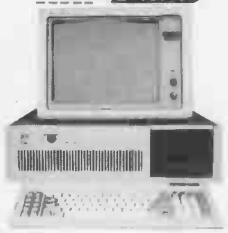

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- 8-slot expansion
- Intel 80286

XT-SBC

- 4.77 & 8 MHz clock
- Serial & Parallel
- 4-layer PCB design
- RTC Calendar

XPC *TURBO*

- 4.77 & 6.67 MHZ
- 4-layer PCB design
- 8-slot expansion
- up to 640K Memory
- 8088-2 processor

XPC-XT

- Standard 4.77 MHz
- up to 640K memory
- 8-slot expansion
- standard 8088 CPU
- 8087 socket avail

Power Supplys

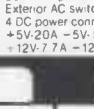
XT 135 watt

- 135w switching
- Whisper Fan
- Side AC switch
- +5V-15A −5V-5A
- +12V-4.2A −12V-5A

XT 150 watt

- Whisper fan
- Hi-output 150 watt
- 4 DC connectors
- +5V-15A −5V-5A
- +12V-5.5A −12V-5A

AT 200 watt

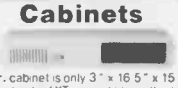


- 200 Watt power
- Exterior AC switch
- 4 DC power conn.
- +5V-20A −5V-5A
- +12V-7.7A −12V-5A

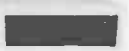
XTC 135

- Rear Mount
- Rear On/Off switch
- extra AC outlets
- +5V-15A −5V-5A
- +12V-4A −12V-5A

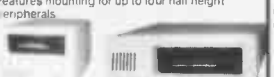
Cabinets



The **XTjr.** cabinet is only 3" x 16.5" x 15" yet it will hold a standard XT compatible motherboard. Includes a switching power supply. Front panel cut-out for a half-height floppy or hard disk.



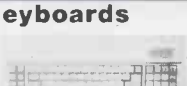
Our **XPC-XT** cabinet has an 8-slot back panel with additional cut-outs for two RS-232 I/O ports. Features mounting for up to four half height peripherals.



The right choice for an external add-on cabinet! Add-on a floppy, tape back-up, or up to 33 meg of hard disk (half-height). Switching power supply is included.

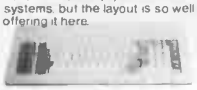
Keyboards

AT



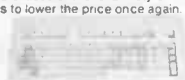
This Keyboard is standard equipment with all of our **XAT** systems, but the layout is so well liked, we're offering it here.

XT



Our volume purchases of these IBM style units allows us to lower the price once again.

5151

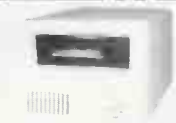


Now a fully selectric unit at an affordable price. Features a 10-key numeric pad & a separate cursor pad.

Drives

Archive
Irwin
Maxtor
Memtek
Miniscribe
Panasonic
Seagate
TEAC
Tulin

3 Sub-Systems



This full height cabinet will hold a Tape Back-up with full or ½height Hard Disk inside (or two Hard Disks).

A perfect cabinet for Tape or Hard Disk, a nice addition to your PC.

Choose from single ½height, dual ½height or ½height with full height base. All Sub-systems include controllers, cables, software, and manuals.

3 Networks

One way to stay ahead of the competition is by using a Multi-User or Network system configuration from **Micro Products International**. Choose Hi-speed RS-232 - **XOR-NET SDLC** or Token Ring. Data transfer rates up to 4 megabytes second can be obtained.

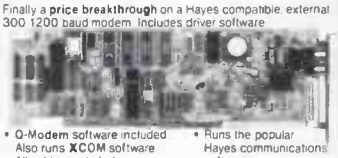
Cassette Training

What is the Cassette Training concept? Using Interactive Audio Training to combine the advantage of classroom and self-teaching methods.
The Method: One audio track delivers a lecture explaining the program, while the second track emulates the keyboard, actually running the student's computer. At frequent intervals the tape pauses automatically to allow the student keyboard input, which is monitored for accuracy by the **MITS *COED***

Int/Ext Modems

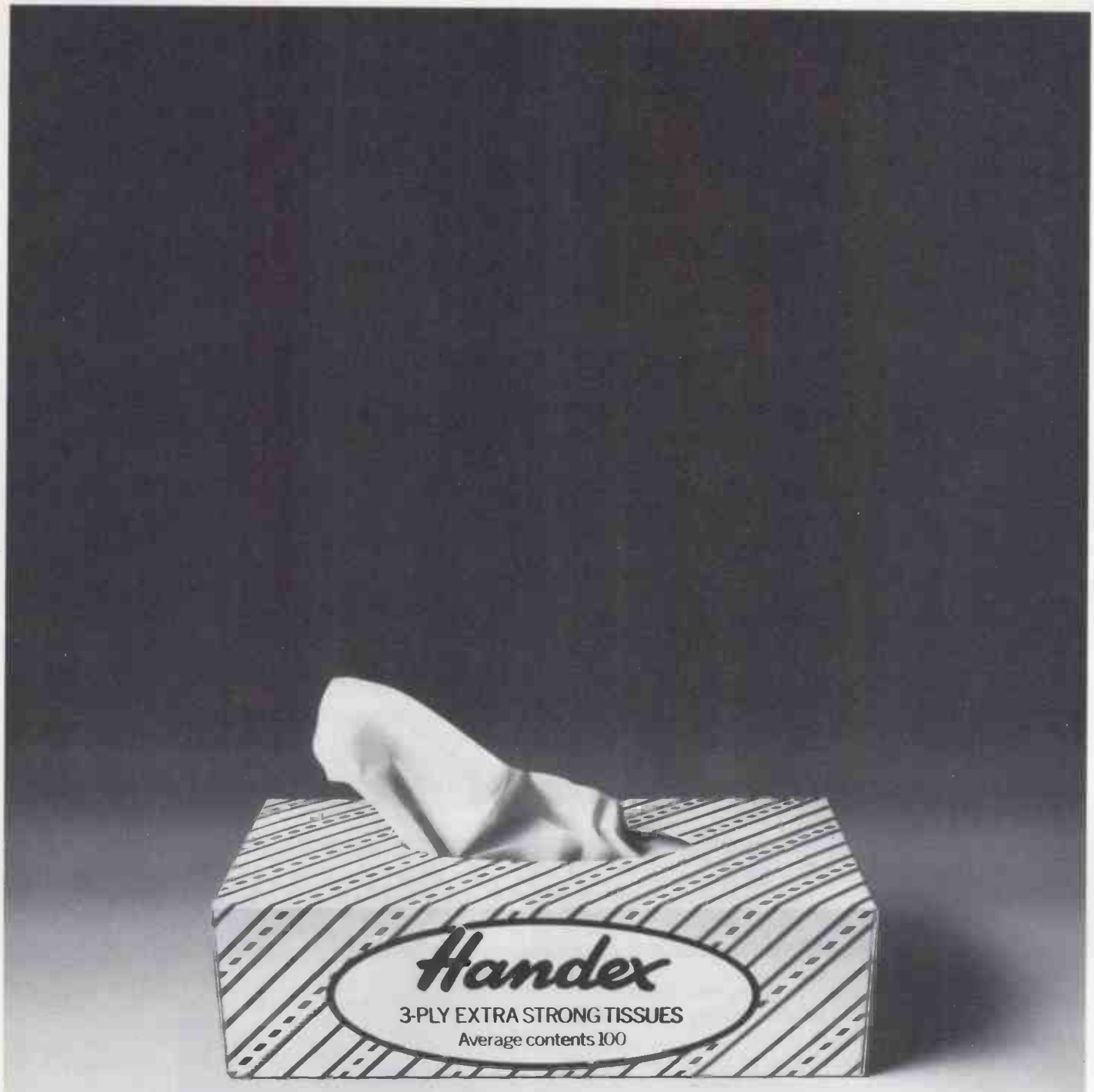
- FCC approved for direct RJ-11 connection
- Phone Cable & Power Supply
- Runs the popular Hayes communications software

Finally a **price breakthrough** on a Hayes compatible external 300/1200 baud modem. Includes driver software.



- Q-Modem software included. Also runs **XCOM** software
- All cables included
- Runs the popular Hayes communications software

We included every feature you would want in a modem card. It's FCC registered for direct connection to your modular phone jack with the cord included.



Essential software if you've just spent over £2,300 on an IBM.

You might well shed a tear.

The IBM PCXT costs over 30% more than the new Tandon PCX10.

And to add insult to injury, the Tandon is by far the better computer.

It has greater expandability and a larger monitor.

Like every machine from our range, the £1,595 PCX10 is IBM compatible. So you have immediate access to the world's largest library of business software.

And that's not to be sniffed at.

For further information, and your complimentary copy of the 48 page Access Software magazine, send off the coupon or phone Tandon on 0527 46800.

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Tandon
Less money. More micro.

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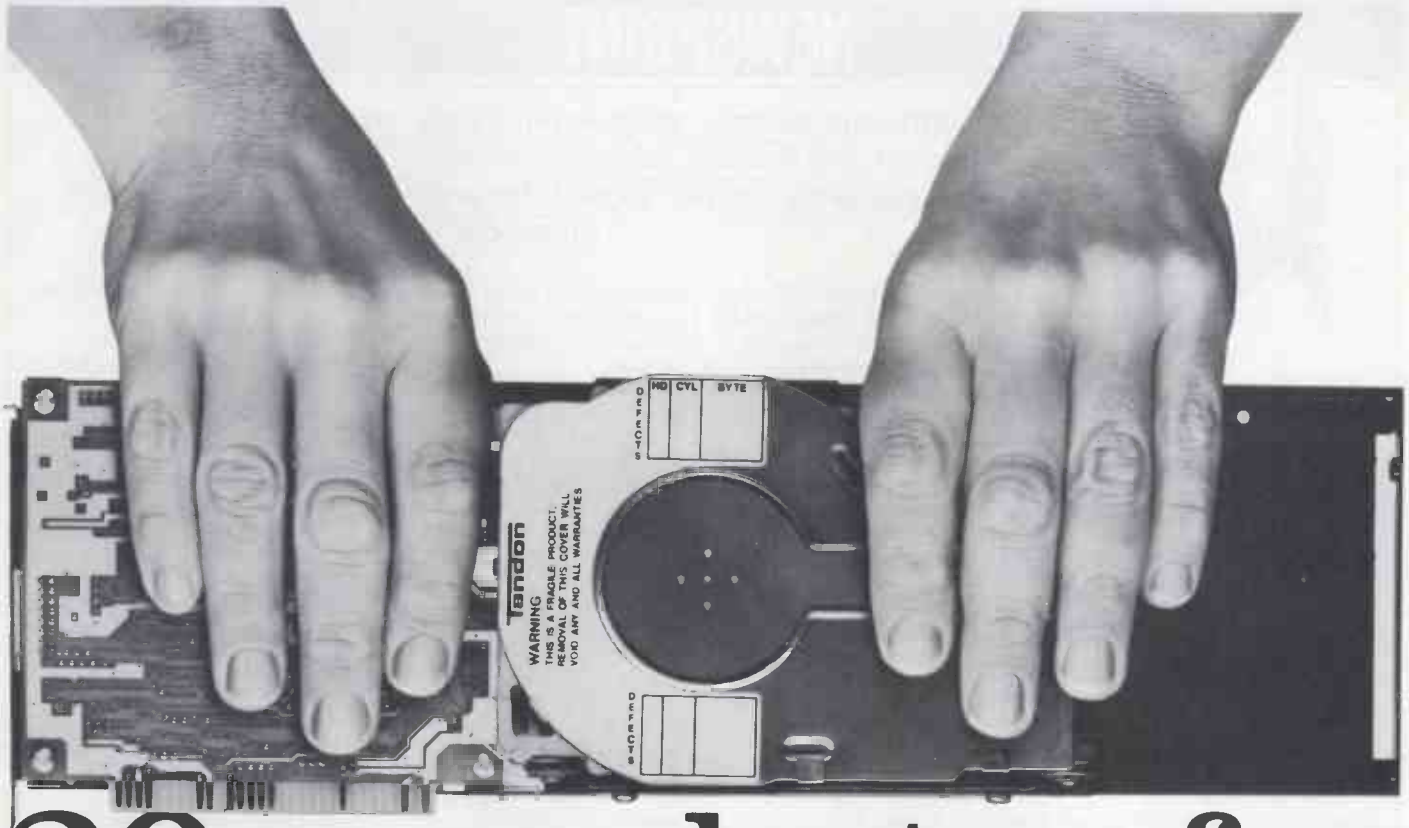

20 megabytes for the price of 10, and no strings attached. Or cables, or wires, or plugs, or accessory boards, or installation software, or...

Amazing isn't it.

The new Tandon BusinessCard can convert your existing PC into a powerful 20 megabyte XT for only £775 excluding VAT.

Alas, our competitors can do little more than offer you half the memory for the same price.

And unlike some conversion units, the Tandon BusinessCard requires no installation software, accessory boards or cables.

It simply slots straight into the back of your PC, so you still have the use of your two existing floppy drives.

No wonder we call it the BusinessCard.

For further information about the Tandon Business Card, send off the coupon or phone Tandon on 0527 46800.

I would like to know more about the Tandon BusinessCard. Tandon (UK) Ltd., Freepost, Redditch, B97 4BR.

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Tandon
Less money, more memory.

Prices quoted are recommended retail prices and exclude VAT. Prices correct at time of going to press.

NEWSPRINT

Although secrecy still surrounds the specifications of the Amstrad and Apricot IBM-compatibles, Guy Kewney hazards a guess at what we can expect. He presents this month's news round-up.

Something's cooking

Both Amstrad and Apricot are releasing their IBM-compatible machines about three months later than I had thought — in September, rather than June.

In the case of Apricot, the machine is the Xen, with an IBM-compatible BIOS and properly IBM-compatible disks — and I bet you thought, like me, that Apricot already had diskettes that were compatible with IBM's brand-new 3½in Convertible.

In the case of Amstrad, secrecy has not lifted one whit since we last printed rumours. However, we are now sure that the spec will include:

- an Intel 8086, running noticeably faster than IBM's 8088, and, therefore, making a very much faster machine — up to Olivetti M24 speed.
- Digital Research's GEM with a mouse, and a version of MS-DOS, but not Microsoft Windows.
- standard 5¼in diskettes (no, I don't yet know, for sure, how many, but I think two).
- either colour or monochrome screens included (options) in the two basic models, but no printer.
- a proper IBM-compatible bus available, but not necessarily included as standard.

Amstrad is selling its cheap add-on printer in a version that does IBM graphics and characters, which means (to me) that the Amstrad PC won't include a printer. But the people who should know say that it won't anyway, because that would steal the PCW's market. I'm not convinced.

The price? Well, nobody knows for sure, but what little leakage there has been from Amstrad suggests that it will be higher than the £500 people were led (by this column) to expect.

From that leakage, I deduce that it will in fact be slightly *lower* than £500, and that the price is being 'talked up' to make the PC sound better when it arrives.

When will it arrive? Well, I'm fairly sure it will be on show at the *PCW* Show in September, and I rather think that it won't be on sale before that. But I expect to see previews at the Amstrad User Show.

So much for Amstrad.

Apricot's delay is caused, very simply, by the fact that the Xen has been selling far better than it deserves to.

The multi-user Xen has tapped a market that looks pretty lucrative — and so have ordinary Xens — and the Xen CD (cut-down) 512k version is only just out.

So, politically, there is nothing to gain by killing off those machines by releasing a truly IBM-compatible machine — yet. And there is everything to gain, politically, because dealers who sell the current machines are not going to take kindly to the suggestion that they have to carry on buying what they have already ordered, when the new one is available.

There is also the embarrassing theory (my source is authoritative, but two people I have never spoken to were fired when we revealed the Xen in advance, so they will remain secret this time) that the Apricot disk directory is wrong.

A year ago, when it began to look likely that IBM would, at least, make the move to 3½in disks, Apricot was cock-a-hoop. 'We were there first,' the company crowed.

It seems that somebody inside Apricot decided that they would 'improve' on DOS directories, and as a result, they still aren't there.

In the next three months, Apricot is likely (according to this source) to quietly change the version of the operating system, for one that more closely resembles IBM's.

Analysis: Apricot is about to start paying the penalty for its persistent belief that it didn't have to be technology-based.

This theory won't go down well in Birmingham. The fact of the matter is that management there is simply not aware of how thin its technical competence is spread.

However, a few conversations with software developers will reveal that information of a technical nature is almost impossible to get out of Apricot — not because the company is secretive, but because it is ignorant.

Apricots sell because they are the descendents of the very, very successful Sirius, which ACT sold. They started out looking neater and smaller than IBM PCs, and with the 8086 in them, should have been faster. In fact, they were (and are) slower.

The Xen is (at last) faster than the equivalent IBM, but after the mistakes — technical, not just marketing — of last year, Apricot's image has collapsed, and the Xen has given the company just 10 per cent (or so) of the market. And software for it is just, simply, not available — until the IBM-compatible version is out.

What the Xen future after that may be, I don't know: I believe something clever will have to be cooked up, and I don't smell anything cooking in the kitchen.

New chips to boost ST sales?

Atari's ST is about to get yet another boost with the launch of the famous 'blit chip' and a matching sound chip, which, we all hope, will make the ST directly comparable with the Amiga.

At the same time, Commodore is planning to announce its 1Mbyte Amiga, around the same time that Atari launches its blit-based machine — and this time, the Amiga blitter will be able to reach parts of memory that it can't on the original model.

The blit chip is a kind of 'personal assistant' to the main processor, handling the fast data shifts that are necessary to produce animated graphics, without requiring the processor to spend time working out which dots are going to be red, green or blue.

The good news is that the blit chip is due for a September release: the (possibly) bad news is that it won't be available for current ST models.

A totally new model with 2Mbytes of memory and the add-in chips, plus one or two other improvements (possibly a hard disk version, too) will be presented to the world at the *PCW* Show in September. It will be on sale some time thereafter, and don't ask me how soon thereafter, because there is no way of knowing.

This new model is the only machine with the blit chip currently planned, until bigger and better (such as 4Mbyte) designs are released. Current machines are not affected.

For some people, the news is good. It means they can rely on the current specifications staying constant.

The rumour of the blit chip was started by programmers, in the know, around Christmas 1985. Subsequently, senior engineers at Atari began giving details of the chip, and included the news that it would not be available in the 520ST, but would be available in the 1040ST as an upgrade.

That turns out not to be true.

You will hear from 'authorities' who 'know about Atari' that the current 1040ST has two empty chip sockets ready for the blit chip and its sister, the sound processor chip.

It doesn't. There are no empty sockets in the 1040.

You will also read, in some places, about the wonderful plug-on box which will allow ST users to upgrade to the blit and sound chip.

This will not be possible, either.

The good news, however, is that as you can't upgrade today's ST boxes to blitter spec, you don't have to worry about software for the 520 and 1040 models coming out in two versions, or about making a 520 bought today work with a 520 bought for Christmas this year. They should stay the same. The bad news, obviously, is that many people quite possibly

thought they could upgrade, and they can't.

At this point, I'd really like to say how many people in the UK, Germany and France are likely to be upset by the news; but I can't, because controversy rages among us industry observers (journalists) about how many STs have been sold.

My own information comes from sources which should be accurate — people who are selling software to ST and Amiga users.

Some of these people get royalties on the sales of machines, and these royalties show that, despite the non-existence of the Amiga in Europe up until June, it is not very far behind the Atari ST in terms of the total number sold.

The numbers are very, very approximate. Making guesses about sales after the last royalty figures, one has to assume that Atari's American sales have been hurt by the company's decision to go mail order with the 260. And I have to report sources saying that the Amiga's big US price cut (down to $700) in May was very good for sales.

Mixing all that together with a lot of other guesswork, it looks as if neither company has hit 150,000 sales, yet.

But in the US, Amiga sales may now be twice Atari sales (very roughly), while in Germany, Atari sales may actually match US figures. And in the UK, I'd guess there are rather fewer machines than rumour has it for Atari: there may be as few as 150,000, according to one informed source. To be fair, other people have estimated 50,000 — which I simply don't believe.

The current price of the Amiga in the UK (£1475 plus VAT) is stupid beyond belief, and is compounded by the fact that any number of potential buyers are BBC Micro owners who already have monitors. But Commodore, initially, isn't selling the machine without a monitor.

That will change as the machines become available.

And the bigger Amiga, due out before the end of this year (where? the US only? I can't get details) should put price pressure on the current model.

I shouldn't rush to buy an Amiga at current prices, if I were you.

Play it again

A levy on blank tapes, as long as they are 35 minutes' playing time or more, has failed to delight the nation's software publishers.

The Guild of Software Houses (GOSH) has, on occasion, been accused in this column of being a sleepy outfit — when I was trying to flatter them.

The GOSH performance on the subject of the levy illustrates my point beautifully — I agree with the Guild's opinions on the levy (it's stupid), but am amazed at its failure to promote it earlier.

The only person inside GOSH who seems to be prepared to speak clearly on the subject is one of the four 'chairmen' for the year — former director Tim Langdell of The Edge.

'We think we should get 10 per cent of that levy,' said Langdell. 'I think the only real reason they haven't given it to us is that they don't think much of GOSH — the argument is that we don't have the system to disperse the levy among copyright owners.'

The honest answer, as Langdell admits, is that GOSH *doesn't* have such a mechanism. Who should pretend to be surprised? GOSH doesn't even have a way of organising the Top 20 Games Charts; those are produced by the trade weekly, *MicroScope*, as a self-promotion item, and frankly, it shows.

However, though GOSH's disorder may be the real reason, the given reasons are a masterpiece of spurious logic.

Essentially, the legislation putting 10p on blank tape prices for copyright holders falls down on two levels. Firstly, it seems to imply that you can't copy programs onto C90 tapes. Ha! They are, obviously, the school-kid favourite medium, because you can get so many on one tape.

Putting no levy on short tapes is silly. As Tim Langdell put it, in his furious passion: 'I read this as saying that short tapes are "non-infringing uses" including computer software uses.'

And, he added: 'I think this is because they were writing the Green Paper before the FAST act got through, making copying of programs an offence against the copyright act.' In other words, an administrative foul-up. The act should have included copyright infringements of most kinds.

The effect, however, is to imply that it's OK to copy software as long as you use shorter tapes than 35 minutes. Which is not true: it remains illegal — but it's going to be hard to pursue such cases in court if the defendants can argue that it *must* be legal, or there'd be a levy. And does the existence of a levy mean that it's OK to copy music?

In the end, the software business must oppose the levy. However it is operated, it must be seen to be a licence to pirate by most users.

In truth, the users will probably not do the industry any harm by swapping tapes the way they do — it's a very effective publicity mechanism — and it certainly can't be stopped. But software producers really cannot say that in public, nor should they.

I left a dispirited Langdell growling angrily: 'The music industry has the Mechanical Copyright Protection Society, MCPS, designed to look after the general copyright industry. We only have FAST (Federation Against Software Theft) mixed in with GOSH, and also the British Computer Society.

'Only' is right.

Another 'first' removeable Winchester disk: this one from HAL Communications is actually the Micro Storage Corporation drive. You take out the hard disk exactly as if it were a floppy disk, but it isn't, and it has 10Mbytes of data instead of 360k.

Cost is likely to be princely for a combined fixed (10Mbyte) disk plus a removable (10Mbyte again) disk, including a controller, costing £1600, and bigger systems costing more.

Details from HAL on (0252) 517175.

Time to upgrade?

A simple plug-in processor chip has been released by NEC, to make all machines with an 8088 go faster.

The chip has been on the market for some months now — several thousand have been sold by Nigel Grant's Control-Alt-Deli — and is supposedly a simple plug-in duplicate for the Intel 8088, but with lots of internal functions speeded up enormously.

Do not throw away your 8088 chip, if you perform this upgrade; most of your software will be unaffected, but by no means all of it.

From the *Victor/Sirius file*, a specialist newsletter, comes the news that some of the fundamentally essential programs for copying and formatting diskettes need alteration, if you are using that chip. The newsletter has published a fix for the Sirius version of DISKCOPY, but don't try this on an IBM-type processor.

Incidentally, the newsletter also reports that an upgrade for the Sirius is due out shortly, giving it the speed of (at least) an IBM AT. The newsletter is contactable on (01) 883 3501.

Many months after I promised to reveal how to upgrade an Amstrad PCW8256 to 512k, I was just getting pleased with myself, having discovered Citadel Products, when my colleague Simon Goodwin of *PCW*'s 'Computer Answers' (he's a consultant) rang up to ask if I'd done it.

'Yes', I said, 'and the kit including a 1Mbyte disk and memory chips costs £190.'

'Wow', said my colleague, 'that much?'

I thought it was cheap.

Citadel has arranged for a network of dealers to carry the product, so that people who really aren't happy about fiddling with their circuit boards can get somebody else to do it —

from the company on (01) 951 1848.

'Computer Answers' next month will carry full details of a really do-it-yourself solution, from MicroBridge, 75 Goodramgate, York YO1 2LS — tel: (0904) 39449. The memory costs £50 (fitting included).

Current model 256 machines allow the memory to be switched in with a little jumper on the board, but original designs need a little work on the board itself — soldering, in fact. These details will also be in 'Computer Answers', next issue.

Pegasus accounting

A program generator with a really obvious purpose is one that allows you to add bits to your accounting program — and Pegasus now has one for this task.

I found this generator almost by accident, when somebody rang up to say that Brikat might be struggling financially — for sale, even.

The idea that the producer of the company's leading accounting package, Pegasus, might be in trouble, seemed so strange to me, that I actually phoned the company to ask what was going on.

The group has been investing its enormous revenues fairly widely — setting up shops, buying other software houses and expanding its technology, which seems to have been what has frightened a lot of people.

According to Colin Stanley, the founder, the problem is probably simple. In a nutshell, the shops aren't hugely profitable, but then they weren't expected to be at this stage. But they have cost money.

The program generator is one example of where the money has gone.

SoSoft, which was taken over last year, has a database called Elite. It turns out that nearly half the people who buy Pegaus also buy the database package — which is why Brikat, the parent company, bought Sosoft. But it also turns out that the main reason for buying the database is to manipulate the accounts records to give features not included in the standard Pegasus design.

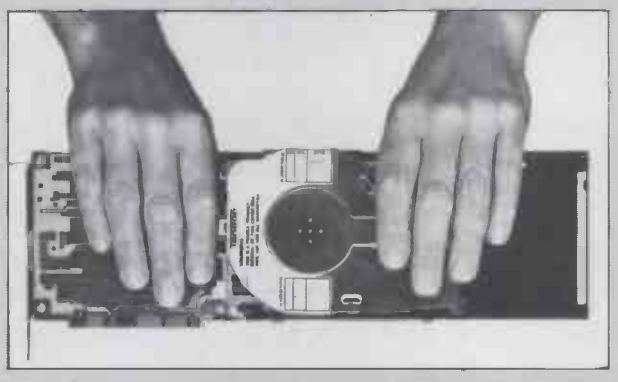
Sosoft got together with C specialist System C, and produced a special version of that company's product, Sycero, which lets the typical computer dealer add features to Pegasus.

The new features appear on the standard menu and behave in standard Pegasus ways, giving the appearance of a vastly expensive, custom-made accounting system, with the advantage of being a bog-standard Pegasus system underneath it all.

A lot of the anxiety about Pegasus arose because of the enormous success of Sagesoft, which has a CP/M accounting system for the Amstrad. That has made a lot of money, and a lot of headlines, at a time when Pegasus stories have been on the back burner.

The *Financial Times* subsidiary, *Investors Chronicle Newsletter*, came out with an analysis of the group in the week the generator was launched — suggesting that, far from being in trouble, the only reason Brikat might be for sale was that the shares were hoeplessly undervalued.

Colin Stanley smugly told me that he'd been taking advantage of the low price to buy a lot more of his own shares.



Do not assume, when using a business PC or a clone, that every message it gives about errors is correct. In particular, don't believe it when it says your latest plug-in, multi-purpose card, including modem, doesn't work. It probably does.

The problem seems to be software, most of the time.

There's a fundamental difference between the typical PC and the typical AT: the AT has four more DMA channels, and more complex interrupts. The result is that you have to be careful with plug-in cards — especially plug-in disk cards.

The problem is often one of timing, of course, with the AT machines going very much faster than the PCs, and peripherals designed for the PCs just getting confused.

The illustrated Tandon plug-in disk card, 20Mbytes for £775, will fit into most PCs, says the maker — except Olivetti's M24; a special version is available for that machine. But you do have to worry about how many hard disk controllers there are in your system, because these devices use direct memory access, and interrupts, and can conflict with each other.

Strange things happen when these conflicts arise.

Adding-in memory cards, for example, can be a hazard, because IBM-family machines can have 640k. You can't create 640k from 256-kbit chips, so you have to go for 512k, or 768k. Or you can plug in 512k's worth of 256k chips, and 128k's worth of 64-kbit chips — but nobody bothers these days.

Plug in a memory extension card (it may not look like memory extension, and you may think it's just a network controller, or a serial port and a clock) that uses the same spare 128k, and you have two chips responding to the same addresses. Chaos.

People report strange symptoms when they buy their own memory chips to plug into empty memory sockets.

One simple fact (which I discovered in the CP/M user group magazine recently) is that these memory chips are supposed to keep their data for two milliseconds without electronic refresh. In fact, most of them can keep data for two seconds!

Why is that a problem? Because some software people know they can rely on memory even if they starve it of refresh, and so they can do things much faster. Then you plug in chips which meet the official spec, and the software expects them to exceed it, and the system falls down.

There isn't a lot you can do without sophisticated technical help, except take the board back to the shop and say: 'It may not be faulty, but it doesn't work in my system, and I want a different one, please.'

Merlin on the phone

I am asked, officially, to cheer for the arrival of the first Merlin exchanges. 'You'll like this,' said my Telecom contact. 'You're always groaning on about tone dialling, and Merlin will do that.'

All the arrival of Merlin tone dialling means is this: the few people who were really vocal about the shortcomings of the standard telephone system (businesses) will now have an alternative.

It's amazing how dumb Telecom Authority can be.

It really doesn't understand why British people vandalise public phones, and Americans don't. It's simple: Americans all have phones, and so they want the public boxes to work so they can call their friends. British people with below-average incomes don't have phones.

'But we provide public phones! — so they can use those,' complains Authority. Quite so, but who are these people supposed to be calling with the phones? Another public phone box, just in case a friend happens to be vandalising it?

American 'common people' have phones because Bell gave free local calls for two decades. Everybody installed phones. Now, Bell charges for local calls, but everybody now needs phones because all their friends have them.

Today, Americans are all buying 2400 bits-per-second modems in order to dial up

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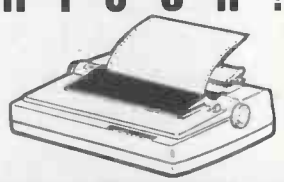

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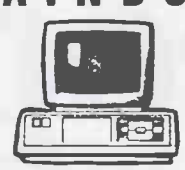

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apricot *XEN*

There's a lot of talk about the new Apricot XEN. Experts, normally restrained in their praise, are becoming unusually enthusiastic.

Phrases like "in a league of its own" and "incredible value for money" are being used.

So why is Apricot XEN so special?

Because of its astonishing performance, for one thing. Apricot XEN has come out on top in every test so far. In an article measuring computer power, the Guardian decided that something called "processor → memory bandwidth" was the most accurate yardstick. Naturally, Apricot XEN achieved the highest score, even beating one of the leading minicomputer systems to the mark.

And when you look at XEN's storage capabilities, it's clear that they are just as impressive as its processing power.

XEN's disk drives have broken all the benchmark records too. So whether it's the XEN FD with twin 720K floppy drives, or the XEN HD with a 20 Megabyte hard disk, a XEN won't keep you waiting.

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But what has really caught the imagination of the computer industry is how little this powerful machine costs.

With multi-tasking Microsoft Windows as standard, a twin floppy disk XEN FD with 512K of RAM and a monitor can cost as little as £2494, while the XEN HD with a 720K floppy drive, 20 Megabyte hard disk and a full 1 Megabyte of RAM is an astonishing £3494.

When Apricot offers this kind of value, the competition will have to take a long look at their own prices – if they expect you even to glance at them.

Choosing even the basic XEN configuration can mark the beginning of a long and fruitful partnership.

The memory of an Apricot XEN can be expanded to 5 Megabytes. You can add a second 20 Megabyte hard disk. Soon, telephone and modem communications, and even an expansion box to make use of specialist IBM cards, will be available, as will a tape cartridge back-up system.*

And XEN's open architecture means it can run on Apricot Networks, and even run as a multi-user system under the Xenix operating system.

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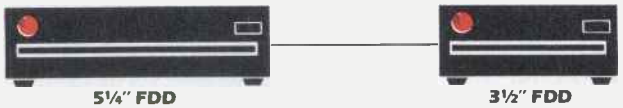
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COMPATIBILITY TABLE & PRICES

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XF700A	**APRICOT (range)**	**3½"**	**(single/double sided disks)**	**295.00**
XF1200A	**APRICOT (range)**	**8"**	**IBM 3740 format**	**695.00**
XF400S	**SIRIUS/ VICTOR**	**5¼"**	**IBM PC/XT**	**495.00**
XF700S	**SIRIUS/ VICTOR**	**3½"**	**APRICOT (range)**	**395.00**
XF1200S	**SIRIUS/ VICTOR**	**8"**	**IBM 3740 format**	**695.00**
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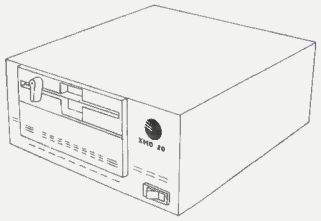

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In the days before graphics-based word processors such as MacWrite and Microsoft Word, there was a package called Volkswriter Deluxe which, like WordStar, just printed text on paper, but gave you several options on how this could be organised.

These days, Volkswriter is out in Version 3, which is more graphics-based. But Volkswriter Deluxe, instead of being abandoned, has been put back on the market at £99 (it was previously £289).

If ever I saw an example of preparing for the launch of the cheap Amstrad PC, this must be it.

Details on (0494) 772422 from Lifetree.

communications using X.pc, or other error-correcting protocol databases.

In this country, despite a lot of hot air, the only serious suggestion packet-switching people have for high-speed data links to their service is 'buy an X.25 link at £2000 a year.' (That's the starting fee.)

In 10 years' time, when American users are all swapping high-speed data on 9600 dial-ups, our Authorities will still be arguing that it can't be done without the installation of more sophisticated equipment, and that we should wait for 64-bit comms. When Americans are all using optical links at 2MHz, our Authority will be saying: 'No, no, wait for the satellite service, which we can install on the roof of your business for a mere £6000 a year, at 50MHz.'

We'll never get there, you know.

The Pawn

I like The Pawn, because when you type in something like: 'Ask the dragon whether ontological poof of God's existence is a prerequisite', it says (like any other adventure): 'I don't understand poof' — but you don't have to retype the whole sentence. Instead, you just hit Escape and edit the 'proof'.

No, I suppose that won't do as an adventure game review.

Professional adventure game reviewers must have infinite wisdom or infinite patience. The rest of us, when given a new adventure game like The Pawn, from Magnetic Scrolls, have to cheat — which means we can tell you what the game is about, but not, of course, what it is like.

Except that this game is rather different from many.

I must say that it grew on me, where most adventures wear thin, because it develops in unpredictable ways.

Here is a typical conversation between two players of the game:

'How do you open that wretched safe?'

'Oh, that's simple. You use the key you find near the passage.'

'There is no key there.'

'Oh, yes, there is; in the niche.'

'It's damn well-hidden, that's all I can say.'

'Not at all — you just get it, and there you are. Then you wait for the adventurer to come by, and . . .'

'But the adventurer is fighting the snowman! And he's opened the . . .

'Ridiculous! He can't do that, because then he'd save the princess, and you have to do that yourself.'

In most adventures, there is a set order of doing things. Get the scrolls, then read the spell, and you can open the casket. Try and open the casket without the scrolls, and you will merely fail.

In The Pawn, if you don't get the scrolls, somebody else will. If you don't eat the hamster, you'll possibly never be able to free the tiger; but at the same time, the snowball won't be needed in hell. (I'm inventing things and possibilities, so as not to spoil the game.)

Having decided that you took too long to get a key from one side of the adventure to the other, you go back and replay it, leaving out one or two distractions. This time you get the key, and find that there's nothing inside the room! And it dawns on you, after two or three goes, that there never will be. Something you did has prevented somebody else getting there, and you've got points for doing something else after all.

Magnetic Scrolls is run by Anita Sinclair, an earnest young programmer with a sense of destiny, and a conviction that adventures aren't really as important as the parsers that you use to understand the people who play them.

I nearly agree. The trouble is, the parser for The Pawn is so good, it's almost useless.

Where normal adventures have to be told 'get key; look key; look tumblers; look chip; in lock', this one can cope with the far more normal English-like: 'Get the key from the desk, look at it and examine the tumblers, then examine the chip and put it in the lock.' (That's a phoney sentence, so don't try it in The Pawn. No chips.)

But if a parser can cope with complexities like: 'Put the key in the jeans on the stump in the pouch,' and even worse tangles of grammar, then you don't expect it to be stymied by: 'Ask trader what the jewel is worth' (you have to say 'what the jewel costs'). Of course, there is a limit to any parser. As with any program, if the programmer thought of it, it can cope. If he/she didn't, it can't.

But for a lot of the puzzles in this game, correct phrasing is vital; for others, it doesn't matter a damn. And I find this a distraction, oddly enough, from the puzzles themselves.

My theology says that Magnetic Scrolls is quite right up to a point. If you're in a dark room, and you say 'Get all', nothing should

This splendid building is just to prove that we run nice stories about Apricot, as well as gloomy ones. The building is the new £1m R&D complex built by Apricot on the campus of the University of Birmingham, and Apricot says it's a 'pioneering move to forge stronger links between industry and education.' Well done, Apricot. And pay attention to what your research people tell you.

Objections to several PC-based design programs are based on lack of speed and a grotty (standard PC) display.

Pricey enough that the company doesn't reveal the price, Aydin Controls' new Revolution is a high-resolution, high-speed graphics controller, imported from The Number Nine Computer Corporation in the US. It gives a display resolution of 1280 by 968, which is impressive, and Aydin claims that on an IBM PC/AT or an Olivetti M28 (AT-equivalent, but faster), the system is the fastest in the world.

happen because the program should be smart enough to know that you can't see the objects. And it certainly should not (as with one Level 9 game) give the whole game away by saying: 'But you can't see the Allosaurus!'

But for me, 'examine fountain' and 'look in fountain' are equivalent, and with a clever parser like The Pawn's, you assume that it understands what you mean.

You get used to it, once you crack it, and it's just perfectionism, I suppose, to grumble.

On the Atari ST there's an extra problem, in that The Pawn has been written as if for the Commodore Amiga, and has then been adapted for the Atari. The result is that several things that the Amiga does automatically take forever on the ST, and use up valuable memory — Magnetic Scrolls has had to abandon several nice features as a result.

I hope they re-appear on the Amiga. I might enjoy playing The Pawn again — only this time, I might try to rescue the princess.

Laser storage

Amazing: more than six months after I wrote in this column about optical disk storage at last year's Compec show, Apstor has announced 'Britain's first optical disk units'.

The Apstor devices are one up on previous ones, in that they will be available as complete units, not just with SCSI interfaces. Apart from that, it's the same technology we saw last year: write once, then read as often as you like without overwriting or deleting.

With 100Mbytes on a laser disk, there's no urgent need for the ability to re-write. And Apstor also does a 400Mbyte drive.

Details on (0273) 422512.

Amstrad over a barrel

It looks as if Amstrad may yet regret launching the model 664, which was available for a few months last year as a stop-gap before the appearance of the disk-based 6128 — the company may have to refund the money of quite a lot of 664 purchasers.

I'm keen to see how Amstrad answers the accusation that this temporary machine (the 664) is 'not suitable for the purpose for which it was designed,' since it won't run most CP/M programs.

The accusation comes from a user, Vincent Oliver, backed by advice from his local Consumer Advice Centre. Vincent Oliver wants his money back, or a swap for the 6128, or a swap for the 8256.

The incautious claim which may land Amstrad in some legal debate is one which appeared in the advertisements a year ago: 'The Digital Research CP/M operating system is supplied with the CPC664, permitting the user to access the wealth of applications software written to run under CP/M.'

Had Amstrad insisted on the word 'access' as the basis of its defence, it might have been able to convince legal authority that the word implied merely 'some of' the 'wealth of applications software', rather than meaning 'very likely the program you have in mind'.

Unfortunately, in a reply to the careful Mr Oliver (who has sent me all the letters in this dispute), an Amstrad official, Mr Angel, described himself as 'confused' by the suggestion that his machine wouldn't peform as advertised. Mr Angel referred the complainant to NewStar Software — a distributor which does, indeed, have a long list of CP/M titles.

Unfortunately, these titles all run on the 6128 or the 8256, with very few being available for the 664. 'To relieve you of any confusion,' wrote Mr Oliver in a kindly way, 'a lot of CP/M titles require a minimum transient program area (TPA) of 55k, and most popular CP/M titles require a TPA of 61k.'

The 664 does not have enough memory to run most CP/M programs, and Amstrad knows this.

At this point Amstrad's executives lost their bottle, and told Mr Oliver that it was up to the retailer which sold it. The retailer, not unexpectedly, quickly told Mr Oliver that it 'would take up the matter with Amstrad.'

My own opinion, for what it is worth, is that in the special circumstances of Vincent Oliver's requirements, he has a pretty convincing case. I can see that Amstrad didn't want to give in and set a precedent. But possibly, the company would have done well to settle with Mr Oliver before he publicised his dispute. I feel sure that there are other people who feel similarly annoyed and hadn't thought of taking this action, who may now feel inclined to imitate it.

NewStar to the rescue

The outlining 'shareware' program, PC Outline, which appeared at the West Coast

Another box with disks and paper in it. This is Oracle Corporation's way of publicising the fact that its Oracle database is now available on the expensive IBM Risc Technology computer, known as the RT all around the world (except in the UK where IBM sends out publicity literature with RT on it, but insists that you call it the 6150 when you talk to the company on the phone).

Oracle is a well-known relational database, and this is the PC version, not the RT version; though I can't see you having any trouble loading the photograph.

Details from Holland — phone 31 2159 49344, preceding that by the Netherlands dialling code.

Faire recently, has been the subject of such intense UK interest that NewStar Software is planning to give it away free with copies of NewWord (a WordStar-like word processor).

Very fortunately for me, the company has also offered to unload the alarmingly heavy postbag of floppy disks which have been sent by PC users anxious to try out the program.

Anyone who feels that I should stick by my offer ('Newsprint', *PCW* June) to do the disk duplication myself rather than hand over names and addresses to a commercial outfit, can feel free to exercise their scruples on my behalf: I simply don't have the time to respond on the scale that readers expect.

The product will be officially available from NewStar for £160 (registered user status), as soon as the company has the manual ready.

The current version lacks some features of the forthcoming upgrade. For example, it tends to get confused on AT-like machines (the 80286 varies subtly from the 8088) and can corrupt a file. It doesn't allow double-spaced printing, which will be available soon; and it sticks to one colour scheme (white on blue) which not everyone likes.

The shareware concept requires that if you want upgrades, you have to register. Please don't ask me for upgrades!

My own enthusiasm, however, remains high for the program. I use it now as my main word processor, and also as my main desk diary/phone book. I still don't understand all the printer controls, and I have a 'wish list' of new features, including a phone dialler. But despite any little grumbles, I think PC Outline is superb.

Magic approval

To the sheer astonishment of rival modem makers, the £100 Magic Modem has, after all, been approved.

There was a theory going around at the time Magic got its green sticker, that modem makers might soon be able to award their own green stickers.

It proved very hard to get an official 'yes' or 'no' to this idea, which was actually published as fact in a communications journal, and at the end of investigations, I have a lot of notes from people who have a pretty good idea themselves, but would only say 'no comment' when pressed.

There is, apparently, a committee, or Working Party, looking into ways of improving approvals. The idea is to get approval quicker, cheaper, and more sensibly-based than on outdated safety requirements.

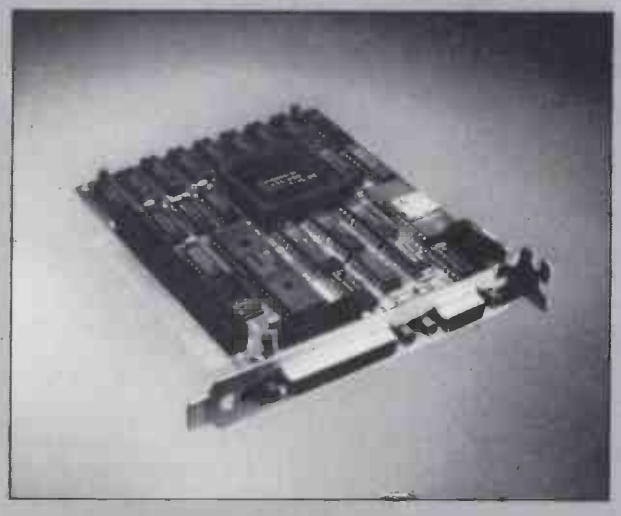
The Working Party is due to report before the end of the year, and certainly some of its members do favour some kind of 'manufacturers' declaration' instead of today's awesomely complex testing, independent laboratory assessments, and then the obstacle course of three different authorities who can veto a design.

Barry Krite reckons that getting Magic Modem approved has set him back £10,000. Higher prices have been paid by rival firms.

But just because many people favour making things simpler doesn't mean that the lawmakers can accept their proposals: I gather that a major hang-up is likely to be new European laws, which will insist that modems approved in one EEC country must be accepted in others.

In the meantime, remember that approval is purely a question of safety for the Telecom lines, switchgear and software, and doesn't even try to guarantee that the modem will work as advertised. I have several modems from various suppliers, all with green stickers of approval, and not all of them are even useful for interrupting voice phone calls.

All of which is not intended to be a reflection on Magic, which I haven't tested. Details of the Magic Modem on (01) 482 1711, and feel free to write to me with your impressions of the beast.



This is supposed to reduce the confusion of IBM colour implants. It is from Intelligence Research, and it provides 'all the major colour and monochrome standards on a single card,' at a price of £445. That includes monochrome 16-colour emulation, 720 × 348 bit-map resolution (mono) and up to 16 colours in high-res on standard IBM monitors. IBM graphics options are immensely complex; your strategy should be to decide what you want to run, and then ask IR whether its card will handle it, on (01) 740 5758.

Masterly release

Complaints flood in from BBC Micro users, saying that nobody writes software to take advantage of the extra memory in the Master, or in machines with sideways RAM. But there's Big Software, from Academic Software.

The subject matter is a little esoteric — four 'educational' programs. There is Boat Hull Design, there is Kitchen Planning: both sound extremely useful, and the boat program allows timber selection and a 3D design sequence, culminating in computer-monitored tank testing.

Then, believe it or not, there is Human Digestion 'which employs colourful and instructive graphics simulations,' and Meal Planning, which 'enables complex recipe selection from a large recipe bank, with a separate database of nutrients.'

Details by sending an addressed envelope with stamp; Gwynneth Pettit runs Academic Software, at Sourby Old Farm, Timble, Otley LS21 2PW, Yorkshire.

First Word — the last word

Atari has decided to continue supplying its free word processor, First Word, which it originally gave away instead of GEM Write (which wasn't ready).

Anyone who bought an ST during the period when it wasn't being bundled, has merely to send name, address, name of dealer, date of purchase, model and serial numbers, to Atari Customer Relations in Slough — and you'll get the disk back, free.

Expensive extras

Four pounds fifty is quite a price for disks — even for 3in Amstrad-style disks. The only reason for mentioning the Hi-Tech offering, then, is the 'extra': they are supplied formatted, with 'templates' on them, for LocoScript.

The templates are documents, with certain bits and pieces which are otherwise tedious to type in — forms, in effect.

They are: invoices for VAT-registered or non-registered businesses, delivery notes, statements, memos, order forms, or labels for standard label strips. Tell Hi-Tech how you want these laid out when you order.

Details on Derby (0332) 382657. END

YANKEE DOODLES

David Ahl sifts through the best of the new US releases, and presents the other headline stories from the States.

What's new?

Apple has introduced a new entry-level Mac, the Macintosh 512k Enhanced, which incorporates several features of the Macintosh Plus including an 800k disk drive, a hierarchical file system in ROM and increased performance, particularly in disk I/O. The $1999 price is the same as the earlier 512k Mac, but doesn't include MacPaint or MacWrite software.

General Computer Corp has introduced several new versions of its Hyperdrive hard disk for the Macintosh Plus. The line now includes two internal drives of 10Mbytes ($1399) and 20Mbytes ($1699) as well as a top-end system, the Hyperdrive 2000, with a 20Mbyte drive, a 68000 co-processor board and 1.5bMbytes of memory ($3199).

A tiny company, Data Pacific, demonstrated Mac Cartridge at the West Coast Computer Faire. This nifty product plugs into an Atari 520ST or a 1040ST and emulates a Macintosh. A few Mac programs, especially ones with sophisticated copy protection, won't run with Mac Cartridge, but most will: Microsoft Excel, for example, runs 20 per cent faster on the ST than it does on the Mac. Currently, the company is trying to work out a deal with Apple to use two proprietary ROM chips. Selling these chips to Data Pacific would seem to be to Apple's advantage, as it would virtually establish the Mac operating system as the standard in the 68000 arena.

IBM has finally released its long-anticipated lap-held portable, the PC Convertible (reviewed last month). The machine has an 80C88 MPU, 256k of memory (expandable to 512k), two double-sided, 720k 3½in floppy disk drives, a fold-up 25-line by 80-character screen, a 78-key keyboard, and rechargeable batteries which last six to 10 hours. Weighing an arm-stretching 13 pounds, the machine costs a wallet-thinning $1995.

An enhanced version of True Basic has been released which supports the Hercules graphics card in the IBM PC. This is the first Basic language to allow users of Hercules and other graphics cards to access a full 640k and the 8087 co-processor. The graphics syntax is said to be hardware-independent, so graphics developed on the system are directly portable to the Apple Macintosh, the Commodore Amiga and the Atari ST. Price is $189 for the complete package or $39 for an upgrade.

Quadram has unveiled Supersprint, an 8086 accelerator card that allows 8088-based computers such as the IBM XT to operate with the speed of 80286-based machines such as the IBM AT. The $695 price should drive down the $1200+ prices of some of the 80286-based accelerator boards.

Brightbill-Roberts has introduced Show Partner, a memory-resident graphics editor for the IBM PC. The package combines extensive animation capabilities and a 'slide show' manager with the features of the company's previous Grafix Partner graphics editor package. In the slide show mode, image transitions include replace, wipe, split, box, scroll, fade and weave. Show Partner supports IBM and most third-party graphics cards; price is $149.

High-tech sting

Despite the enactment of computer crime laws in most US states, fewer than 100 cases have been prosecuted. Moreover, of the computer criminals who are prosecuted, few ever go to jail or pay major fines. However, some interesting facts have emerged from the prosecutions. Most crimes are committed by programmers, students and input clerks with an average age of 22. The most common targets for malicious tampering are commercial companies, banks, telecommunications companies and government agencies; the average incident causes $93,600 worth of damage.

As a result of the growing frustration in trying to track down malicious hackers, a number of police agencies throughout the US have set up 'underground' electronic bulletin boards. One, devised and run by Sgt Dan Pasquale of the San Francisco Police Department, has attracted a wide collection of system passwords, account numbers and long-distance access ports. Recently, seven suspects in the Silicon Valley area, none older than 18, were arrested and charged with possession of stolen property, and trafficking in unauthorised credit card numbers and long-distance access codes.

CD-ROMs poised

To date, only 11,000 CD-ROM players have been shipped worldwide, the majority of which have gone to developers and system integrators. At a recent CD-ROM conference sponsored by Microsoft, over 900 developers and publishers gathered to talk to one another and hear about the latest projects. Most agreed that there are few commercial products to attract the average user today, but the market is poised on the verge of enormous growth.

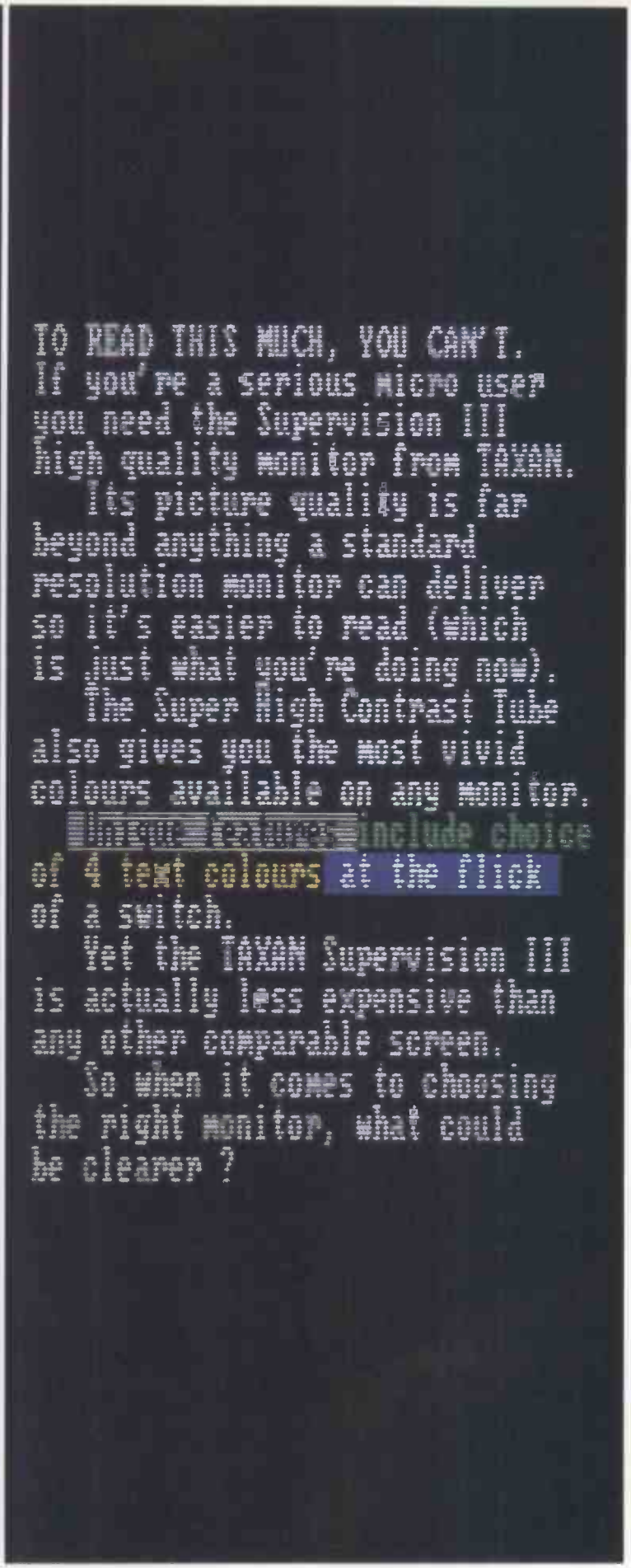
Gary Kildall, inventor of the CP/M operating system and co-founder of Digital Research, was the keynote speaker at the conference. A leading proponent of video disk technology, he has started a new company, KnowledgeSet Corp, which has recently introduced a CD-ROM electronic encyclopaedia. His company has also established a joint venture with Sony in which KnowledgeSet will offer data preparation services, and Sony will master and reproduce the disks. Kildall believes that the key to making CD-ROMs successful is to make it easy for existing publishers to transform their current materials into CD form, and then work with the CD-ROMs to take advantage of the multi-media capabilities.

One early CD-ROM on the market has been put together by the Personal Computer Software Interest Group (PC-SIG), which claims to be the world's largest distributor of user-supported and public domain software. It offers its entire catalogue of 479 programs on a single CD-ROM for $195. In addition to the software, PC-SIG offers a Hitachi CD reader for $995; this includes software for using the reader with an IBM PC.

Other CD-ROMs currently available are mostly specialised databases.

Random bits

Apple has reduced its 2600 US outlets by 600 stores in an effort to eliminate weaker outlets and those who have been wrongly cutting prices . . . Lotus has cut the price of Jazz from $595 to $395 to put it more in line with Microsoft's Excel package which has been outselling Jazz in several markets . . . US Apricot, having never shown a profit and having recently laid off one half of its employees, has been purchased by two former employees. They plan to distribute Apricot products as well as other brands, including a Xenix-based machine . . . Good news and bad news among the old-timers: Kaypro, following a shift in emphasis from 8-bit CP/M machines to IBM PC-compatibles, has reported a nine-fold jump in profit in its latest quarter . . . Meanwhile, Morrow Designs has filed for creditor protection under Chapter 11 of the Bankruptcy Code, just two weeks after the IRS (Internal Revenue Service) awarded Zenith a $27 million contract for 15,000 Z–171 lap-helds, a design that Zenith purchased from Morrow last year for a minuscule $1.2 million . . . The last of Osborne Computer Corp's office and manufacturing equipment was sold in mid-April to a liquidation firm . . . END



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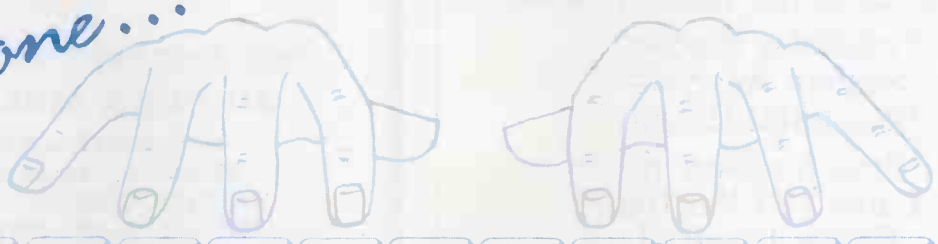

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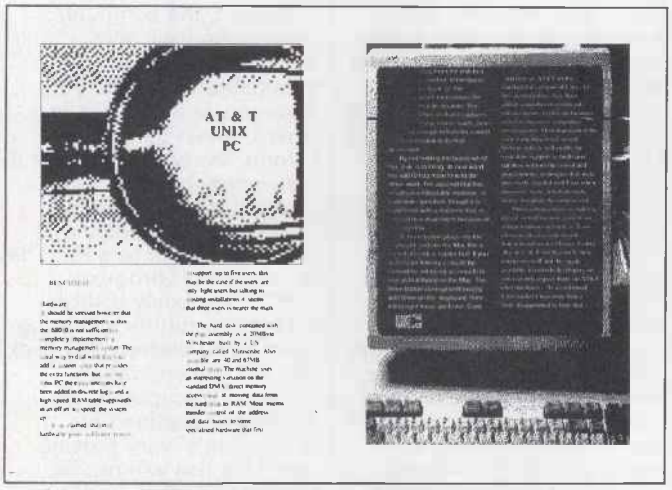
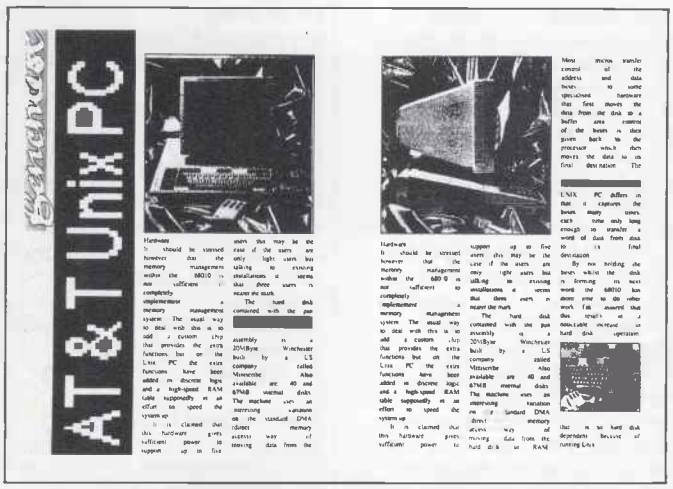


The winning Benchtest design from Roger Giddings . . .



. . . closely followed by Howard Shaw's fine layout

The *PCW* Graphic Challenge competition, run in the December 1985 issue in combination with Apple UK, pulled in one of the largest entries we have seen at the *PCW* offices. Hundreds upon hundreds of forms from as far afield as Wisconsin and New Jersey flooded in, giving their senders' ideas on what was important in page layout and composition.

Creative flair

This was hardly surprising, given the prize on offer — a complete Macintosh system including one of the new 512k RAM/800k floppy Mac system units, an HD20 20Mbyte hard disk drive, an Imagewriter II printer, and copies of MacWrite, MacPaint, and Aldus' PageMaker graphics layout software.

The discussion over what the official winning order should be ranged far and wide between Apple's Desktop Publishing manager David Jones, *PCW*'s art director Peter Green, and other concerned parties from both Apple and *PCW*.

In the end, the order was decided with 'creative use of white space' at the top, well ahead of all other contenders.

The top 10 entries closest to the judges' final order — and not one entry out of the hundreds got it right down to item 15 — were selected, and the senders invited to the final at London's Mayfair Holiday Inn.

The finalists came from all areas and walks of life, from graphic designers and RAF officers to osteopaths, united only in their unfamiliarity with Aldus' PageMaker software on the Mac and their willingness to learn.

Free choice

At the event the finalists were given a tutorial on the Mac and PageMaker by an Apple training specialist, and then, after lunch, let loose with a Mac each and a set of original copy from one of *PCW*'s machine Benchtests. The review chosen was that of the AT&T Unix PC in April's 100th issue of *PCW*, and the photographs used in the original piece were digitised into Mac format using Thunderware's Thunderscan digitiser and software written by Macintosh 'software wizard' Andy Hertzfeld.

The finalists were given the freedom to use the text and graphics in any sizes, formats or styles they wished, and re-arrange the final page layout blocks on a standard *PCW* page format in any way they saw fit.

The problems they hit were those of any micro user faced with a new and unfamiliar package — despite the expert tutorial on the day; a lack of complete knowledge about what the package could actually do, and some trouble in making it do what it should.

Despite the problems, all the finalists produced finished artwork within the four-hour time limit, and had their designs run off in hard copy on Apple's LaserWriter printer ready for the final judging session.

Once more the arguments cropped up, since the judging was now being done on the basis of ideas used and implemented rather than on the efficiency of using PageMaker and the Mac.

The finalists' entries were whittled down to the two shown here, and the eventual unanimous vote for the winner went to Roger Giddings, the osteopath from Cottenham near Cambridge, with the close second vote going to graphic artist Howard Shaw from Highgate in London.

According to *PCW*'s art director Peter Green, the winning design showed that Giddings 'had thought carefully about the elements of the design, and not simply re-arranged blocks of pictures and text on a blank page.' And Apple's David Jones agreed, adding that the high standard of all the entries, created in a very limited time, showed what could be done with the combination of software and hardware produced by Aldus and Apple.

The other finalists, whose designs cannot be shown here due to lack of space, were John Woodman, H Trevor Shakeshaft, Malcolm Gain, Peter Damsberg, AB Paine, H Sagoo, I Wilkinson and W MacDougall.

Many thanks from *PCW* to all the entrants, to all the finalists, and to Apple UK for organising the final, supplying the hardware and venue for the final, and donating the prize.

END

LETTERS

This is the chance to air your views — send your letters or contact us on Telecom Gold 83:VNU200 or PCW Online: PCW 009. The address to write to is: Letters, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Too early to tell

I am provoked to write to you by two pieces in the May issue of *PCW*. Firstly, Guy Kewney tells us that to him spreadsheet use is a totally irrational human activity. Then Nick Walker enthuses over the Atari 1040ST as compared to all those boring PC-compatibles.

The link between the two is the blinkered view of the computer and its potential. To Messrs Kewney and Walker, computers are marvellous grown-up toys; not only can these gentlemen spend their time playing with them, but they can get paid for doing so. To me, and I suspect most other serious computer users, the computer is a tool, something to help us do more, and better, than we could otherwise achieve.

Nick Walker is impressed by the Atari, because he is a self-confessed enthusiast for the latest technology. He admits the poor record on reliability, the failure to deliver the originally promised bundled software, and the absence of any substantial business software of the kind that IBM or even Macintosh users can choose from. This is quite enough to dampen any remaining enthusiasm I might have for the machine, but it apparently has no effect on him. Why? Because he is fascinated by the technology, whereas I am interested in what can usefully be done with the machine. Boring the compatibles may be, but in terms of serious use they offer far more now, and probably in the future, than the Atari. As Amstrad has shown, with its 'outdated' CP/M machine, there is a mass market for old technology if it means good value and a wide choice of existing software. If Amstrad's rumoured PC-compatible does appear, I would back it against the Atari any time.

Guy Kewney's problem is obviously that he is literate but not numerate. Because he works with words he fails to realise that, for those of us who work with figures, a spreadsheet is just as much an essential tool as his word processor. Just as he would not be satisfied with the kind of word processor found on most home computers, I would not be satisfied with the equivalent spreadsheet. Is it too much to hope that in the future he will stick to what he knows, and does well, and not fall prey to the occupational disease of journalists, namely uninformed comment based on their own prejudices?

RJ Williams, London NW3

You mention the Apple Macintosh as a machine that has a substantial amount of business software. Two years ago the Mac was in a similar position to the one the Atari ST is in now — no decent software, insufficient RAM and full of bugs. But still the journalists of the day ranted about how wonderful it was. It's my belief that the ST represents such exceptional value for money that it's guaranteed some measure of success. True, this success will initially be among the enthusiast (hacker) type, but give the machine two years, and it will be a serious proposition for a business which requires a cheap, easy-to-use system — Nick Walker.

NewBrain Numbers

I wonder whether anyone has found himself in my predicament. Since mid-'83 I have been deeply interested in Mike Mudge's *PCW* series, 'Numbers Count', and although I have never submitted any of my work to Mr Mudge, nevertheless I have spent endless hours of enjoyment tackling the problems posed on my NewBrain.

This is the situation I have found myself in. A typical straightforward problem might take me about 10 minutes to program in NewBrain Basic, but due to the nature of the problem, the execution time runs into many hours. It's not the first time I have had to wait eight hours (two sessions of four hours each) to obtain a long list of numbers as part of the solution. Now, I know what some of you are saying. Why doesn't he try machine code? OK, let's try machine code; programming time now usually goes up to about eight hours (more than half of this is spent debugging the machine code program). The execution time is now down to about 10 minutes, *so the total time equals eight hours 10 minutes as before.* You just can't win, can you?

Incidentally, may I say how much I enjoy reading *PCW* every month. To all those involved, I would like to say keep up the good work.

Albert N Debono, Rabat, Malta

Intuitive thought

I am an avid reader of *PCW*, not necessarily because of its useful contents, but because of its entertainment value. In my opinion, it reflects the romantic attitudes of a minority.

I run one of those very 'backward' computers — an IBM PC clone. I use mainly a very 'backward' integrated program called Intuit, which bypasses DOS and takes over the computer completely, doing its own thing.

It formats, copies, saves and organises the material in hierarchical file structures automatically and naturally. In addition, it automates the A-B drive selection. It has limited database-reporting facilities, a programmable 'spreadsheet', and text as its main modules. The Basic machine requirement is a PC/AT with a minimum of two drives and 256k.

As an ordinary individual I am thankful for the standardisation provided by IBM in the market-place. A long, basic halt in technical progress seems to be a prerequisite for useful applications to appear. Software is the gasoline needed for unromantic, private users like myself. Without it, the computer remains an exclusive, unobtainable toy for the uninitiated multitude of ignoramuses, and that is where I most definitely belong. Everyone can type if they have access to a typewriter; everyone can now compute reliably and fast with access to a PC. That is real market progress.

PCW obviously dislikes that. That attitude will bring horses and blacksmiths back into the transportation business. Computers are eventually destined for 'Everyman's' very prosaic use. That use will not be limited to games, and it certainly will not include programming.

The Intuit program obviously was made by enthusiasts with a very definite set goal. It reduces computing to a push-button operation; the things that Intuit will do are therefore limited. However, I do not have to study my fat DOS manual when running that program.

I stumbled on Intuit by accident when reading about the maker's marketing philosophy; it interested me — and made me curious about the product, so I ordered a copy from the company by direct mail. The program is sufficiently different to warrant an interesting review. I have used the program for more than a year and can recommend it.

Intuit is a 'no frills' type of program: 'Copy your old data for use in new contexts' is the basic philosophy. All the commands are simple push-button operations. The program uses the 10 function keys on two levels only to achieve full control. Small stickers on those keys inform you what happens if you press them. The basic Intuit operator requirement is thus an ability to read.

I am a user who is very far removed from the authors of the Intuit program package. I use it because it's easy, and because it's fast. In addition,

the package is very competent in some user-important areas.

I suspect that I'm not the only person who has a difficult time understanding the DOS manuals. I have been so used to Intuit hierarchical files that I, with floppies, have had to study DOS to bring about something similar when running DOS-dependent programs. I dislike Microsoft immensely — those engineers are not my cup of tea.

My main objection to the Intuit program has now been removed. Earlier Intuit program editions and upgrades were copy-protected — the new edition is not. A copy of Intuit can be ordered from: Noumenon Corporation, 512 Westline Drive, Alameda, CA 94501, US.

Carl Fr Figenbaum, Norway

We are not heavy investors in buggy-whips — the IBM standard has frozen the microcomputer world like a statue. We are trying to show that there is still movement and excitement in the business.

In touch with the stars

I would to comment on one or two points which arose out of Bob Couttie's letter in the May issue of *PCW* concerning astrology and computers.

From Mr Couttie's letter, it is plain to see that he is aggressively, almost angrily, opposed to the use of modern technology in any form of astrological technique, and is scathing of any suggestion that such computerised analysis might be valid. This might have passed without need for comment but for his assertion that this '4000-year-old belief system . . . has been abandoned by today's equivalent of the Babylonians,' which I find arrogant and offensive. He also talks about 'pseudo star positions', no doubt in an effort to devalue the subject still further.

It seems, therefore, that Mr Couttie's objections are not really concerned just with astrology and computers, but with astrology in general.

In the circumstances may I say that, with his objections to computerised prediction, I heartily agree — not because a computer can't perform such a task, but because astrology is not a predictive science. As to the production of computerised character analysis, this is perfectly possible, given a large-enough database. That we haven't seen such accurate analysis from computers up to now has been to do with the prohibitive cost of large-enough storage devices rather than technique.

As to the 'pseudo star positions', the mathematical techniques available to modern astrologers for the accurate calculations of planetary positions according to time and space are, in the main, those given to us by James Neely — an American who worked for NASA. The calculated positions of stars against the ecliptic, using these techniques, are accurate to within a few seconds of time, and about this there can be no argument.

As to astrology, Mr Couttie is entirely out of touch with the very nature of the subject. Astrology has never been a system for the prediction of future events. This is a misapprehension usually present in those who have not studied the subject in depth. Astrology is, however, very closely linked with psychology and deals with the 'subjective nature' of Man. It is a system which leads to self-analysis and a greater awareness of a person's potential. It is a system which, in all cases, also makes the person more aware of his relationship to other human beings, the environment and the lesser kingdoms in nature. Such self-analysis, incidentally, has a natural tendency to make us less aggressive, angry and intolerant, Mr Couttie, and this, in itself, should validate the subject.

Having considered the tone of your correspondent's letter and knowing how upsetting it can be for the scientific mind to have to come to terms with events which seem to lie outside the framework of current knowledge, how does Mr Couttie feel about Archibald Cochran who changed base metal into gold in 1906, or perhaps Armand Barbault who converted vegetation into gold in the 1960s? What about Padre Pio, the Roman Catholic priest who died about 10 years ago? He used to appear in two places at the same time and frequently levitated while saying Mass. How about Haridas who, in 1900, was buried alive without food, air or water for 10 months and was then dug up alive and well? All these events were witnessed and documented by eminent persons and, however much disbelieved or even slandered by modern 'educated Man' (I use the term loosely), cannot be dismissed as the ramblings of ignorant and uneducated people.

John Laidlaw, Lytham St Annes

Bob Couttie's comments on star positions come from the precession of the equinoxes; what the astrologers call Aries now has nothing at all to do, in real life, with the constellation of that name. The challenge still stands.

The voice of reason

Further to the recent correspondence in 'Letters', *PCW* May regarding astrology programs, I would like to take this opportunity to inform you that we Geminis don't believe in horoscopes anyway!

Geoff Penn, Hove, East Sussex

A balanced, or perhaps schizophrenic, point of view.

Nothing new here

I am the proud owner of an Amstrad *PCW*8256, which I bought in December 1985.

I purchased a copy of Cash Trader from Quest Computer Technology at the Amstrad Computer Show in Manchester at the end of March this year. I rushed home and eagerly began to work my way through the set examples, and all was well until I reached the Analyser module (other owners of the 8256 may know what's coming next!). The manual says 'List to screen or list to printer'; the program doesn't say anything. The printer bursts into life and spews out metres of hard copy. 'Aha! — must be a bug in the program,' says Mr Grey from Quest. 'Call you back later today.'

Mr Grey never did call back. I phoned Quest again and was told by the software products director, Mr Richard White, that this part of the program had been removed. 'But you should have told us,' I pleaded. 'The small print clearly states that the program was written for other computers and that it may not work on the 8256,' replied Mr White, and he continued with these immortal words: *'It's the computer that's faulty — not the software.'* And there you have it. The 8256 is a faulty machine with insufficient memory to implement Cash Trader. It seems a pity that Amstrad did not think this fact important enough to mention on the Quest stand at Manchester.

T Biddulph, Kings Norton, Birmingham

Business as usual

Recently I spent a good part of a day in Aberdeen trying to find Amstrad disks (single-sided) at a reasonable price. The going rate seemed to be about £4.95 per disk. Dixons has been selling them in boxes of five or 10 at just under £4 per disk, which seems more reasonable, although still a bit expensive. The general picture, then, is of retailers cashing in on the present shortage of disks. Not much new here, I suppose.

But, as they say, 'imagine my surprise' on entering Boots to find single-sided disks retailing at £5.95. I queried the price, and expressed, with what I still regard to have been admirable self-control, the view that this overcharging was wicked. The price was checked and confirmed.

Even more astonishing, I was assured that the price reflected the Boots Price Pledge attitude, and was 'very competitive'.

I think the public has a right to know. Who is running this competition for the highest price charged for an Amstrad disk? What is the prize? (A day trip to Amstrad Consumer Electronics; second prize, two days . . ?)

More seriously, with the double-sided disks for the second drive on the Amstrad PCW8256 priced at roughly 50 per cent above the single-sided disks, what are the retailers gong to charge? Are we really going to see £9 per disk? I have set aside enough money to buy the PCW8512 as and when I can see it running the software I want, but with this gross overcharging as the norm, I doubt very much if I'll now go ahead. It's about time Alan Sugar got his finger out and recognised that a great-value machine is no use if running costs are jacked up like this.

Dr HW Smart, Montrose, Angus

Amstrad tells us that Matsushita makes more blank disks and drives whenever Mr Sugar sends the Japanese giant a firm order . . . END

BANKS' STATEMENT

The great divide

If we are to fully appreciate artificial intelligence, we must learn to see man/machine 'integration' as a logical advancement. Martin Banks explains.

I'm an ardent traditionalist, really. Being a great believer in the idea that humanity shows an illogical desire to invent things simply for the sake of inventing them — in the hope that they might one day prove 'useful', like the hydrogen bomb — I try to avoid some of the excesses of the computer industry.

I'm the type who finds morris dancing more streetwise than body-popping (and the tunes are a lot more interesting), so it's hardly surprising that I am pleased to see machines like the Amstrad PCW range making a significant impression on things.

Here we are, having come nearly a decade from the days when the first Z80-based computers appeared, running floppy disks and an operating system called CP/M. Ardent technologists have built IBM mainframe processors into single chips, elephantine memories which put all the world in a match box, and applications software which can sing, dance, wreck national economies and play Russian Roulette with strategic missiles, all at the same time.

What, however, is the punter doing? If the sales figures of Mr Sugar's little enterprise are anything to go by, they are buying large quantities of Z80 machines which run CP/M. The customer, as they say in retailing, knows best.

Given all that, I have to now admit that I have been smitten by something new (or newish, anyway). I am certainly not the first to succumb, but I have come over all emotional about expert systems and artificial intelligence.

There are those who would say that such an interest has come not a second too soon: a goodly dose of the artificial stuff would be more than adequate compensation for my lack of the natural variety. There are also those who suggest that my interest springs from participation in a fairly large conference on artificial intelligence in the south of France.

Actually, that isn't true. For example, I'd forgotten that it was Digital Equipment that took me out there, so that proves it. The most interesting people speaking at the event weren't from DEC, they were from places like MIT (Massachusetts Institute of Technology) where they've invented at least one of anything technical you've ever thought of.

And what was interesting about these people was not the standard kind of techno-flash, gizmo-orientated, 'this-is-what-we're-making now' presentations one might expect at a high-tech laud and honour bash. Instead, they had things to say which suggested to me that, at last, there might be signs of common ground between computers and humanity.

One of the key issues about artificial intelligence is its name. There seems to be considerable debate as to whether it should be called that, or something like 'applied intelligence' (which is a little more specific and accurate).

Many people favour calling artificial intelligence something completely different and far more indicative of where the subject is going. The words they use are 'knowledge engineering'.

This is a nicely rounded description of what AI is all about, being ambiguous enough to have a variety of interpretations, ranging from engineering knowledge itself through to engineering with knowledge as a tool.

The words also carry with them the hint that the subject is more than just a fancy computer program. The data processing people have had it their way for too long, producing clear-cut, logical solutions to problems that are in reality all bends and squiggles, and usually fairly illogical.

I have always felt that this is why most computer programs don't work that well. Point a clear and logical mind at a real problem, and the result will often only fit where it touches.

Knowledge engineering is about working with, through, and because of, knowledge. It is about doing interesting, constructive, useful and even sometimes profitable things with knowledge.

The AI *cognoscenti* at the conference were saying that the best people at knowledge engineering systems are philosophers, psychologists, neurobiologists and . . . well, virtually anyone who isn't a rigid, unthinking data processing person. That, I suspect, is the proof of which I spoke. Early AI applications are only likely to come from data processors because AI runs on computers, doesn't it? Data processing applications will often be of the 'more efficient bomb' variety.

Knowledge-based systems, if they are to even scratch the surface of their true potential, are going to be about much more than that. Early expert systems are simply capturing the knowledge of specific individuals so that it can be employed by others. This can be laudable in itself, even when the application is something simple like an automated paint-spraying system. But it is a pin-prick of what is possible. Capturing the knowledge of experts is only the start, and is only a logical extension of the computer as computer.

The future, however, lies in removing the 'computer' part as much as possible, so that the application becomes far more integrated with the way in which humans work and the way humans are. That is why people such as psychologists and philosophers are becoming so important to the development of AI: it will be through them that such integration between humanity and 'systems' will occur.

It is entirely arguable that the future for humanity is not good. Either we will continue as now and blow ourselves up (quickly in a big one or slowly and in stages), or we will develop entirely logical systems to the point and capability where they realise that humans, as irrational beings, are totally illogical and should be dispensed with. A third alternative is that we can teach the systems to work with us rather than the other way round.

The last thing needed to achieve such a future is a narrow qualification in computer programming. END

Illustration by Paul Slater

Spectravideo X'press

The name will be familiar as the company which failed to make it with MSX — but Spectravideo is back with a vengeance. The X'press is a high-specification, 8-bit MSX and CP/M system with a truly impressive range of business software. Will it be competition for Amstrad on home ground? Nick Walker tracks it down.

Almost three years ago there was a lot of talk within the microcomputer industry about an invasion of home computers to come from Japan. What made these machines unique was that they all adhered to a standard known as MSX, which meant that the home computers from all the major Japanese electronic manufacturers were compatible with each other. Unfortunately this MSX invasion came at a time when home computers were involved in a severe price-cutting war. And while everyone appreciated what MSX stood for in terms of compatibility, the machines just couldn't compete in terms of price, and consequently MSX flopped. The MSX manufacturers have since retreated back to the security of their home markets where MSX is a success, although there are rumours of an MSX III to be launched later this year.

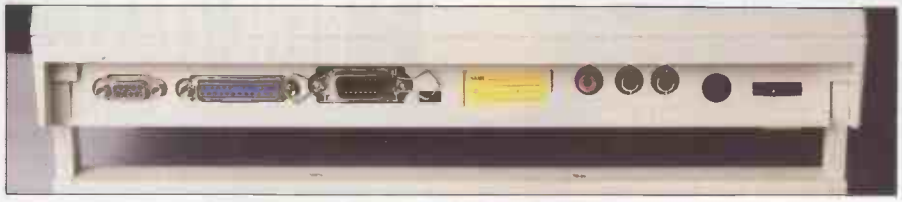
In the meantime the home computer market has settled down in terms of price, and two dominant trends seem to be emerging: a new generation of machines with true 16-bit processors and high-resolution graphics on the one hand, and machines running yesterday's 8-bit business operating systems on the other. The greatest exponent of this second trend is Amstrad, whose disk-based machines have a native mode used mainly for games and also run the old-fashioned business operating system CP/M.

The X'press from Spectravideo, like the Amstrad machines, includes a built-in disk drive and offers CP/M as a second operating system. However, unlike the Amstrad, the native mode of the X'press is MSX. So can CP/M revive the unsuccessful MSX standard? I took a closer look at the Spectravideo X'press in an attempt to find out.

Hardware

Spectravideo is not a new name to the UK market. Over two years ago the company had two almost-MSX-compatible machines which looked set for failure even before MSX flopped. Since then Spectravideo has sold various other computer-related products including cartridges for the old Atari games console, but the only product that sells in any quantity at the moment is a joystick called the 'Quickshot II'.

Unlike the list of other MSX manufacturers which reads like a *Who's Who* of Japanese electronics companies (Sony, Toshiba, Cannon and the rest), Spectravideo is actually based in Hong Kong. This may explain the cheap and tacky 'Made in Hong Kong' feel that runs through all the company's products. This is as true for X'press as it was for the company's earlier machines, though to be fair I am comparing it with the high-quality MSX machines from Japan and not with the likes of the Sinclair Spectrum. It's a shame Spectravideo doesn't spend as much time on the design of its machines as it obviously does on packaging.



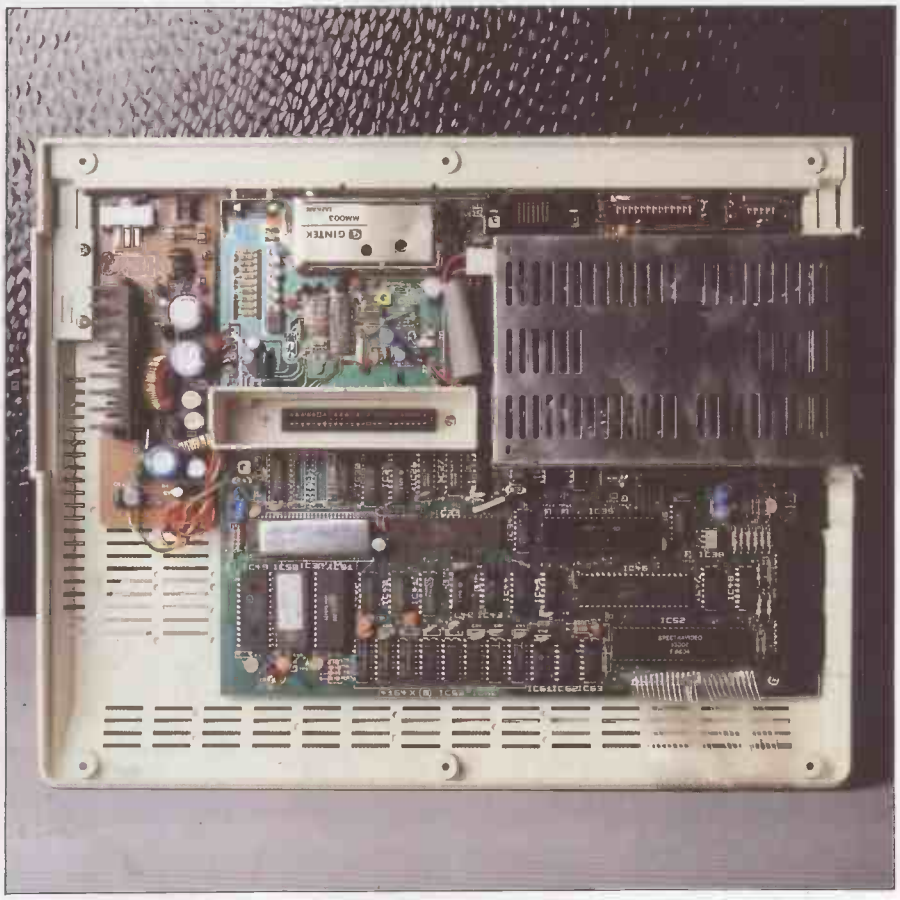
The rear ports include a non-standard MSX printer port

The X'press is finished in an off-white plastic and has an appearance similar to the Apple IIc — squarer than other home machines, thanks to the inclusion of a disk drive at the rear. Spectravideo obviously sees the X'press as a semi-portable machine, as a smart carrying case is provided which sensibly has sufficient room to include all the necessary bits and pieces, such as power supply, disks, and so on.

By finishing the keyboard in the same colour as the casing, Spectravideo has made the X'press a very dull computer to look at. The keyboard is a full-stroke affair consisting of 73 keys, and conforms to the standard of MSX; if you look very closely it is possible to detect that the control keys are finished in a slightly darker off-white. The keyboard can be broken down into four areas: five function keys running along the top left; a square cursor key cluster to the far right which is as horrible to look at; the main qwerty area dominating most of the centre of the keyboard; and a good complement of control keys to the left and right of the qwerty area.

There are no LEDs indicating when the 'Caps Lock' and similar keys are in operation, though the Caps Lock does look as though it was designed to incorporate an LED. With the exception of the cursor cluster the keyboard has a very good feel, better than many of the so-called 'business machines' I've tested recently. Above the cursor cluster there are two LEDs, one marked with a disk icon which lights whenever a disk access occurs, and the second a power LED that for some inexplicable reason is marked I/O.

The MSX standard defines a good complement of I/O ports. Unfortunately, so confident were the MSX manufacturers of success that they didn't conform to industry standards. This means that there can be some difficulty in finding the necessary leads. Looking around the X'press you will find on the right hand side



The main PCB reveals the original MSX formula's economy of design

two Atari standard joystick ports, an MSX standard cassette DIN socket and the disk drive opening. The rear ports are covered by a carrying handle which serves a dual purpose of tilting the keyboard to a good typing angle. Once exposed, the rear panel contains, from left to right, a 9-in D RS232C socket, a 25-way disk drive socket, a non-standard MSX parallel printer port, modulated TV output, composite video output, audio out, power in and, finally, a power switch. There is also a 50-way expansion slot above the keyboard area which is usually for ROM cartridges, but is in fact capable of supporting most types of peripherals.

The internal disk drive is a 3½in, single-sided micro-floppy giving a formatted capacity of 360k. The MSX standard did specify a disk format for MSX machines which is adhered to with the X'press, so if MSX programs ever become available on disk in this country they should work.

The processor on the X'press is an 8-bit Z80 running at a relatively leisurely 3.58MHz in a user RAM area of 64k, an architecture once considered the *de facto* standard for serious business micros. In addition to the 64k user RAM there is 16k video RAM, bringing the total RAM to 80k. The MSX standard of 32k ROM, used mainly for Basic, is added to on the X'press by 16k disk firmware and 8k of RS232 configuration firmware, giving an impressive total of 56k ROM.

Getting inside the X'press proved no problem at all; undo three screws at the front and three at the back and the keyboard lifts off. The main PCB shows the economy of design that was a feature of the original MSX formula, consisting of little more than a processor, four custom control chips, a bank of RAM and three ROMs. It was quickly forgotten when MSX flopped just what a competent home computer design the four custom chips represented. The largest of these four chips, completely obliterated on the X'press by a large heatsink, is the sprite-based display chip. This is a version of the Texas Instruments TMS9918A extended to give the 80-column support needed to support CP/M, in addition to its usual functions of controlling screen resolution, colour, and so on, via its own 16k of dedicated RAM. Another custom chip, the well-known PSG AY 3-8910, complements the graphics chip and is responsible for the three-channel, eight-octave sound that is a feature of MSX machines.

I found the X'press a little disappointing when connected to a colour television. I tried the machine on a number of colour sets, and found they all needed an excessive amount of colour and brightness. More disturbing, on a couple of sets I was unable to stop the screen from sporadically rolling vertically.

A number of extras and peripherals were listed in the *Owner's Manual* including a second disk drive, a local area network interface card, an additonal 64k RAM card, a custom cassette recorder and 'Quickshot' joysticks. It's not clear how many of these peripherals will become available in the UK, the official line being that it depends on demand.

One peripheral that wasn't listed in the manual but, nevertheless, was supplied with the X'press for review was a robot arm. I found it very difficult to take this robot arm seriously at first, due to its packaging, which showed two children complete with toy builders' hard-hats using the robot arm. It also had advertisements for a mask to make your voice sound like 'Darth Vader', and for a toy parabolic ear.

The robot arm in fact compares favourably with many more expensive and far less robust competitors. A total of five axes, each with excellent fine control, makes it a serious introduction to simple robotics. Control of the robot arm is by means of two 9-pin D sockets, and in its cheapest form signals are supplied to these sockets by two Atari-style joysticks. However, to get the most from the arm it must be interfaced to a computer, which in the case of the X'press means adding an MSX standard cartridge.

This cartridge provides two 9-pin outputs to drive the arm, and includes a specifically modified version of Logo in ROM, called Rogo. Owners of existing MSX machines will be pleased to know that this set-up will work with their badly supported machines.

Spectravideo expects to adapt the interface to work with popular home micros such as the BBC, the Spectrum and the Atari.

System software

The X'press offers two operating systems: a version of the full MSX operating system which includes handling of the disk drive, called MSX-DOS; and the definitive standard for 8-bit business systems, CP/M.

MSX didn't stay around long enough for disk drives to sell in any great numbers, so little has been written about MSX-DOS. This is a shame, as it is a very good home disk operating system.

Unlike many other home computers whose disk operating system was grafted onto Basic late in the life of the machine, MSX-DOS was designed *from the beginning*. Sensibly, MSX-DOS is driven by means of a command line and not one of the so-called 'friendly' menu systems that have wooed some manufacturers. The trouble with menu-driven disk operating systems is that while they seem appealing for inexperienced users, they soon become extremely tedious with the disk-intensive operations of more advanced users.

Placing the MSX-DOS system disk in the internal drive and switching the machine on will result in a sequence that will be all too familar to CP/M or MS-DOS users. You will be prompted to enter time and date, and then enter the command line interpreter denoted by the ubiquitous 'A>'.

The similarity to today's most successful business operating systems doesn't end there. Directories are obtained by 'dir', the command processor is called 'COMMAND.COM', '*' and '?' are the wild-card characters in file names, and the power-on

A 50-way expansion slot above the keyboard supports most peripherals

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batch file is called 'AUTOEXEC.BAT'. All in all, MSX-DOS is functionally identical to CP/M, the only difference being that MSX-DOS manipulates MSX Basic and object code files. While this may make MSX-DOS difficult to use for a beginner, it does mean that the power will be there as they become more advanced, and, once mastered, the transfer from MSX-DOS to CP/M, or MS-DOS for that matter, will be painless.

Offering CP/M as a second operating system could hardly have been a difficult task given the similarity to MSX-DOS. The version of CP/M offered is CP/M 2.2, which is considerably faster than the original CP/M but not as friendly as the later CP/M Plus found on Amstrad's machine. It is also incapable of using memory beyond the maximum 64k address space of a Z80 processor.

To run CP/M applications it is necessary to emulate one of the early terminals used with the operating system. Two of these are supported by the X'press, the most popular being DEC's VT-52 and the second Lear-Siegler's ADM-3A. A good range of system software support files are included on disk, including a disk-based 8080 assembler, a text editor, an RS232 configuration program, and all the CP/M regulars such as PIP, STAT and SUBMIT.

There are two versions of MSX Basic included with the X'press: the ROM-based cassette versions, and MSX Disk Basic loaded from the MSX-DOS command line. MSX Disk Basic has identical commands to standard MSX Basic, with the addition of 24 commands and 13 functions to give access to the disk drive.

MSX Basic is a powerful Basic of the old school; that is, there is little in the way of good control structures, procedures and the other niceties that are needed to write good structured programs, but there are plenty of commands to drive the sound, graphics and other features of MSX.

The five function keys are pre-set to include commands useful to programmers, and include AUTO to generate line numbers, LIST, and of course RUN. These keys can easily be redefined, and can be used effectively from within MSX Basic by means of the ON KEY GOSUB command.

In addition to all the usual Basic features, MSX Basic offers some very powerful constructs. Most prominent among these is the facility to run interrupt-driven Basic programs by means of the ON INTERVAL command. This defines time interrupts, generated by the display chip, at which subroutines are called. The time interval is written in sixtieths of a second, so 10 seconds would be coded as ON INTERVAL=600 GOSUB 1000. This command would be given at the beginning of a program and would be started by INTERVAL ON. Thereafter, every 10 seconds, the program would jump to subroutine at line 1000. Later in the program it could be halted by INTERVAL OFF.

Other interrupt-driven commands include ON SPRITE, which is activated by sprite collision; ON ERROR, which is activated by a program error; and ON STOP, which traps an attempt to stop the program. The ON SPRITE command is particularly powerful since, without it, it would be almost impossible to monitor all 32 sprites while performing other functions.

'With the bundled CP/M business applications, the X'press is a good entry point for the small business looking to computerise on the cheap.'

The sprite command is just one of the many graphics facilities of MSX Basic. Others include the self-explanatory CIRCLE and PAINT, and the powerful LINE command. This, in its simplest form, draws a line between two points, but adding a 'b' in its syntax draws a box with two of the corners at the defined points. Finally, adding an 'f' after the 'b' 'fills' the box.

More complex line drawings can quickly be created using the graphics macro language via the DRAW command. This is a Logo-style language which follows simple drawing instructions. For example, U10 draws a line 10 pixels long up the screen. There are similar commands for left, right and down as well as the diagonals. The instructions are placed in a string which is then drawn. DRAW "U10L10D10R10" draws a box. A similar macro language controls the sound, which is then PLAYed.

There are five different screen resolutions available on the X'press; a 256 × 192 pixel graphic screen; a 40 × 24 character text model; a 80 × 26.5 character model; a 30 × 24 character mode used mainly in Japan; and a 20 × 20 character mode. The character display is changed by means of a width command, and while it is possible to run CP/M on a 40-column screen, I would recommend a WIDTH 80 operation as soon as CP/M has loaded. Most CP/M applications expect an 80-column screen, and get very confused if they don't find one. It looks like using MSX Basic in 80-column mode is a recent addition, as the manual states that it is impossible, but a slip of paper inserted at the rear explains how to do it.

I would advise that 40-column mode is used when running commercial MSX programs, however. I was particularly impressed with the quality of the 80-column display when used on a TV. By clever design of the character set, Spectravideo has created a reasonable quality 80-column TV display.

It was a great disappointment with the original MSX machines that only 28k of RAM was available to the user, and with Disk Basic loaded this whittled down to 23k — not very good for a 64k machine. Having said that, the extra commands do give an impressive range of disk access commands from within Basic. A word of warning is given with Disk Basic: loading a further program called 'RS232.BAS' gives even less user memory in return for additional commands to drive the RS232 serial port — a feature rarely found even on business micro Basics.

Applications software

MSX was set to be to the computer world what VHS is to the video world — the most successful standard over a wide range of different manufacturers' machines. Unfortunately, it never caught on outside Japan.

However, enough machines were sold with the initial hype of MSX to justify some of the larger software houses having at least one MSX title, usually a game, in their catalogues.

If you hunt around you will find a reasonable selection of applications, but don't expect the kind of support given to the Sinclair Spectrum or the Commodore 64. I doubt that any MSX programs will reach these shores in disk format, and the copy

Benchmarks

BM1	2.2
BM2	5.9
BM3	16.7
BM4	18.0
BM5	19.0
BM6	31.0
BM7	44.4
BM8	213.1
Average	43.8

All timings in seconds. For a full listing of the Benchmank programs, see page 185, January 1985 issue.

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protection on most cassettes will make it impossible to transfer programs from cassette to disk. As far as MSX programs go, the only use of the disk drive will be for your own personal program development.

A word of caution should be given here about compatibility. Many software houses didn't take heed to the expanded MSX disk standard when writing their applications. Such applications, when run from Disk Basic, will not run as they interfere with the disk I/O calls. The problem should be solved by not inserting a disk and using the ROM-based Basic, but even then there may be a problem with the extra 16k ROM base-level disk operating system. I tried a number of cassette-based programs, mainly games, and found that none of them ran from Disk Basic but all of them ran from ROM Basic.

There are two programs included on the MSX disk that can roughly be called applications. The first of these is a better-than-average demo program. The second is called 4-in-1 and includes a simple word processor, an incredibly simple spreadsheet, a file manipulator and disk maintenance programs.

CP/M, the business operating system included with the X'press, certainly wasn't a failure. For many years it was by far the most successful business operating system, and many serious applications were written for it. The business world has moved on now, mainly to MS-DOS, but the success of the Amstrad home micros has meant a mini-revival of CP/M.

Many CP/M software houses are willing to offer their applications at substantially reduced prices; after all, they pronounced these applications dead and buried a couple of years ago, and are happy to make any profit they can on them. The only problem an X'press owner will have is obtaining applications on 3½in disks. CP/M programs were initially supplied on 8in and 5¼in floppy disks, and the Amstrad machines use an unpopular 3in format.

Spectravideo has done its best to minimise the difficulties by including on the CP/M system disk a terminal emulation program called ADM-3A, which makes the Spectravideo compatible with the Bondwell lap-held CP/M computer and its 3½in drives. There are a number of specialist retail outlets and distributors like Softsel, which will convert your 5¼in CP/M applications to 3½in.

For £100 on top of the price of an X'press, Spectravideo will bundle a collection of MicroPro's standard business applications, consisting of the WordStar word processor, Mailmerge, the DataStar database, the CalcStar spreadsheet and ReportStar for report generation. This is an excellent collection of all the popular business applications, and represents a good starting point for a small business trying to computerise at low cost. At this price it is worth buying the bundle just to learn about business applications.

One application is included with the basic CP/M system disk, a program called Schedule+ which is a 'desk accesory' type program consisting of a diary, a notebook, a unit conversion, a phonebook, a world time calculator and an address book. Of its type it is not at all bad, but I've never been a great fan of these desk accessory programs and would rather use pen and paper for most of these 'administrative' operations.

Documentation

Four manuals were supplied with the X'press; a *User's manual*, an *MSX-DOS manual*, a *CP/M user guide*, and an *MSX Basic reference manual*. The manuals are very well-written, and, unlike earlier MSX manuals, they contain a great deal of technical information for more advanced users. The only thing missing was a Basic tutorial — something I always like to see with home computers.

Prices

The Spectravideo X'press is only available by mail order direct from Spectravideo. Without the bundled CP/M software it costs £399.95, while with the bundled MicroPro CP/M software the cost is £499.95. Both prices include VAT. The Robot Arm costs £39.95 alone and £69.95 with the MSX driver cartridge. No UK prices are available for any of the other peripherals.

Conclusion

Technically, the X'press is an excellent home computer which combines the CP/M business operating sysem with a high-specification 8-bit home machine.

If MSX had been half as successful in the UK as it has been in Japan, I would have no hesitancy recommending the machine. As it is, I feel the X'press will only sell to those who will use it fundamentally as a business machine with only occasional use of the MSX side for Basic programming and a little games playing.

With the bundled CP/M business applications, the X'press is a good entry point for the small business looking to computerise on the cheap. If nothing else, buying an X'press will be a vote against Amstrad's current dominance of the home computer market. END

Technical specifications

CPU:	Z80A processor runing at 3.58MHz
ROM:	56k
RAM:	80k; 16k video RAM and 64k user RAM
Keyboard:	73-key full-stroke MSX standard
Size:	16in × 12in
Weight:	7.5lbs
I/O:	Parallel printer port, MSX cartridge slot, cassette DIN socket, RS232C serial port, composite video, audio, 25-way peripheral expansion, two Atari standard joysticks, modulated TV output
DOS:	CP/M 2.2 and MSX-DOS
Bundled software:	CP/M Schedule+, 4-in-1 MSX application
Peripherals:	Robot Arm and interface, external disk drive, cassette recorder and 64k RAM expansion
Power:	2.5V DC

In perspective

There is only one real competitor to the X'press, but it is a formidable one — Amstrad. For £400 you can buy a machine from Amstrad which includes an integral disk drive, CP/M and a colour monitor — and it is hard to justify the price of the X'press against that. What brings the X'press back into competition is the bundled CP/M software available for an extra £100, which is truly a bargain.

I would suggest that a prospective X'press purchaser also takes a look at the latest crop of 16-bit machines, in particular the Atari ST range. For £400 more than an X'press you can purchase a 1024k RAM Atari 1040ST complete with a high-resolution screen and a full-blown 16-bit processor. There's even a CP/M emulation package available should you need it. However, the ST is still in its infancy and applications tend to be bug-ridden, while CP/M applications have years of development and use behind them.

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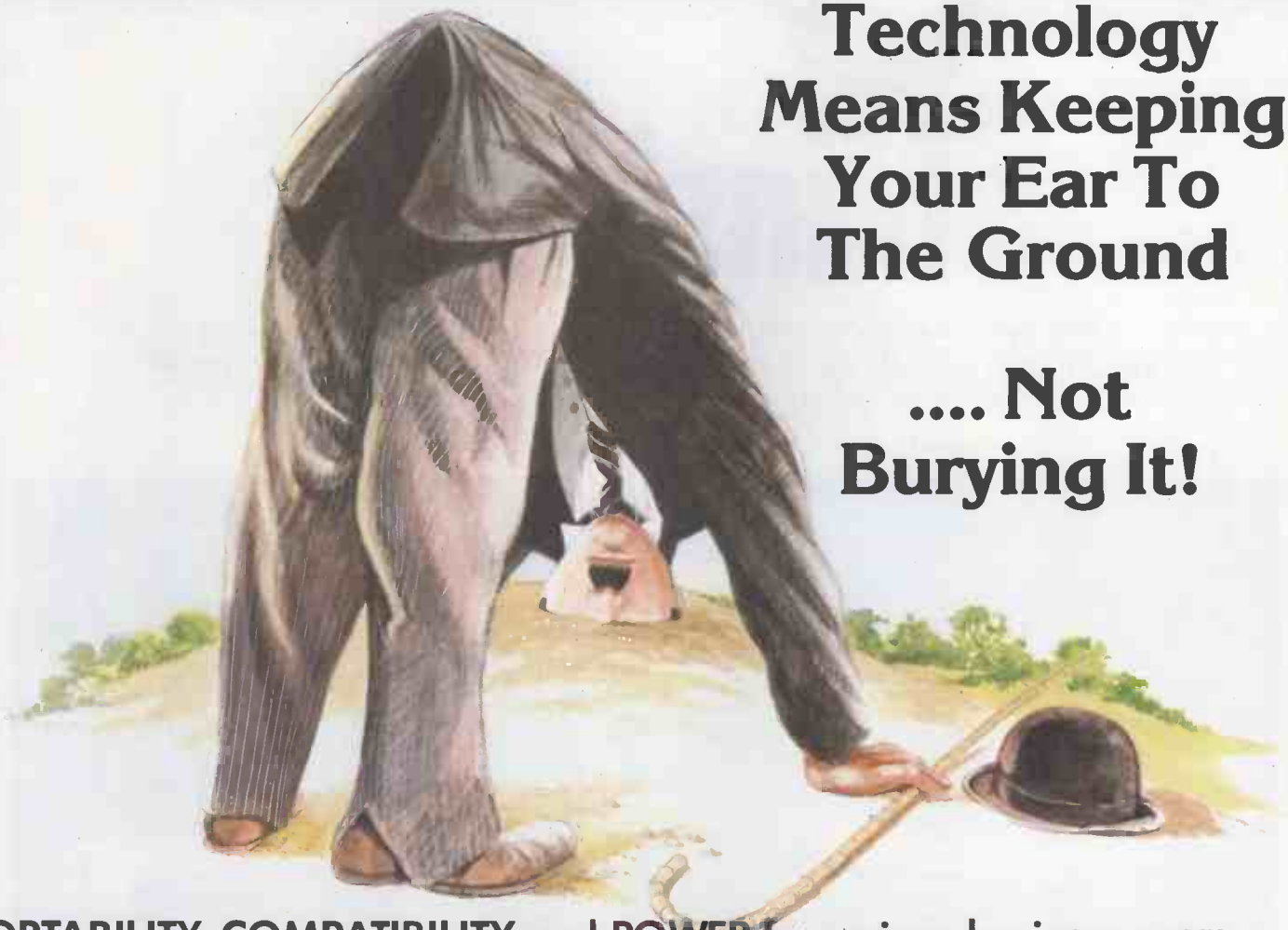

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Minstrel 4

HM Systems' Minstrel 4 is an unconventional, S100 networking system with aspirations towards the multi-user, multi-processor market. But is its lack of real IBM compatibility a hindrance? Peter Jackson finds out.

In the cable-strewn cellars of US micro hobbyists, there's little room for conventional desk-top micros like the IBM PC. Just as real men are said to avoid cheese-and-onion flan, real US micro men have avoided the single-board computer for the last decade, and tied their banners firmly to the mast of the S100 bus.

There are various reasons for this, but probably the most important was the electronic engineering background of most early micro pioneers. They were used to rack-mounted collections of breadboards and experimental electronic rigs, and carried the same idea through when digital systems appeared over the horizon in the mid-1970s.

But the S100 bus had more advantages than familiarity. Technology was moving as fast 10 years ago as it is now, and it made sense to build a system — most systems were built, not bought, at that time — that could easily be upgraded as the hardware improved. New processors, disk controllers, and graphics boards could just be plugged into an existing system and made to work with some fiddling around, and a system could be built with a selection of microprocessors doing various jobs.

As microcomputers began to move into the commercial market, the S100 bus went there, too. It made it possi-

ble for dealers to configure systems with specific processors, memory boards, combinations of disk drives, and particular terminals to suit particular customers' needs. With the appropriate operating system software, multi-user and multi-processor systems could be built up from standard building blocks rather than from scratch.

This S100 market has made a lot of money in the last decade for US companies such as Viasyn (formerly Compupro, in turn formerly Godbout Electronics), Cromemco and North Star. And in the UK there has been, and is still, a definite niche for the high-performance S100 machine in the multi-user business sector. Small UK companies such as Sirton and Jarogate, originally importing S100 boards from the US but eventually designing and building their own, have survived the ups and downs of the micro business better than most. And HM Systems' Minstrel 4 is an honourable descendant of that tradition.

HM Systems was originally known as Hotel Microsystems, and sold US micros and home-produced software to the vertical market its name suggests. The move into building its own S100 machines came in 1981, with the original Minstrel; this has been followed by the Minstrel 2, and now the top-of-the-line Minstrel 4, a multi-user, multi-processor, networking system running under the TurboDOS operating system. The Minstrel 4 is aimed at small-to-medium business and professional software development houses, where the need is for multi-user power combined with flexibility, and where the user is prepared to pay a premium price up-front for 'future-proofing' later.

The premium price is an inevitable factor in any S100 bus machine — and that's worth a look on its own.

The S100 bus

The S100 bus, now dignified with an Institute of Electrical and Electronic Engineers standard as IEEE 696, is like all other microcomputer buses in that it puts a particular set of electronic signals across a 'motherboard' which supports a number of edge connector sockets. In this case, 100 signals are defined by the specification, and the edge connector sockets have 50 contacts on each side.

Of the 100 signals, 24 are address lines — capable of addressing 16Mbytes of memory directly — 16 are data lines, 43 are control signals of various kinds including direct memory access (DMA) handling and system resets, and eight are the power supply and earth lines.

So far, this is all reminiscent of the expansion buses found on the Apple IIe or the IBM PC. But the difference with S100 is that, in most cases, the motherboard has no computer on it at all. The motherboard simply provides the slots, the connections between the slots and a power supply. Everything else that makes up a typical micro system has to be built up using plug-in S100 boards.

The typical technically-proficient buyer of an S100 system starts by buying a motherboard with a number of slots — from five to 20 or more — and a casing for it that leaves room for the extra boards once they are inserted. The casing, normally in sheet steel for rigidity, also usually includes a power supply capable of driving the whole rack-full of boards if all the slots are full of power-hungry hardware. The box also normally includes a heavy-duty fan to cool the hypothetical rack-full of hot boards.

All this heavy engineering (and over-engineering, to cover future contingencies) means that the entry-level price of S100 systems is high. When you buy one, you must be sure that you will use the inherent flexibility of the system to the full in the future, or the economics of S100 are prohibitive.

But given the right application, S100 systems are certainly competitive with any single-board micro, and definitely superior for multi-processor, multi-user systems.

The real major problem with S100 machines is software. As a manufacturer, you have no idea which combinations of boards from which other manufacturers are going to be plugged into your system, or even which microprocessors will be driving the machine. Standard operating systems such as MS-DOS or Concurrent DOS are useless in multi-processor systems, and in the low-level software region, the provision of a BIOS to handle a multitude of different hardware combinations is a nightmare.

The conclusion is that if you have the cash and need an S100 machine, but don't have solder in your blood and hexadecimal code at your fingertips, get a good dealer to put the system together.

HM Systems gives the same advice, and the Minstrel 4 came in for review ready-configured, with all the right software drivers and ready for assembly. We'll see how the company tackled the software problem later, with an examination of TurboDOS and the networking facilities. First, the S100 hardware.

Hardware

Rather than follow the orange-crate style of Compupro and Cromemco, HM Systems has gone for the tower block motif. The power supply and up to four half-height disk drives or tape streamers take up the bottom floors of the tower, while the 10-slot S100 motherboard sits in the top two-thirds.

The block is remarkably heavy for its size, thanks to the heavy-duty power supply in the 'basement'; the weight is an advantage, since the narrow tower needs something hefty at the bottom to prevent toppling. This also explains the positioning of the Winchester and floppy drives in the base, although with the Minstrel in its normal position — floor-standing beside the desk — the low-down floppy drives are difficult to reach. Overall, the Minstrel is reminiscent of a much-scaled down DEC PDP-11.

On the front panel there is an AT-style barrel lock which is actually the power switch, and two lighted reset buttons, one red and one green. Pressing both buttons simultaneously resets the system, and both have

The S100 bus structure

The Minstrel's tower block style

long key travel and positive click action to help prevent accidental reboots.

Turning the tower round reveals the S100 bus structure. There are 10 slots, each covered with a narrow metal panel; the choice of panel depends on the 'port-holes' needed by the output ports of the S100 boards inserted in the slots. In the standard configuration of the Minstrel 4 system, two of the slots are filled before you start, with the HPZ186 processor board and the HWAC Winchester controller/network board. These must go in the extreme right and extreme left slots respectively, the HPZ186 going at the end of the bus without resistor termination.

The HPZ186, as its name suggests, is built around an Intel iAPX 186 processor (better known under its unofficial name, 80186) running at 8MHz and handling 1Mbyte of RAM on the board. It also includes a memory management chip capable of bank-switching up to 4Mbytes of overall memory space, serial and parallel ports, an interrupt controller and a floppy disk interface.

The other essential board, the HWAC, combines a standard Winchester disk controller with a networking interface and a battery-backed, real-time clock/calendar. Up to four Winchesters, each with a capacity of up to 256Mbytes, can be controlled by the Western Digital WD2010-05 chip. The network interface, built around the Standard Microsystems COM9026 LAN chip, uses the Arcnet standard invented by Datapoint and later adopted as standard by Tandy and others, with a data transfer rate of 2.5Mbits per second over coaxial cable.

Horizontally below the main card cage sits the HSFT interface board, which converts the raw signals from the HPZ186 processor into RS232, QIC-02 and SA400/800 standard forms to handle physical serial devices, tape streamers and floppy disk drives respectively. The HSFT provides two standard RS232 sockets and an 8in floppy drive socket on the back panel, and also controls the floppy drive or drives in the main tower. Up to four floppy drives can be handled by the HSFT, two 5¼in and two 8in, while the HWAC board controls up to four Winchester drives.

The basic single-user configuration of the Minstrel 4 simply adds a drive or two and a terminal or two to the HPZ186, HWAC and HSFT boards, and leaves the eight spare slots empty. However, most users will want to add extra processor boards for extra users, and HM Systems offers two possibilities.

The monitor is terminal-dependent, but is normally 24 lines × 80 characters

The keyboard is terminal-dependent; this is the HM Systems Ampex 230

The first choice is the HTS286 board, which actually includes two complete computers. Each half of the S100 card has an NEC μPD70116 processor — an 8086-compatible chip, its own 512k of RAM, and two RS232 serial ports for printers, terminals or modems. The second choice is the SPAM, which includes a Z80B processor, 64k RAM, two serial ports, two parallel ports and a clock/timer. The Z80B is a fast version of the elderly 8-bit Z80 chip, running at 6MHz.

The eight spare slots of the Minstrel 4 chassis are intended to be filled with any combination of these boards, depending on the number and type of users who will be using the machine. The idea is 'one user, one processor', where every user has a separate processor and RAM space but shares the disk drives and printers attached to the master 80186 processor on the HPZ186 board.

In fact, the various processors in the Minstrel form a 'tight-coupled network' under the control of TurboDOS. All the disk drives in the system are connected to the HPZ186 processor, which acts as the 'master', and the various 'slave' processors only have terminals and printers and no local mass storage. There is no need for this as far as TurboDOS is concerned, since any processor in a TurboDOS system can have disks attached and the operating system will handle them, but it's the way HM Systems has chosen to do it.

This network arrangement introduces a bottleneck, since to get across to a disk drive, a slave processor has to send a request to the HPZ186 over the bus; the 186 processor, while fast, is thus the sole controller of disk access, and this could cause a slowdown if every processor in the system was involved in disk-intensive operations.

Four HTS286 boards were supplied with the review machine, meaning that the box could support up to 10 users if the two serial ports on the HSFT were used for terminals rather than printers. No SPAM boards were supplied, but it's likely that these would only be chosen by customers with a large base of CP/M software and data which they wanted to carry onto the new machine.

On dismantling the machine, removing the boards is simple and easy with the exception of the built-in HSFT. All the boards look solidly built and 'finished' — no funny lumps of wire soldered on to correct faults in the printed circuit board layout. And interestingly, it's difficult at first to figure out where the memory is on the HPZ186 and the HTS286 boards. There's no sign of the familiar banks of RAM chips, and it's only on close scrutiny that the row of components which look like capacitors or resistor arrays are found to be 256k RAM chips mounted in single-in-line packages rather than the familiar dual-in-line.

Installing the processor boards is a simple matter, and is easier than the equivalent job would be with IBM PC-style expansion boards. All the work of recognising how many boards of which type are installed is done by the software, and all the user has to do is set a bank of four DIP switches on each extra board to tell the software which user numbers to assign to which processors. Then the boards are simply slid into their guides, contacts first, and pressed home into the motherboard sockets. Any board can go into any slot, and the order is not important; once again, the software sorts it out.

Each extra HTS286 processor board brings two standard 25-way D sockets out to the back panel of the Minstrel, while the Z80-based SPAM boards have no I/O sockets of their own, but need a special slot panel with floating cables to connect them to the outside world.

Apart from the HTS286 ports, and the three horizontal ports on the HSFT interface board, the only back-panel connector is a standard coaxial BNC socket for the Arcnet network interface (more on this later).

Also inside the review box were a 40Mbyte Winchester drive, a single 96tpi, 80-track, 800k floppy drive, and a 20Mbyte tape streamer using audio cassette-style tapes rather than the standard ¼in cartridge. The floppy drive and the tape drive came from TEAC in Japan, HM Systems' standard supplier for these components.

The floppy drive can read disks in the 96tpi format, or standard IBM PC 48tpi disks; other formats can be added by changing a table entry in the operating software.

The two terminals that came with the system were amber-screen Ampex 230 models made in Taiwan, but badged-up with 'HM Minstrel Workstation' labels. HM supplies four Ampex models — the 210, the 219, the 220 and the 230 — which confusingly use different control codes but look the same. Different versions of the driver software are supplied to handle any combination of terminals. The terminals need only be dumb, as all the computer intelligence is on the processor boards.

As is usual with S100 systems, all communication between the Minstrel and the world is through its serial ports, and there is no way — at least with boards supplied by HM Systems — to drive, say, high-resolution graphics terminals directly. This means that any serial port on the system can be used to drive anything, whether it's a terminal, a printer, a modem or something more obscure.

In fact, some of the ports can drive two things at once. On the HTS286 boards, each processor has two serial ports but the two ports share a single physical connector. Therefore, although each board has two 25-way D connectors, there are actually four serial ports coming out to the back panel. One printer and one terminal can be connected to each physical connector at the same time, and HM Systems provides splitter cables to make this possible. The splitter cable plugs into one of the connectors on the HTS286 board, and dives into two female 25-way sockets to take the standard RS232 cables from the terminal and the printer.

This may sound a little odd, but it is certainly logical and effective, and saves on back-panel space and connector hardware.

Connecting the terminals to the HST286 boards is as simple as plugging an RS232 cable between the main port of the terminal and one of the connectors on the board's back panel. Turning on the power to the terminals, then powering-on the main box, starts the system with a TurboDOS boot-up message on both screens and a sign-on request.

If anything shows that the system has been ready-configured, it's this. Connecting anything to a micro over an RS232 link is more art than science, and it can be guaranteed that when *you* try to do it, the damn thing will not work first time.

The dealer who supplies the system will have sorted out all that, setting the speeds and serial handshaking of all the peripherals, and integrating all the appropriate software drivers for processors, terminals, disk drives, printers and modems into the overall operating system — TurboDOS.

System software

Software 2000's TurboDOS operating system has been around since the mid-1970s, and originally evolved as a solution to the multi-user failures of CP/M, which was then the standard 8-bit operating system. CP/M originator Digital Research's own multi-user upgrade, MP/M, was a disaster, as it had no file and record security, and had capricious hardware requirements.

TurboDOS was designed to run networked systems, where every user has a processor, rather than systems where all the users share one overworked processor. The disk drives and printers in the system are spread around the users' processors, but are accessible to all the users at any time.

That TurboDOS is a product of its time can be seen in the fact that it still proclaims full compatibility with CP/M, MP/M, CP/M-86 and MP/M-86, but *not* with PC-DOS or MS-DOS. The Software 2000 manual does claim that TurboDOS includes an emulator for IBM PC-DOS 'that allows many programs written for PC-DOS to be run under TurboDos.' In fact, there's a software emulator called TPC which allows 'many programs' compatible with PC-DOS 1.1 to run under TurboDOS. There's no support in the emulator for PC-DOS 2.0 hierarchical directory structures or any of 'the other Unix-like extensions' of later PC-DOS versions.

Any combination of 8-bit Z80 processors, and 16-bit processors from the 8086 family — including the 8088, the 80186 and the 80286 — can be linked under TurboDOS. The only requirement is that the Z80s have 65k RAM or, even better, 128k in two 64k banks, and that each 8086-family processor should have a minimum of 128k RAM and preferably more.

TurboDOS will support two or more concurrent processes in any processor in the network: one doing the foreground task — running an application such as WordStar, say; while the other services network requests from other processors for the resources attached to the original processor.

The run-time operating system is stored in two files: OSMASTER.SYS, which loads into the HPZ186 master processor's RAM at start-up; and OSSLAVE.SYS, which loads into the HTS286 slaves. A third file would be necessary for any Z80 slaves in the system.

Each of the run-time files is made up of TurboDOS core modules and hardware-specific drivers, and these

are put together into the files using the TLINK utility supplied with TurboDOS. The drivers are for the Winchester and floppy disk drives, the processor boards, the Arcnet network, the terminals, the real-time clock/calendar, and any other miscellaneous lumps of hardware which are hooked up to the system.

All this can be configured by the user, using the voluminous TurboDOS documentation from Software 2000 and the detailed instructions in HM Systems' own *Technical Reference* manuals. And all I can say, after picking my way carefully through the whole lot, is that I'd be glad to pay a dealer to set it all up for me. It isn't straightforward, it isn't simple, it needs a lot of detailed consideration and some software patches; not to mention a deeper understanding of the interface between operating system and hardware than I ever want to attain.

I was grateful that the configured system worked so simply, and the manuals just made plain the amount of work which had gone into making that happen.

At boot-up time, a program stored in EPROM on the HPZ186 board looks for an 8in floppy drive, then for a 5¼in drive, and then for a Winchester that is ready. Then it looks for a program called OSLOAD.COM on the ready drive; this program finds the run-time operating system files and loads them into the memory of the appropriate processors.

When this has been done, HM Systems' own autostart program puts up a TurboDOS version line, a rather obscure Minstrel 4 logo, and an invitation to log-on with a user ID. The user ID required depends on how the dealer has configured the system, which presumably depends on how the customer wants it configured. If the defaults have not been changed, typing 'system' logs you on to user area 0, drive A (which is normally the Winchester) and gives you privileged status.

Otherwise, the dealer can create a USERID.SYS file which sets up the access routes and privilege levels for various IDs, or a STARTUP file which boots different terminals directly into different application programs.

On the review machine, HM Systems had included a menu-driven front-end for TurboDOS, intended to protect users from the depths of the operating system. The menu included such operating system commands as disk formatting, Winchester head parking for power-off, and user shut-down, as well as named application programs. Even TurboDOS commands could be executed from within the menu structure by selecting the appropriate menu item and then typing in the command, without ever actually seeing the TurboDOS' 0A} prompt.

Using TurboDOS is like using a combination of CP/M and MS-DOS, with perhaps a tendency more towards CP/M. Anyone used to CP/M will instantly be happy with user numbers, non-hierarchical directories and other such arcana.

There are helpful changes, though. The directories are hashed, and displayed in alphabetical order, although this can cause some unbelievable delays in getting a directory when you have, as I did, 295 files in one user area of the big Winchester. Those used to the instant response of DIR under CP/M or MS-DOS will find the wait intolerable; a reorganisation into smaller numbers of files in separate user areas is indicated.

The print spooling facilities are, to use Software 2000's own words, 'rather elaborate'. Up to 16 printers can be connected to the system, all in use simultaneously. Each printer has a letter, just like the disk drives, and any printer can be given from any processor in the system. TurboDOS intercepts the print output from its processors and 'spools' it onto disk, forming a queue of spooled output if more than one user wants to print at a time. There can be a separate print queue for each of the 16 printers if desired.

The use of one processor in the TurboDOS network with disk drives attached to another is perfectly natural, and you would not normally be aware that any other processors were sharing 'your' disks. The only time it matters is when you want to use a particular set of commands referring to the disk drives hanging from the HPZ186, such as BACKUP, FORMAT and VERIFY commands for the floppy and Winchester drives. These commands must be addressed directly to the HPZ186, and this can only be done from a slave processor by connecting the slave's terminal directly to the master processor.

This connection is done using the TurboDOS standard Master command which attaches any console to the master processor in the system, as long as the user of that console has the privileged access required to mess around with the disks of the entire system. Typing DETACH disconnects the console from the master, and reconnects it to the slave. The prompt changes when you log-on to the master, from 0A} to 0A>, so you always know which processor you are using.

It is intriguing to try this on the Minstrel 4; the speed difference between running an application on the HPZ186 and running it on one of the HTS286 processors is remarkable. This demonstrates that the Intel 80186 is more efficient than the 70116 8086-clone, even though both run the same software and are running — in the Minstrel 4 at least — at the same 8MHz clock rate.

The overall impression of TurboDOS is that it does the job in as unobtrusive a manner as possible, considering the balancing act it has to do between processors of differing types and resources of differing types. The impression is also of something primitive, like the original CP/M, although this can be concealed by using menu-driven add-ons like the HM Systems' unit. The user should be protected from TurboDOS, which is even less friendly and less amenable to user manipulation than MS-DOS.

Networking

As far as TurboDOS is concerned, another Minstrel 4 or a more conventional PC hooked up to the first Minstrel 4 over a local area network is just another processor or set of processors. These remote processors may not all be in the same box, as they are in the tightly-coupled Minstrel 4, but TurboDOS is equally happy with 'loosely-coupled' networks. All the processors, as before, can access each other's disks and printers.

HM Systems has adopted Datapoint's 2.5Mbit-per-second Arcnet as its networking standard, and the HWAC board in the basic configuration includes an Arcnet interface (but without the 9026 and 9032 controller chips) as standard. The interface comes out to a BNC coaxial cable on the back panel of the HWAC board.

Up to four nodes (Minstrels or PCs) can be connected together simply, but for more than that, an 'active node' must be added to take the number up to eight. More active nodes can be added to take the absolute maximum network size up to 255 nodes.

Like any other part of a TurboDOS network, a software driver for Arcnet must be included in the run-time operating system file loaded into each master processor connected through Arcnet. HM Systems says that 'the operating system requires careful setting up' for Arcnet operation. If HM says that, I read it as meaning 'get someone else to do it.'

Arcnet boards are available for the IBM PC and compatibles, and also for the Apricot; these, combined with Software 2000's Turbo/PC software running on the PC or the Apricot, let the Minstrel 4 act as a file server to a network of the smaller machines.

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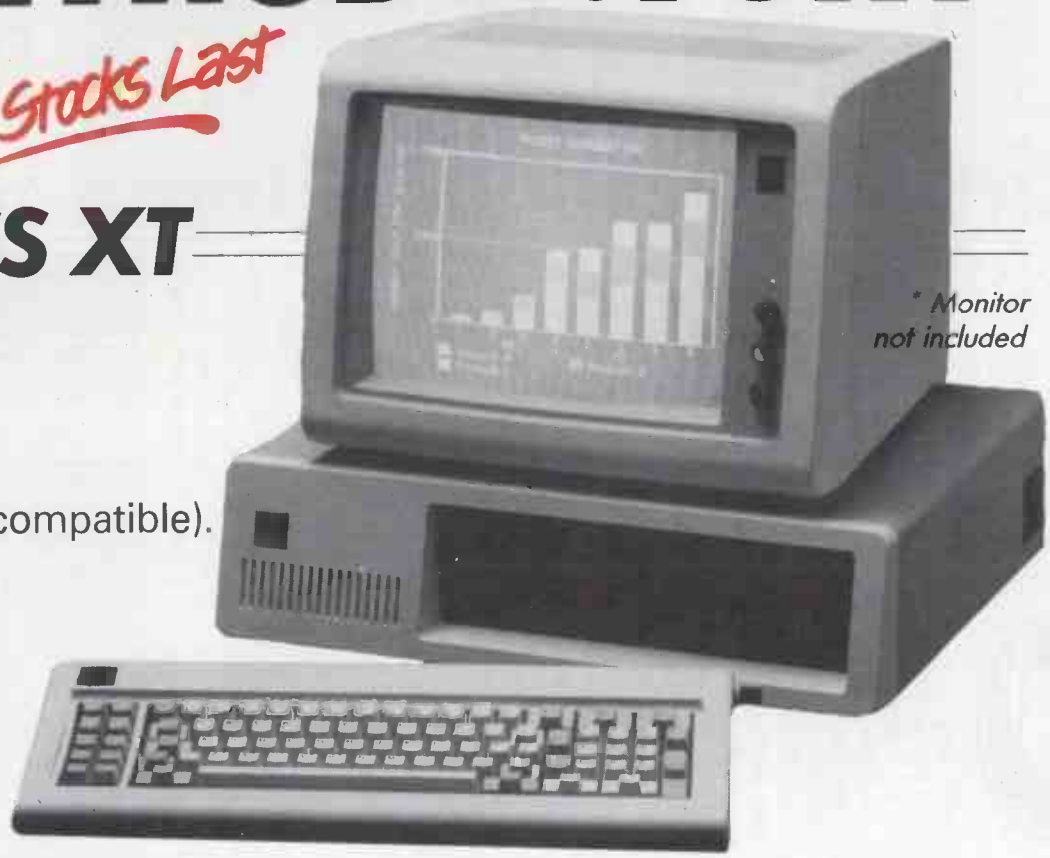

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Applications software

Any standard CP/M or CP/M-86 program is claimed to work under TurboDOS, which gives users a wide choice of thousands of packages, even if the list does not include the latest glamour programs produced only for the IBM PC and MS-DOS machines. Some of the more elderly PC-DOS 1.1 applications should also run in emulation.

HM Systems bundles NewStar Software's WordStar clone, NewWord 3, and a spreadsheet program, with the Minstrel 4. There is some confusion over the actual spreadsheet involved, as the documentation says it is The Cracker, and the software supplied on the review system was SuperCalc 2. But then, the review machine had WordStar installed on the boot-up menu alongside NewWord, and also included the multi-user Dataflex database.

Although none of this software is specifically multi-user, the built-in TurboDOS file-locking facilities protect the various users from interfering with each other. With WordStar and SuperCalc, two users cannot use the same program at the same time, as TurboDOS locks the overlay files needed by the program. Whichever console gets there first runs the program. With NewWord, though, two users can run the same program at the same time, and even edit the same text file. A warning message is put up saying that someone is already editing this file, and that the second user can read it but not modify it.

Also included is the Minstrel SoftPack, a set of utilities including the menu program, a diary, a card index database, a calculator and a rudimentary but effective electronic mail package. This is obtained from HM Systems by returning your Minstrel registration card and the TurboDOS licence agreement; I'm not sure, however, that the SoftPack is worth that much effort. Sidekick it isn't.

Documentation

As befits its tradition, the Minstrel 4 documentation is unbelievably thorough on all the most technical aspects of hardware and software, and as such will be largely incomprehensible to its business customers. There are three loose-leaf volumes: one is a skimpy *User Guide* on putting the system together and getting it to do something, along with the official *TurboDOS User Guide*; one is a *Technical Reference Manual* on the hardware, complete with data sheets on the main chips involved; and the other is a *Programmer's Reference Guide* with the full TurboDOS technical documentation.

All the volumes are competently produced, and I'm sure that anything you might need is in there, if you can find it and understand it once you've found it.

Technical specifications

Processors:	Intel iAPX 186 (master); up to 16 NEC µPD70116/Zilog Z80B in any combination
ROM:	8k EPROM on master
RAM:	1Mbyte on master; 512k on 70116 boards; 64k on Z80B boards
I/O:	Four RS232 serial ports/two connectors per 70116 board; two RS232 ports, one 8in floppy port from master processor board; one BNC coaxial connector for Arcnet
Keyboard:	Dependent on terminal; illustrated for HM-supplied Ampex 230
Display:	Dependent on terminal; normally 24 lines of 80 characters plus an optional 25th status line
Mass storage:	800k at 96tpi 5¼in floppy drives (up to four); 1.2Mbytes at 48tpi 8in floppy drives (up to four); 256Mbytes max per Winchester drive (up to four); five-track, 20Mbytes-per-cassette tape drive
Network:	Arcnet standard, 2.5Mbit/s, coaxial
Extra:	Real-time, battery-backed clock/calendar

In perspective

The competition for the Minstrel 4 comes from the straight multi-user makers like Altos, as well as from the S100 camp led by US-based Viasyn/CompuPro and UK companies like Jarogate.

But in these days of cheap microprocessors, each user should really have a processor and RAM of his or her own, and here the tightly-coupled S100 network wins hands-down over the single-processor, multi-user systems.

The up-front cost of an S100 system is high, and success will be very dependent on the quality of the dealers and system integrators which the manufacturer can attract to the flag. But the advantages of the breed are obvious once you have seen an 8086, or even a 68000, trying to handle 12 users or so on its own.

The Minstrel's tower-block design is more compact than most of the competition, the terminals are attractive and competitively priced, and the performance is all you could ask for.

Prices

Basic system	£6995
Including:	
512k RAM/iAPX 186 master board	
Twin 512k/70166 slave board	
20Mbyte Winchester drive	
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Single 720k floppy drive	
Two Ampex 210 terminals	
Two-user upgrade	£2190
Including:	
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64Mbyte Winchester option	£2000
145Mbyte Winchester option	£6500
Arcnet option	£215
Including:	
Arcnet controller cicuits on Winchester board	
Arcnet cards for IBM and Apricot PC	£495 each

Conclusion

There is no doubt that there's a market for multi-processor, multi-user machines which are reliable, fast and easy to use.

With the caveat that a reputable dealer is essential to configure the system and get it going, the Minstrel 4 seems to score on all those points. There is little more to add; TurboDOS has been around long enough to have the bugs shaken out of it, as has the S100 bus itself. The terminals, connected to the processors at 19,200 baud, are quick enough for most purposes.

The only drawbacks for the business buyer will be the lack of real IBM compatibility and the lack of graphics — at least without adding extra graphics boards and terminals to the system.

For software developers, the machine looks very good. But then, all the top software developers have been using S100 machines for many years, even if the software is being written for the Apricot or the IBM PC.

As S100 systems go, the Minstrel 4 has all the advantages of the breed and fewer disadvantages than many. It is a shame, though, that the S100 is no longer for hobbyists.

No Benchmarks are available. END

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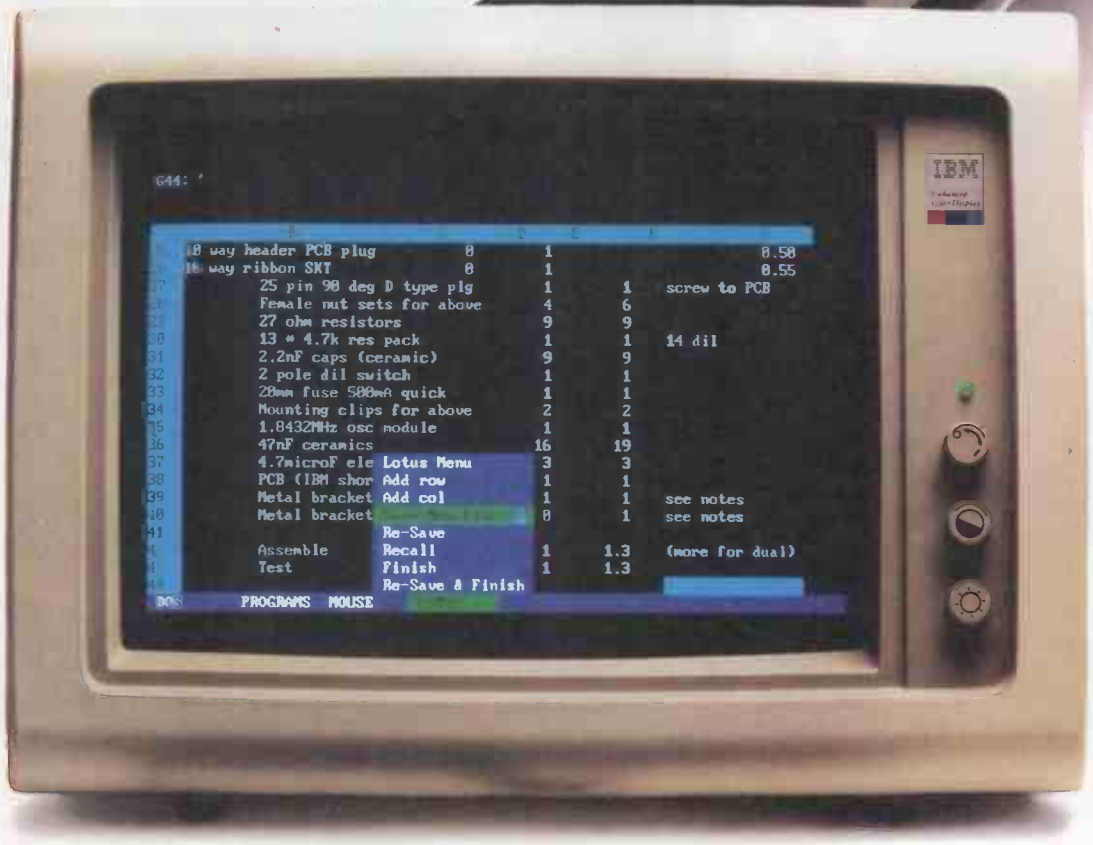

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SummaMouse software comes complete with example menus for Wordstar and Lotus 123. Straightforward set-up routines are provided with an excellent manual and any word-processor or text editor can be used to prepare menus for all other application programs.

Price?

We'd better say it again: £99 + VAT for the whole package. (Some mouse, SummaMouse.)

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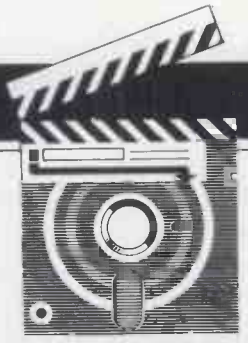


SCREENTEST

Business graphics

Presenting your business information in graphic form may be just the boost your company needs, and you don't have to be a great artist to do so either. Nick Walker takes a look at what's available and puts you in the picture.

To the uninitiated, the screen of a micro running a spreadsheet is a perfect example of everything that's wrong with computers — rows and rows of seemingly meaningless figures. To you those figures may indicate the most significant discovery in your company's history, but, unless presented in a meaningful form, they may as well be a hex dump of RAM.

Many modern spreadsheets, such as Lotus 1-2-3, contain a facility for showing a set of figures as a graph. Graphs are fine for showing a colleague your discoveries, but are not generally of presentation quality. For some time now there have been packages available that take the data from the likes of 1-2-3 and turn it into much higher-quality graphs. The quality of these products has steadily improved over the last two years, so much so that I decided that the time was right to examine the most promising of the current crop.

To assist me in my choice I set some criteria to which all the packages had to conform. Firstly, they had to run on an IBM PC or compatible. (I didn't really want to stipulate this, but it *is* the machine that both small and large businesses most commonly use when running spreadsheets.) Secondly, they had to be able to display graphs in both CGA mode (colour graphic adaptor) and one of the higher graphics modes such as EGA (enhanced graphics adaptor) or Hercules.

CGA is by far the most common colour graphics standard used with the IBM PC, but its low resolution and lack of colours pose problems to anyone trying to produce decent graphics. EGA is IBM's attempt to produce a higher-quality colour graphics standard, which despite its high price (if bought from IBM) seems well on the way to becoming the second IBM colour standard. Hercules is by far the most successful third-party, high-resolution monochrome for the PC.

Two final criteria I expect from a decent IBM graphics package are that it must be able to take data from a Lotus 1-2-3 spreadsheet and be capable of producing a good quality hard copy of what's shown on the screen. A surprising number of the older packages don't support peripherals capable of high-quality graphical output.

You may think that there would be few packages that satisfied such a specification, but I discovered well over 20. I picked three, all new packages to the market and each one with a very different approach to the creation of graphics. The three selected for review were 'Harvard', a full-blown presentation graphics system from Software Publishing Corporation; Perspective from Three D Graphics, a package whose *forte* is three-dimensional graphics; and Graph-in-the-box from New England Software, a memory-resident graphing program. Unfortunately, at the last moment I had to drop Graph-in-the-box as the final version was not ready at the time of writing; this was a shame as it has the unique ability to produce a graph of any data on the screen regardless of what application is loaded.

Obtaining the necessary hardware for this review was no great problem, except for one thing — an EGA colour display. No end of manufacturers and distributors offered me plug-in expansion cards which provide EGA output, but no-one seemed to have a suitable colour display. Finally, after much searching, the London-based distributor Digitus was able to supply a genuine IBM one.

Even so, if there are any third-party monitor manufacturers out there which produce EGA monitors, could you please let me know.

Harvard Presentation Graphics

To install Harvard you need a 256k RAM system with two floppies or one hard disk, version 2.0 (or greater) of the MS-DOS operating system, an 80-column monitor and either a CGA, EGA, Hercules or IBM monochrome display card (although you can't see the graphs on the screen with the IBM mono set-up). The installation process is executed via a batch program called 'INSTALL'. Once installed it is impossible to load the program on another system until it is de-installed; a nicer form of copy-protection than the key-disk system but still not perfect.

When you first start Harvard, it displays a main menu from which you select each of the program's major functions. Unlike most graphing packages that have a general data entry screen, Harvard has a different data entry screen for each of its graph types.

A pie chart is the easiest graph to create with Harvard, although this has much to do with pie charts being used to graph only one set of variables rather than being an easy-to-use feature of the package. To get to the pie data form, you select 'Create

graph' from the main menu and then 'Pie' from a second menu. The menu structure is the same throughout the package, so I won't bore you with the details.

For some reason, with graphing programs, I find a menu system far less irritating than with other programs, even with repetitive use. The data entry form lets you enter the graph title, subtitle, footnote and, for each segment of your graph, a value and label. A number of options can be applied to enhance the pie chart's appearance, including showing a slice as a cut-out for extra emphasis, changing the colour or fill style of each slice, adding percentage or currency signs and creating a three-dimensional effect. Two pie charts can be displayed on the screen and one can be linked so as to show a breakdown of a single segment. Finally, if you desire, pie chart-style data can be shown as a single broken-down column. A particularly effective combination image-wise is a pie chart together with a column on the same screen.

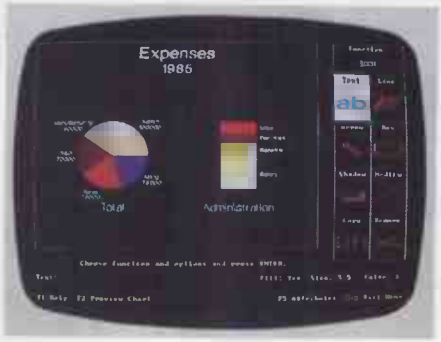
Line and bar charts add another dimension to the type and amount of data that you can handle. Before entering the data input form, a window will appear requesting information about the x-axis, specifically the units (that is, name, day, week, month, year, time, number and others), the start value, the end value and the increment. The data entry screen will then be suitably customised and ready for the entry of y-axis data. Up to eight series of data can be displayed on a single chart with up to 60 values per series, although it is obviously wise to keep the number low if you want an easily understandable graph.

There are so many customised options available for these types of graph that Harvard has broken them down into three pages of options. These pages of options are filled in just like the data entry forms.

From page one you can change the title, subtitle or footnote. You can also type a title for the X and Y axes. In the table at the bottom of the screen you can change the legends of each series in the graph, select the graph type (bar, line, trend, curve and point) and specify if you want the graph sorted or cumulative.

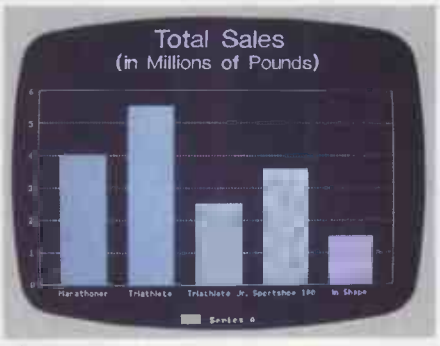
From page two you choose overlapped bars, stacked or 100 per cent bars or lines. You also select the type of grid lines (if any), a label for the values shown along the Y-axis, the style of the frame and the placement and justification of legends. For bar charts, you can specify that Harvard displays the bars with a three-dimensional appearance or with values above the bars. You can also indicate whether the bars are to run horizontally or vertically.

Finally, on page three, you can choose the colour of the lines or bars, the marker style for line or point chart, the pattern for bar charts, and the line style for any of the variations of line charts.



Harvard's annotation screen

An organisational chart



A traditional bar chart

A pie and column chart

Two other types of graph are available from the 'Create New chart' submenu. These are the area chart — a cross between a line graph and a stacked bar — and the high/low/close graph used almost exclusively to show the high point, low point and closing price of stocks and shares. These graphs are really variations on the bar/line graph theme and use limited forms of the bar/line graph data entry screens.

Harvard Presentation Graphics, however, is more than just a graphing program; it is an attempt to provide everything you need to make a complete presentation. A substantial proportion of the program is concerned with other aspects of creating a presentation. There are facilities for the creation of many types of text chart. Among these are hierarchical charts, which are used to show company structure; and bullet lists, which give visual impact to a list and tabular charts.

One of the most useful features of Harvard is its annotation facility. This takes any chart created with Harvard and loads it into the window of an annotation screen. A graphical menu of the tools available to add the finishing touches to the graph is shown on the right-hand side of the screen. From this menu you can add extra text, draw lines, position arrows, draw boxes, copy any part of the graph and remove any part of the graph. (Users of MacPaint or similar painting packages will feel quickly at ease with the operation of the annotation screen, as Harvard is based on the same principles.)

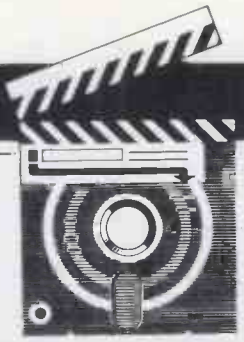
Harvard will import and export to a number of different commercial packages. From Lotus 1-2-3 and Symphony you can import a worksheet directly into a data entry screen and you can import a Lotus 1-2-3 or Symphony graph directly into its much improved Harvard equivalent. For other applications the data has to be in the form of an ASCII file, and the procedure is considerably more complex. A graph generated by Harvard can be exported but only to one particular package, the word processor PFS:WRITE.

The choice of output devices for your finished graph is the most impressive list I've ever seen for a single package, and consists of around 30 printers including a number of laser printers, 12 plotters and four colour slide peripherals. The chances are that even if your printer is not listed it will behave like one of those listed; if not, considerable information is included in the manual for those who feel confident enough to design their own printer driver.

The documentation consists of one excellent 200-page manual which is well-written, easy to understand and well-illustrated. It is also one of the few manuals which successfully combines tutorial and reference information in one book.

Perspective

It was only half-way through the review of Perspective that I realised that it didn't conform to the criteria I had specified. Perspective will not run on a CGA-driven monitor; the



SCREENTEST

manual fails to mention this, and I foolishly assumed, as I happily worked away on both EGA and Hercules set-ups, that this popular standard was supported.

By the time I realised that CGA wasn't supported, I was so impressed with what Perspective could do that I felt I had to review it anyway. I suspect that there was no way that Perspective's programmers could get anywhere near the standard of graphics they wanted from CGA — even so it's a serious omission. The other hardware requirements needed to run Perspective are an IBM or compatible with 512k RAM, DOS 2.0 or greater, and either two floppies or one hard and one floppy disk drive.

Installing Perspective is simple: insert disk A, type 'INSTALL' and a batch file does it all for you. There was no copy-protection on the review version, but I am assured that the final version will have this, though Three D Graphics is unable to state what form this will take.

Normally, with a good graphics package, it takes about 15 minutes to draw your first simple graph, two minutes to enter the data and about 13 minutes to find your way around the system sufficiently to draw a graph. With Perspective it takes about three minutes in all, and the finished graph is just one variation on a vast number of excellent three-dimensional graphs.

It is obvious from the moment you load this program that Perspective is a particularly well-written piece of software. The user interface is a real joy to use, and proves that to make a piece of software easy to use you don't have to slavishly follow the Apple Macintosh WIMPs (Windows, Icons, Mice and Pull-down menus) interface.

Perspective's menu-driven system is totally graphics-orientated; the main menu consists of a graphical representation of the function keys f1 to f5. Almost all the operations within Perspective are performed with these five function keys and the occasional use of other keys is restricted to entering data on the numeric keys, the space bar to remove the menu from a full screen picture and the cursor control keys.

'Harvard is an attempt to provide everything you need to make a complete presentation.'

Logically, the first thing you do when creating a graph is enter data. This is carried out via the data manager screen regardless of whether the data is entered directly at the keyboard or from a spreadsheet.

The data manager screen is divided into two parts, the worksheet and the status area. The worksheet takes up most of the screen and resembles a typical spreadsheet, as it is divided into cells that contain the data for graphing. However, there is no facility for even the simplest spreadsheet calculation. The status area takes up the top three lines of the screen and allows you to specify which cells will be labels and which will be plotted on the graph as well as a title or subtitle for the graph.

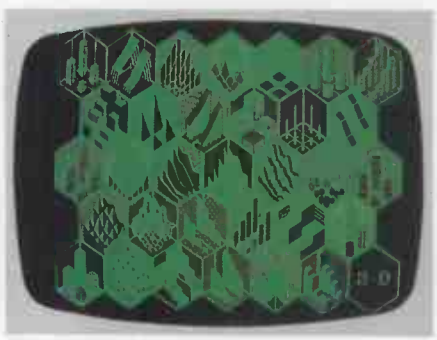
The graph types in Perspective are broken down not by pie, bar and line, but by three-dimensional and two-dimensional graphs. Selecting the 3-D Graph types from the main menu results in the most impressive menu I've ever seen; the screen is broken down into 33 hexagons each containing a miniature three-dimensional picture of the different graph types. Pressing the space bar highlights each of the graphs in turn while hitting f1 will draw the required graph.

The bottom right-hand corner of the 3-D Graph types menu contains a familiar two-dimensional-type graph. Selecting this takes you to a similar menu consisting of 15 two-dimensional graph types. The selection of two-dimensional graph types consists of the variations on the themes of bar graphs, pie charts, line graphs and point graphs.

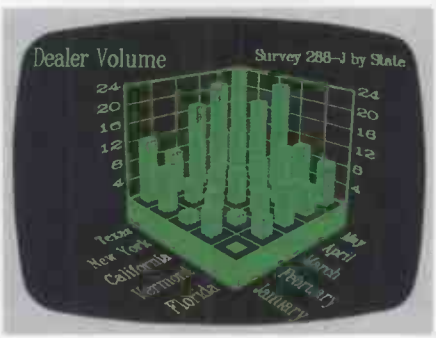
All the usual graphs are available such as stacked bar, shaded line and best-fit line. Of the more unusual options my favourite is Spectral Mapped Cells. The graph for this consists of a simple grid, each cell within the grid being filled with tiny dots; the higher the value for a particular cell, the more densely the dots are condensed. It's all very pretty but I've yet to find a practical use for it.

The options for customising two-dimensional graphs are shown in a five-function key graphical form at the bottom of the graph screen. From this menu you can change the colours and patterns used, explode or cut out a segment of a pie chart, switch rows with columns, adjust the bar width and spacing, and turn the grid lines on and off.

Perspective really comes into its own, however, when drawing three-dimensional graphs. All the other graphics programs I've seen which produce three-dimensional graphs use a 'false' perspective by drawing objects within lines that are parallel and, therefore, don't diminish with distance. This technique gives a three-dimensional appearance to



Perspective's main graph menu



A true 3-D bar graph

A scatter chart

A 3-D surface

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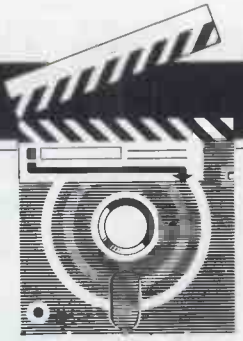


SCREENTEST

what is essentially a two-dimensional bar graph; however, it is totally unable to represent three variables in three dimensions.

The Perspective programs follow Brunelleschi's (the 17th century mathematician attributed with the discovery of true perspective drawings) system whereby objects appear to diminish with distance until they reach a single common vanishing point. This gives a convincing appearance of reality and clearly shows data relationships of three interacting variables.

Perspective offers you 32 different three-dimensional graph types and 16 pre-set viewing angles, which means you can choose from up to 512 different screens when viewing your data — and that's before the customisation options are applied. I don't propose to discuss all the available graph types here, and suggest you look at the accompanying screenshot of the main menu to get a taste of what's available. Needless to say, they are all variations on the traditional two-dimensional graph types.

There is considerable customisation available for three-dimensional graphs broken into the two basic groups: viewing angle/distance and styling. Despite the complexity of these options, the user interface remains simple and is basically driven by five function keys.

Selecting the 'Custom Viewing Angle' from the main menu takes you to a menu from which you can adjust the angle, size or position of the current graph. The easiest way to understand these options is to imagine the graph as a cube, and, indeed, for certain operations Perspective actually reduces the graph to a box-like skeletal outline which you can then manipulate by rotating it in any plane, moving it towards and away from you, zooming in or out on it, panning in four directions and distorting it.

Styling covers all the editing options for everything inside the graph. There are fundamentally seven styling operations that can be performed. These are the selection of colours and patterns for the walls, floor, base, risers and background; adjusting the spacing between each cell of the grid; adjusting the base height; changing the row and column orientation; turning on the front corner outline; removing grid lines from the walls or floors; and tearing down the back walls.

One problem that occurs with the creation of three-dimensional graphs is that of labelling the axis. Each pre-set graph type and pre-set viewing angle comes with its own compatible label format, but because the labels are also drawn in true perspective, this makes the label totally illegible. An option called Label Manager attempts to rectify this problem by allowing you to change the size, spacing, slant and typeface of characters in order to get the best balance and positioning. A word of warning, however: although this option is useful, it can also result in dreadful-looking graphs.

'Perspective really comes into its own, however, when drawing three-dimensional graphs.'

Perspective will accept data from Lotus 1-2-3, Multiplan and any application that produces ASCII files. As far as printing goes, Perspective supports a limited but well-selected number of printers or plotters, although I was disappointed to see no support for laser printers.

The documentation that came with Perspective was a preliminary version, although I'm told that little has been changed for the final version. The general style was good but it has been written in such a way that it couldn't be easily used as a reference manual. I suggest a single read through the complete manual and then put it away; Perspective's ease of use makes it an ideal package to experiment with.

Prices

Harvard Presentation Graphics costs £495 and is distributed by Software Publishing Europe (SPE) on (01) 839 3864. Perspective costs £295 and is available from PCML on (0372) 67282.

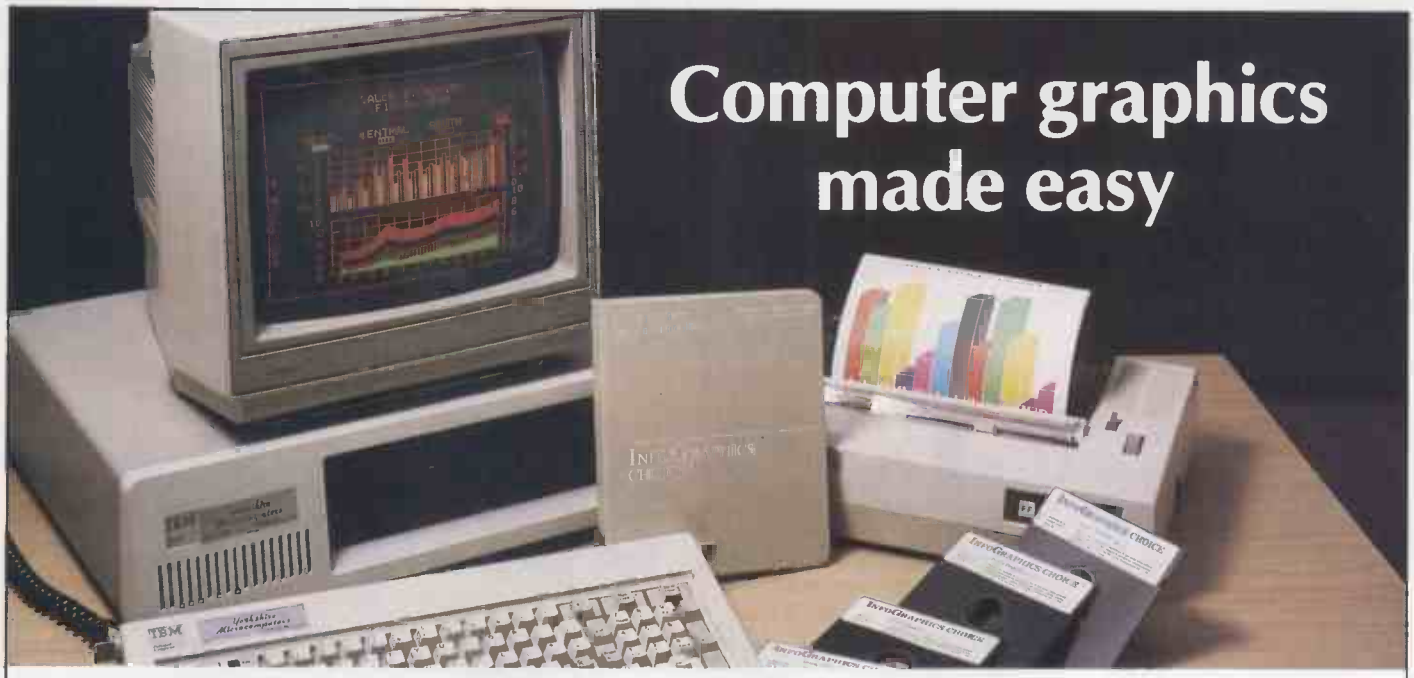
Conclusion

Although both packages can perform the same function of turning a set of data into high-quality graphs, they are really poles apart.

Harvard Presentation Graphics has a more general appeal. Creating a report or presentation is something almost everyone has to do at some time in their working life. If your occupation means you have to produce many reports, then I would strongly recommend Harvard as an aid to both the quality and speed at which such reports are produced.

Perspective is a specialist product that has absolutely no competitor in the production of three-dimensional graphs. I suspect there will be a number of users to whom it will be absolutely essential, paticularly in scientific, mathematical and highly specialised business applications. However, the user-interface is so good that it may well appeal to less specialised users just because they will be able to create impressive graphs with little effort. END

'In the event of a nuclear holocaust, he's the official war artist.'



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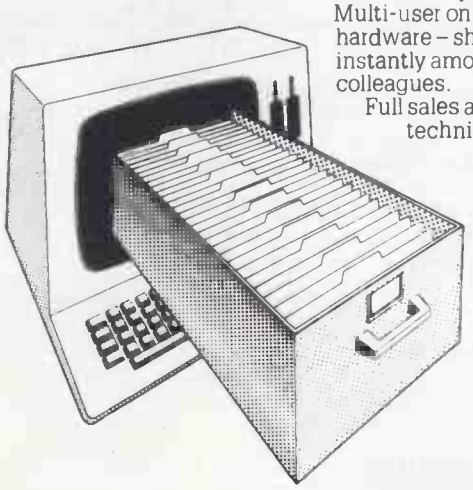

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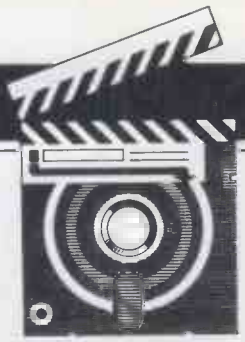


SCREENTEST

Modula-2 compiler

For serious programmers writing large and complex applications, TDI's Modula-2 compiler for the Atari ST is without equal. Gareth Jefferson reports.

Few languages have made more impact upon the computer world in the last 10 years than Pascal, which is claimed to be the most widely used language after Basic. And yet Pascal has failed to make the impact that might have been expected in the 'serious' programming community.

History

The reason for this state of affairs is simple. Pascal was primarily designed as a general-purpose teaching language by Niklaus Wirth, and was conceived as a medium to teach good programming style and methods. It was never really intended to be a commercial programming language and is somewhat deficient in I/O and string-handling capabilities. What it did do, and did extremely well, was instil in a whole generation of student programmers the importance of strict typing, proper declaration and initialisation of variables, and the value of user-definable data structures (which can be of any degree of complexity).

Basic, by comparison, although easy to use for the writing of 'Hello world' and PRINT-the-character-set programs, fails as a professional programming language on several counts. These include the difficulty of breaking down large programs into easily manageable sub-programs, the lack of CASE, REPEAT-UNTIL, WHILE-DO and similar control structures, the ease with which GOTOs can obfuscate the flow of the program, the universality of variables (resulting in potentially serious side effects) and the lack of complex data structures such as sets, records, and so on.

Pascal addressed most of these problems and made ugly 'spaghetti programming' anathema to all those who took the trouble to learn it. On the other hand, Pascal, as originally specified by Wirth, has its own shortcomings. It has poor I/O, cannot handle strings, cannot link to libraries of subroutines, cannot operate on data at the bit level, and cannot get at or modify specific memory and I/O addresses. Small wonder the programming fraternity prefer C, which can do all of these things! Even dirty old Basic can PEEK and POKE, and actually handles strings rather well.

Modula-2 was developed to program a computer under development at the Institut für Informatik in Zurich at both the high and low levels. Commercially successful versions of Pascal (such as Borland's Turbo Pascal) tried to overcome the limitations of classic Pascal by tacking on extensions at the expense of compatibility with other compilers. Modula-2, however, was designed from the beginning to do everything that Pascal ought to have done.

Since Modula-2 will be new to many readers, I'll begin by summarising Modula-2's features and highlight some of the differences between it and Pascal.

MODULA.PRG

```
TDI Modula-2/ST      Release 2.00a

Modula-2 Compiler    Version 2.10a
source file : A:\SIEVE.MOD
Import List Processing
Terminal : A:\TERMINAL.SYM
.....
TextIO : A:\TEXTIO.SYM
.....
.....
.....
..

Declaration Analysis
.....
.....
.....

Statement Analysis
.
Expression Analysis
```

Fig 1 Screen messages provide information on the compiler's activity

Features of Modula-2

Modula-2 is essentially very similar to Pascal, but with a slightly simpler syntax, low-level facilities to make systems programming possible, built-in multi-tasking support and a very important new concept — the module.

Modula-2 allows programs to be split up into small, separate modules that can be individually compiled and shared by other programs.

Modules are of two types: client modules and library modules. Client modules are roughly equivalent to main programs and would normally be quite short and concise. They can *import* constants, types, variables

and procedures from library modules. Library modules are able to *export* such facilities to their client modules, but they may also import from other library modules.

In many ways, library modules replace the procedures of a Pascal program by removing the subprograms to separate files. Library modules contain essential code that can't be dispensed with, but which can so easily obscure the logical flow of a program if incorporated in the main body. Procedures as such are still available and may be used in both client and library modules.

An important part of Wirth's Modula-2 philosophy has been to make the language suitable for the development of large and very large programs. The fact that whole chunks of the program can be hived off, developed by programming teams, individually compiled and independently tested, obviously gives Modula-2 a big advantage over languages that insist on having all the source code in one file.

The way in which library modules are created also helps the team approach. Every library module comes in two parts: a *definition module,* which explains exactly what the library module does, and an *implementation module* which explains how it is done. Definition modules are typically very concise and would normally be written by the chief program designer. The definition module will give the writer of the implementation module all the essentials he/she needs to know in order to write it.

Let's look at how the process works by using an example of a library module does; and an *implementation module,* which explains the chief programmer, is writing a program called 'Monte Carlo Follies' and will need random numbers in a big way but can't be bothered to write the code, so he says to Smith: 'Write me a library module that will return a random number between zero and a specified maximum value. Here's the definition module . . .'

```
DEFINITION MODULE
   RandomNumbers;
PROCEDURE Random(MaxValue :
   LONGCARD): CARDINAL;
END RandomNumbers.
```

This tells Smith that the library module is called RandomNumbers, and that it contains a function procedure called Random, which takes a maximum value and returns a random number. LONGCARD and CARDINAL are big and regular-sized cardinal numbers. These are just like Pascal's INTEGER (which Modula-2 also has), but they only have positive values.

Smith goes away with this definition and comes back with the actual implementation of the library module:

```
MODULE Sieve;


FROM Terminal  IMPORT WriteString, WriteLn, BusyRead;
FROM TextIO    IMPORT ReadCard, WriteCard;

CONST
      Two = 2;
      Maximum = 10000;

VAR
      Sieve : ARRAY [Two..Maximum] OF BOOLEAN;
      left, factor, mult, count, limit : CARDINAL;
      c : CHAR;

BEGIN
      WriteString (" ENTER limit ");
      ReadCard(limit);
      WriteLn;
      count := 0;

         FOR factor  := Two TO limit DO
             Sieve[factor] := TRUE;
         END;

         left := limit - Two + 1;
         factor := Two - 1;

       REPEAT

         factor := factor + 1;
         IF Sieve[factor] THEN
           count := count + 1;
           WriteCard(factor,0);
           WriteLn;
             FOR mult := 1 TO limit DIV factor DO
               IF Sieve[factor * mult]
                 THEN Sieve[factor * mult] := FALSE;
                 left := left -1;
               END;
             END;
         END;

       UNTIL left = 0;

      WriteString("The Number of prime numbers up to ");
      WriteCard(limit,0);
      WriteString(" is ");
      WriteCard(count,0);
      WriteLn;
      REPEAT BusyRead(c) UNTIL c =  " ";

END Sieve.
```

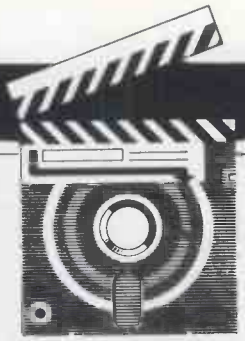
Fig 2 A Sieve of Eratosthenes program written in Modula-2

```
IMPLEMENTATION MODULE
   RandomNumbers;
   CONST
      M = 100000000;
      m1 = 10000;
      b = 31415821;
   VAR seed : LONGCARD;
   PROCEDURE Random(MaxValue :
      LONGCARD) : CARDINAL;
      PROCEDURE Multiply (p, q :
      LONGCARD) : LONGCARD;
      VAR p0, p1, q0, Q1 :
      LONGCARD;
   BEGIN
      p1 := p DIV m1;
      p0 := p MOD m1;
      q1 := q DIV m1;
      q0 := q MOD m1;
      RETURN (((p0*q1 + p1*q0)
      MOD m1) * m1 + p0*q0)
      MOD M;
   END Multiply;
   BEGIN
      seed := (Multiply(seed, b) + 1)
      MOD M;
      RETURN CARDINAL(((seed DIV
      m1)
         * MaxValue) DIV m1);
   END Random;
   END RandomNumbers.
```

These can then be compiled and tested with a very simple calling program. If everything works, the RandomNumbers library module can be used by any program requiring random numbers — be it a weather system simulation, an arcade game or a statistics package.

Very little from these examples will look at all unfamiliar to the Pascal programmer. Differences from Pascal include the comment delimiters. They must be delimited (* thus *); the (curly bracket) option of Pascal is not available as Modula-2 uses curly brackets to specify set members, as in:

```
   CONST
```



SCREENTEST

```
        MonthHasThirtyDays =
            SetOfMonths {Apr, Jun, Spt,
            Nov}
```

Another important difference between the two languages highlighted by the above example is Modula-2's case sensitivity.

Most implementations of Pascal are not case-sensitive, so the identifiers DAYOFWEEK, DayOfWeek, dayofweek and Dayofweek would all be equivalent. Modula-2 is always case-sensitive, and no provision is available in the language specification for a compiler directive to de-sensitise it.

In Modula-2 you could, if you wished, have a program with four completely distinct variables called NUMBEROFPUPILS, Numberofpupils, numberofpupils and NumberOfPupils. This hardly aids program clarity, and to my mind is one of Modula-2's most irritating aspects. Almost every time I've had an error during compilation it's been because I had typed in IMPORT ReadSTring, instead of IMPORT ReadString or Total := Total + Result instead of Total := Total + result. Pascal wouldn't have cared!

All of Modula-2's reserved words must be in upper case, while procedure identifiers are written 'LikeThis'. Variables are supposed to be written in lower case, but don't have to be.

Modula-2 allows open arrays so that the size of an array does not have to be specified when an array is passed as a parameter. Thus we could have:

```
UseStringProcedure(CharacterString
    : ARRAY OF CHAR)
(* Rather than: *)
UseStringProcedure(CharacterString
    : CharArray)
(* Where CharArray had previously
    been defined as: *)
TYPE CharArray
    = ARRAY[32..125) OF CHAR
```

This feature allows different-sized arrays to be passed to a procedure as a parameter, but it does not allow arrays to be created where the size is determined dynamically at run time (as can be done in Ada).

Extra control structures include LOOP-EXIT-END, which tests within the loop and exits if appropriate; and improved IF-THEN-ELSE (it now allows an ELSIF clause); and a more flexible CASE structure.

Multi-tasking is supported by the new sequencers PROCESS, NEWPROCESS and TRANSFER, while low-level programming is supported by CODE (allows machine code to be inserted), SETREG and REGISTER (allow the 68000's registers to be set or read respectively), the function procedures ADR(variable) and SIZE(variable) (return the address and number of allocated bytes for a variable), LISTEN (to service interrupts) and many others.

Modula-2 is a rich and expressive language that should satisfy the professional systems and applications programmer, and this review will no doubt have missed many important aspects. There is, however, a lot to it and a lot to learn. The beginner with no experience of Pascal might find Modula-2 intimidating, but the Pascal programmer will most certainly have no difficulty in making the transition.

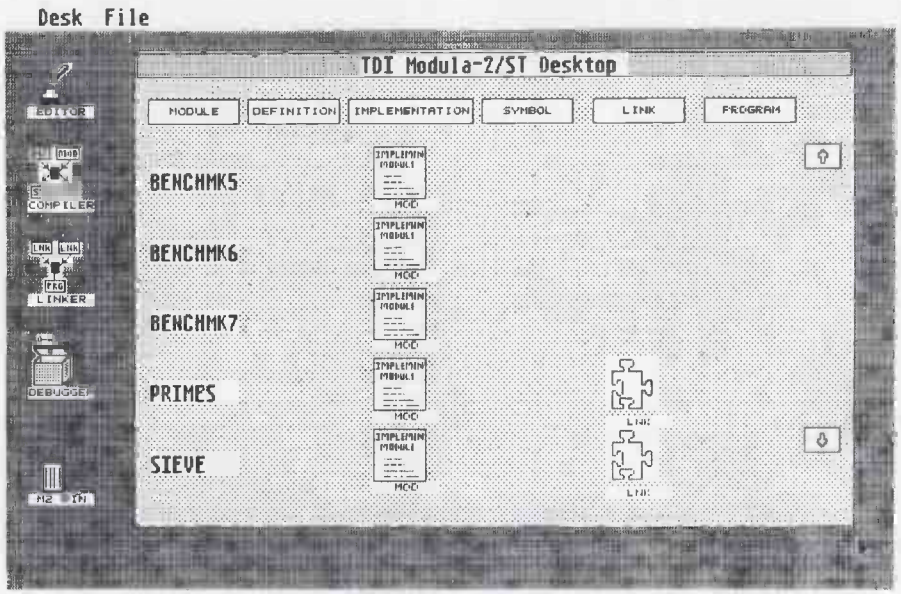


Fig 3 The Modula-2 desk-top metaphor shows how to get a working program from source code — disk modules and appropriate icons are shown

The Modula-2 system

TDI says that its Modula-2 compiler has been so successful that it has formed a new company to market it, called Modula-2 Software Ltd. I hope I will be forgiven for continuing to refer to the company as TDI — Modula-2 Software's Modula-2 compiler is just too much of a mouthful!

TDI has versions for the Atari ST and for the Commodore Amiga. As I don't yet have an Amiga, I obtained the Atari version and was able to start writing programs in Modula-2 within minutes of unpacking the box. Before attempting to describe the language and this compiler in more detail, I will say right away that TDI's Modula-2 software is the user-friendliest implementation of a language I have ever encountered, with the possible exception of Turbo Pascal. The manual, though superb, seems hardly necessary, so easy is the system to use.

The development system — compiler is too modest a name for it — comes on two single-sided disks. Two more are required if the optional 'Toolkit' is purchased. The first thing that will strike the newcomer will be the huge number of files on the disks. There are 64 on the linker/editor disk occupying almost 162k (on the earlier 1.04 version there were 78 files occupying over 310k). On the compiler disk there are 52 files and a meagre 4096k of space left on the disk (corresponding figures for v. 1.04 are 41 files and 37k disk space spare). This is because Modula-2 separates so much off as library modules.

The editor: TDI's Modula-2/ST editor is a very complete and easy-to-use full-screen editor that's ideally suited to writing source code. Most word processor programs are over elaborate and not all are able to produce the necessary pure ASCII files.

This editor allows the mouse to drag the cursor around the screen and has a simple menu bar at the top with all the essential editing functions. The 'Auto indent' function makes pretty structured programming style layout easy by returning the cursor to immediately below the start of the previous line.

Spectacularly useful is the 'search-for-error' function. If errors are encountered during compilation, an error file is written containing the location and nature of the errors. On re-editing the source code, the editor looks for a file with the same filename and the suffix .ERM. It then inserts error markers in the source text, automatically moves to the first error and displays the appropriate error message. The next error is lo-

cated simply by clicking the mouse on search-for-error; the editor locates the next error and again the appropriate error message is displayed. Files can be saved with the same filename, saved to a new filename, backed-up without exiting the editor, be appended to other files, abandoned or have other files incorporated. The editor also allows up to four markers to be set anywhere in the text and instantly searched for when required.

I have virtually no criticisms of the editor; earlier versions did not produce a proper ASCII single quote (ASCII 27H), seriously limiting the value of the editor for writing code for other languages. Modula-2 can use either double quotes or single quotes to delimit characters and strings, but Pascal insists on single quotes.

A small extra TDI could think about for future versions of the editor is some way of switching case in the text. Since Modula-2 is absolutely case-sensitive, the most common errors in the source code are instances where an identifier has been typed sLightly Wrong. Mark of the Unicorn's Final Word word processor has a command that switches the word under the cursor from all upper case to initial cap or to lower case. Something similar would be a useful addition to this editor. The earlier version of the editor also used a thin vertical line as the cursor, whereas the current version uses the conventional reverse video rectangle. It's a mere quibble, but I preferred the vertical line; and perhaps giving the user the choice would be a further improvement.

The compiler: the compiler itself is multi-pass and fairly slow (to those who have been spoiled by Turbo Pascal, at least). It does, however, show on the screen what's going on in a fair amount of detail (see Fig 1) and this relieves the tedium somewhat. The Sieve of Eratosthenes program in Fig 2 took yy seconds to compile, compared with zz seconds using Turbo Pascal on a 4MHz Z80 system. The editor is on the same disk as the linker, so, after writing the source, the file has to be copied to the compiler disk for compilation.

After the file has been compiled, the resulting code has to be transfered back to the linker/editor disk so that it can be linked. On my modest 1/2Mbyte 520ST with only one single-sided disk drive, this resulted in a seemingly infinite number of disk swaps, unspeakable frustration and more than sufficient time to get the simplest program from source code to executable object code. The software engineers at Atari must have worked really hard to create an operating system that requires 10 disk swaps to copy a two-file folder containing a total of 166k (this is an actual example!).

While I still had version 1.04 of the Modula-2/ST system, I got so fed up with this that I rushed out and bought a copy of Kuma's KRam RAM disk utility. The very same day version 2 of Modula-2/St arrived, and one of the many enhancements was a 'free' RAM disk utility. Having a RAM disk certainly helped, but I did experience some problems. I had so many system crashes when using RAMdisks, both Kuma's and TDI's, that I prefered to do without it and suffer the time-penalty and wrist ache of hundreds of disk swaps. The problems should be less acute with a 1Mbyte system.

I have no criticisms of the compiler other than that it's traditionally slow. It does a wonderful job of accurately identifying errors in the source code and seemed less prone to error cascades caused by phase errors (omitted semicolons, for example) than other compilers I have used. TDI claims that the compiler complies fully with Wirth's Modula-2 specification, and everything that I have done to test this confirms the claim.

Pascal programmers have gone over in flocks to Turbo Pascal, largely because of its compilation speed, but Turbo is not yet available on the ST. Serious programmers, writing large and complex programs, will have nothing to complain of with TDI's Modula-2/ST compiler.

The latest version of Modula-2/ST (version 2.0) incorporates a number of significant improvements over version 1.04. These are: a fuller and even better manual (more on the documentation below); a new editor that corrects a few minor deficiencies of the earlier version (see above); a Modula-2 'desk-top' that automates program production, compilation, linking and running; and a so-called toolkit, an optional extra that contains many useful extras for the serious programmer.

The Modula-2 desk-top utility is a program that can be run from the GEM desk-top and produces an analogous desk-top for the Modula-2 programming environment — see Fig 3. All the modules on the disk are shown on the desk-top together with appropriate icons. Clicking on an icon causes the appropriate action. The desk-top utility stays resident while developing or running Modula-2 programs. It gives TDI's Modula-2 something of the integrated feel of a slow-motion Turbo Pascal.

The optional toolkit comes on two disks and contains a symbolic debugger, a cross-referencer, decoders for both link and symbol files, a library of high-level applications and source code for the RAM disk utility. I have hardly had a chance yet to put the toolkit through its paces as it came rather late in the course of this review. It would appear to be the answer to a programmer's prayer, with the kind of tools one normally expects to find only on a minicomputer development system.

Given TDI's massive and brilliantly documented support for GEM disk operating routines, applications environment services routines and virtual device interface routines (source code for all the definition modules is in the manual), there would seem to be no need for the serious programmer to purchase Atari's Development System, though the GEM manuals will certainly be needed.

Documentation

I have to admit that the documentation is 'brilliant'. The *User's Manual* is quite simply the best of its kind. In 370 pages you have everything you need to know to get the best from Modula-2, from simple let's-write-a-working-program-now examples at the beginning to very detailed but easy-to-follow documentation on how to use the system. There are also many sophisticated source code examples of complete programs, source code for the many definition modules, cross-referenced lists; in short, everything you could possibly have asked for in a highly-accessible form.

The manual, quite rightly in my view, makes no attempt to teach you how to write programs in Modula-2, only how to actually use the TDI implementation of it. If you are not already a Modula-2 programmer, in addition to the *User's Manual* you will need *Programming in Modula-2* by Niklaus Wirth and *Modula-2 for Pascal Programmers* by R Gleaves, both published by Springer Verlag.

Conclusion

At £99.95 (including VAT) for Modula-2/ST, and an extra £49.95 for the optional Toolkit, I would say that this system is outstanding value for money. Modula-2/ST does the lot. It could certainly be used to develop very large and very sophisticated programs. Its closest rival is Ada (which is more at home on mainframes), followed by C. I consider it to be far superior to C in that the strict type-checking makes system-wide horror crashes less likely, and the source code is easier to read and more 'self documenting' than C's is. Proof of the pudding department . . . The whole of Modula-2/ST was written in Modula-2.

If you are a novice programmer, I would recommend learning Turbo Pascal, possibly using a CP/M emulator on the ST. But if you already know how to program in C or Pascal and want to write systems software or large applications, then Modula-2/ST has no competition at the present time. You will, however, want a second disk drive despite the RAM disk utility. END

Commodore Music Expansion System

Commodore's Music Expansion System comprises a C64, two powerful programs and a full-size keyboard, and brings a formidable musical capability to your micro. Stephen Applebaum tunes in.

Commonplace as they are today, music synthesisers are a relatively new phenomenon; they were almost unheard of until as recently as the late 1960s. It wasn't until bands like The Beatles and The Doors began to experiment with synthesisers in their recordings, that the record-buying populace really became aware of the revolution that was taking place in the world of music production.

Since those days of flower power and long, hot summers, the synthesiser has become an integral part of most bands' musical arsenal. In many cases, synthesisers have given people with little musical flair a chance to enter a world that would otherwise have been closed to them.

Over the past few years, another revolution, no less important than that which gave birth to the synthesiser, has been taking place; though this time the synthesiser's influence extends to computer programmers, as well as musicians.

MIDI

Although not as obvious as the product of the 1960s revolution, the Musical Instrument Digital Interface (MIDI) is in some ways more important. MIDI's purpose is to provide a standard interface between different manufacturers' keyboards, allowing the musician to play several units simultaneously.

More important, it provides the means to link a keyboard to a computer, turning the latter into a powerful control device for the former. And as MIDI allows two-way communication between keyboards, or keyboard and host, it makes sequencing relatively easy. For example, one keyboard can be made to play one part of a musical score, a second another, and so on — all at the same time. Then, as the keyboards are able to 'speak' to one another, each one can tell the others when to start and stop playing.

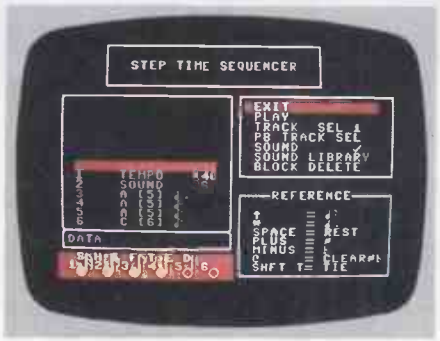
Although it has been around for some time, the MIDI is only now making its presence felt at the lower end of the computer market. Much of the reason for its slow emergence into the public eye has been the lack of software available to use it, and the limited availability of MIDIs designed to work with, say, the Spectrum or the Commodore 64.

Japanese manufacturers have not been as slow to recognise MIDI's potential, and have already incorporated it as standard on their MSX machines. Occidental companies are still dragging their feet, although Atari has seen the light and has included a MIDI on its excellent ST range of micros.

To buy a MIDI and a good-quality synthesiser, you'd probably have to shell out upwards of £500. However, Commodore has produced a powerful music package, the Music Expansion System, based around its 64 and 128 machines, which turns them into a synthesiser or a MIDI-

Sound Expander's vocal repertoire

Sound Studio's Editor function menus



The complex Step-time Sequencer

compatible recording studio. In spite of the recording studio providing the software to control up to six MIDI-standard keyboards, the Commodore package does not include a MIDI to connect your micro to a synthesiser.

For a reasonable £329.99, the package contains a Commodore 64 with a cassette deck; the Sound Studio and Sound Expander programs; and a full-size, 49-key keyboard. If you already own a 64 or a 128, you can buy the programs separately. On its own, the Sound Expander with a keyboard costs £99.99, while the Sound Studio will set you back a mere £14.99. Then again, for £150, you could buy the complete expansion set without a micro and a cassette deck.

From micro to music

Commodore's Sound Expander is a mixture of hardware and software which quite literally turns your computer into a stand-alone synthesiser. The hardware part of the package takes the form of a module which plugs into the cartridge port of your micro. Known as an FM Sound Expander, this rather uninteresting piece of kit apparently uses technology similar to that found in more expensive 'hi-tech' synthesisers.

Inside this 20th-century musical box is a board strewn with seven chips, a mass of resistors and three interfaces.

Of the chips adorning the board, the largest is custom-built from Yamaha (a name synonymous with electronic keyboards, and giving a hint as to the system's pedigree). On the left-hand side of the board is a 16-pin interface, via which you can connect an external keyboard to the module; a larger edge connector, for interfacing to a MIDI, resides in the middle; and an audio output socket sits over to the right.

The software supplied with the module comes on either a disk or a cassette, depending on the set-up of your system, and contains a program to bring out the full potential of the FM hardware without taxing users' abilities to program. In fact, no programming is required at all.

An audio lead to put Sound Expander's produce through a Commodore monitor, a flimsy though comprehensive user's guide, and a leaflet full of chord stickers, are supplied with the software.

Before delving into Sound Expander's facilities and suggesting what you can expect to achieve with them, I'll describe the various methods of making music with the system. As I have previously stated, Commodore's Sound Expander can turn your 64 or 128 into a semi-professional synthesiser — that is, the micro can be used as a musical instrument if a suitable keyboard is added.

There are three keyboards at your disposal: the computer's own qwerty keyboard; a keyboard overlay which is supplied with Commodore's Music Maker package; and a recently launched full-size 49-note keyboard which plugs into the 16-pin connector on the side of the hardware module and has recently been bundled in with Sound Expander.

The latter keyboard is by far the best for aspiring Rick Wakemans, and can be used with Sound Studio as well as Sound Expander. If you just want the Sound Studio, and therefore don't mind forgoing the luxury of the full-size keyboard, you can use the micro's qwerty keyboard or the keyboard overlay from the Music Maker package.

Software

The hardware module is the heart of the Sound Expander system, but can only be brought to life by the software provided with the package.

Loading the software produces a display showing a music stave in the middle of the screen, and a menu bar along the top of the screen giving a choice of Set-up, Synth, Rhythm, Riff or Disk (disk version only). Playing a few notes on the keyboard at this juncture produces a rather nice vibraphone sound. As the notes are played, they're simultaneously displayed on the music stave.

Like most modern programs, the headings on the menu bar refer to a series of pull-down menus. Either a joystick or the function keys F1, F3 and F7 can be used to make selections.

The Synth menu is the most interesting in the early stages, because it allows you to change the musical instrument being reproduced when you hit a note. For instance, the default instrument is a vibraphone, but that can be changed to a guitar, one of two different organs, a flute, or one of three synths, to name but eight of the 12 sounds available.

The Synth menu also features an option to change the pitch of a voice by one octave, which is useful if you have some idea of musical tones.

Two further choices in the Synth menu are Ensemble and LH Voices. Selecting Ensemble allows you to enrich a sound, but this has the more noticeable effect of only letting you play four notes at once instead of the original eight. I'll deal with LH Voices when I cover the Set-up menu.

The 12 sounds (instruments) in the Synth menu can be slightly altered using the '?/' and '›.' keys. Pressing '?/' makes a sound brighter, while '›.' has the opposite effect, making the sound mellower. Pressing either of these keys in conjunction with the Shift key performs fine tuning or sharpening or flattening of the pitch, depending on whether you press the '?/' or the '›.' key, respectively.

The Set-up menu is concerned less with sounds than the way in which notes and chords are played when a key is pressed. (For this section, I'll assume that the optional full-size keyboard is being used.)

Normal is the first option in Set-up mode. When this is selected, the same sound can be played over the full length of the keyboard.

One of the most useful Set-up functions is called One-Fingered Chord; this takes us into the realms of pseudo-musicianship, and is one of the reasons why some so-called musicians sound as good as they do.

Basically, One-Fingered Chord facilitates the playing of a three-note chord with only one key. When the function is selected, you need only press a single key at the lower end of the keyboard to produce the chord plus bass. On the full-size keyboard, this is a major chord which can then be changed to a minor chord by holding down a key to the left at the same time. Sounds simple, doesn't it? In fact, this is one of the ways in which some keyboard players in synthesiser-based pop groups get around deficiencies in their ability.

A really effective part of Sound Expander is its rhythm section. The package contains 12 pre-set rhythms as diverse as disco, rock 'n' roll, swing, march and waltz. Needless to say, these are all found under the Rhythm heading.

If a rhythm is used together with One-Fingered Chord, a complete accompaniment arrangement can be played in the selection chord. As the rhythm plays, the corresponding notes dance back and forth across the onscreen music stave. Even though I can't play a musical keyboard, I found that just being able to select a chord and hear a rhythm played with it is quite satisfying.

Chords need not only be played as described above, but can also be 'fingered'. A fingered chord is one that's made up of several notes and is not played by pressing one key alone. In this case, playing a three or four-note chord at the lower end of the keyboard produces a pre-set inversion of that chord plus bass.

Rhythms similar to those already mentioned can be played in Fingered Chord mode, except this time they're not initialised until a three or four-note chord is played.

Normally, a chord will cease to sound when you let go of the keys. However, Memory prolongs the chord, releasing it only when another is played.

Splitting the keyboard

In this review, whenever I have mentioned one-fingered chords or fingered chords, I have referred to them as being played at the lower end of the keyboard. However, selecting either of the respective modes automatically splits the keyboard. 'Splitting the keyboard' actually means that the keyboard is divided into two sections, either one having a different voice to the other (bearing in mind that in Normal mode the same sound can be played over the entire keyboard).

Two keyboard voices can be selected from the Synth menu. The voice for the upper part of the keyboard is selected in the normal way, while the voice for the lower part comes from the LH Voices option. Clicking on LH Voices produces a sub-menu which contains all the different instruments found in Synth. For practical reasons, the split keyboard option is only available when the optional full-size keyboard is being used.

A couple of other little goodies in Set-up mode allow you to alter the way notes are displayed on the onscreen stave, and change the pitch of the keyboard by a maximum of six semitones up and five semitones down. Unless you have a trained ear for music, I doubt whether you'll refer to this option very much.

Other rhythms

I have already touched on the subject of rhythms, but two other features worth a mention are Intro and Outro. These are rhythm breaks which can be initiated by pressing the cursor up/down key and the cursor left/right key, respectively, while a rhythm is playing. As you've probably guessed, Intro is an introduction and can be used as a method of counting yourself in to a tune. Alternatively, an Outro rounds off a piece.

'Riff' is a term used to describe a constantly repeated phrase in jazz or rock music, typically played as a background to a solo improvisation. Over the years, guitarists such as Bo Diddly and Ritchie Blackmore have been responsible for some of the more memorable and often-copied riffs in rock music. In fact, it's the guitar riff which makes some songs what they are. You only have to listen to Deep Purple's *Smoke On The Water* to appreciate a riff's solid contribution to a rock piece.

Realising the importance of the riff, Commodore has included a riff machine in the Sound Expander package. This consists of several riff titles, each of which is made up of 12 pre-programmed riffs that can be sequenced together in any order.

When you select a riff title from the riff machine menu, the program assigns each of the 12 pre-programmed riffs to 12 individual keys on the keyboard. To sequence the riffs, you press the keys in the order that you want them to be played; pressing the first key will set the riff into action.

In what looks like a piece of blatant discrimination against cassette users, Commodore has given disk owners an additional set of riffs, alternative synth voices and more demonstration tunes.

Sound Expander is a superb add-on which has been aimed firmly at the home music market. All the sounds created with it compare favourably with those from a Casio CZ-101, although Sound Expander's efforts are accompanied by background hiss at times (perhaps that can be cured if you output the sound through the amplifier of a hi-fi system).

Name that tune

Commodore's other package, Sound Studio, is rather different from Sound Expander in that it's both a synthesiser and a home recording studio. I won't dwell on the Sound Studio in too much detail here, because it really needs a feature all of its own to do it justice. Instead I'll take a brief look at Sound Studio Editor, one of the program's major, and most powerful, facets.

Sound Studio Editor provides users with the facilities to create a multi-track arrangement, using the micro's built-in sound chip. Sounds can be played into the computer via a keyboard, one channel at a time, then played back and edited onscreen.

The computer only allows three channels to be used; but by linking the computer to a MIDI keyboard and using it as the sound source, you could double the number of channels to six. You could even let the computer play six MIDI keyboards simultaneously.

Sound Studio Editor comprises two menus: one containing the main editing functions; and the other containing the options for real-time recording. Real-time recording is the most interesting feature, as it allows you to input tracks by playing them on a keyboard, and it is done through a menu accessed from the Editor. Here, you'll find options to record and play back your tracks.

To record a track, you simply specify a number between one and three (or one and six if you're using a MIDI keyboard), then start playing. When you are finished, you can listen to the track by selecting 'play'.

When you have recorded a track, you can have any previously recorded tracks playing at the same time. However many tracks you record, it's still possible to listen to each one individually by selecting a track with the Playback Track Select function.

Step-time recording is rather different from real-time recording, in that tracks can be entered note by note. These tracks can then be edited in much the same way as the tracks recorded in real time.

Conclusion

Sound Studio is a powerful piece of complex software which, although it's aimed at home users, I would not recommend to Commodore owners who lack a sound knowledge of music and how it's constructed.

Together, Sound Studio, Sound Expander and the full-size keyboard make up a formidable music package. The Music Expansion System is a high-quality package which other companies will be hard-pressed to beat. END

Multi-user networking in style

The new Minstrel 4

The designers of Minstrel 4 were given a simple brief: produce a world-beating, cost-effective and practical multi-user system.

And do it with style.

Minstrel power – 80186 master and HTS 186 dual processor slaves.

They passed the latter test with flying colours. But looks aren't everything. Inside this beautifully engineered chassis, you'll find a close coupled TurboDOS† network that holds the key to all your multi-user computer projects.

Now, and for the future.

Minstrel 4 is a multiprocessor machine – every user of the system gets a DEDICATED CPU and 512 Kb RAM. This virtually eliminates the response time degradation you often find on timeshare minicomputers and so-called supermicros.

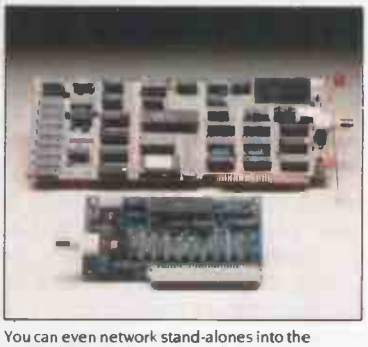
Minstrel 4 is more powerful than most minis, even in its most basic state. You can start with two users, but a full blown 16 user system will give you 9 MBytes dynamic RAM and 17 CPUs with 80186 instruction sets, running concurrently at 8 MHz. With that sort of power, we're confident that you won't run out of steam.

Minstrel design – fast tape back-up for safety and convenience.

Minstrel workstations – come complete with function keys and business graphics potential.

Minstrel 4 has unprecedented networking capability. The Winchester controller has built in ARCnet. You can network IBM PCs, ATs, Apricots, Olivettis and all lookalikes if required. Gateways to IBM and ICL mainframes are available. Most important, you can network Minstrel 4s together – 255 of them to be precise.

Minstrel 4 supports CP/M, MP/M, MS DOS (including version 3.1 with file and record locking) and has PC DOS emulation, so you can run nearly all the popular business packages.



You can even network stand-alones into the Minstrel System, using Minstrel ARC net cards.

Storage capacity is only limited by your budget. A single Minstrel 4 holds up to 160 MBytes formatted disk capacity, with onboard streaming back-up of up to 60 MBytes. Direct memory access means you can download 20 MBytes onto tape in less than 4 minutes. Higher capacity drives can be supplied.

A two user Minstrel 4 system, complete with tape back-up and terminals will cost you less than £7,000. Additional workstations, just over £1,000 per user, a price/performance package you'll find unbeatable.

At last there is a serious alternative to the minicomputer, with the sort of costs and flexibility you'd associate with a micro. It's called Minstrel 4, and you should find out more about it. Write or call us for details.

With Minstrel, expansion is integral, not an afterthought.

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64/128 IEEE 488 interface

The IEEE 488 Interface from Brainbox allows the connection of real Commodore disk drives to the 64 and the 128. Barry Miles explains how.

With the arrival of the Commodore 128, the field is open for yet another flood of add-ons such as those available for the Commodore 64; Brainbox's IEEE 488 interface is one of the first of these to appear. Priced at £69.95 excluding VAT, this very small package, not much larger than a conventional cartridge as used in a Commodore 64, offers an interesting and convenient set of utilities.

The interface's main function is to enable the Commodore 128 or 64 user to hook up his machine to one or more of the many and various IEEE devices on the market. In particular, it enables the fast parallel IEEE disk drives which Commodore has manufactured in the past, and is still manufacturing, to be used with the 128 and the 64.

One of the notable design features of the Commodore 128 is the continued use of the infamous 'slow serial bus' with which users became infuriated on the 64. It's true that the 1571 disk drive, which has been produced for the Commodore 128, does operate quickly. It has a Burst mode for particularly high-speed operations, and is a double-sided, quite densely packed disk.

However, many Commodore 128 users will be people who have upgraded from using Commodore Pets. They may well have not bothered to buy a Commodore 64, or may be buying the 128 as an upgrade from that machine. In either case, they may have available the well-regarded 4040 disk drive or even perhaps the 1001, 8050 or 8250 drives. The truly affluent user may even have Commodore's hard disk!

It's extremely frustrating to find that these disk drives cannot be used with the 128. The same applies to the rather lengthy series of Commodore IEEE parallel printers, which are not compatible with the 128 or 64 computers either.

Implementation

The Brainbox Interface plugs into the memory expansion socket on the Commodore 128 or the 64, which is normally referred to as the cartridge slot. This slot is replicated on the top of the box so that the use of the interface does not prevent your being able to plug in additional memory expansion modules, such as cartridges, for use with this package.

Extending from the back of the interface is an edge connector of the type which will be familiar to Pet users. To this you connect a Pet-to-IEEE cable, which Commodore and other manufacturers (for example, Inmac of Runcorn and White City, and also Brainbox) are able to supply, and you can then connect the computer to any IEEE device you choose, including various types of instrumentation. You can, therefore, use disk drives at their fullest speed and, in addition, you can type the word FAST in order to get the clock rate in your 128 to operate at the fastest possible speed. But this is not quite so attractive as you might at first expect, as the screen now blanks out if you are using a television set rather than a monitor.

The Brainbox device has been made compatible with CP/M so that you can use your IEEE parallel disk drives in CP/M mode. This is significant, as there is a large body of public domain software available for CP/M. Initially this software was not much use to a Commodore user because it wasn't available in a format compatible with Commodore disk

drives, but this is changing. For instance, the Independent Commodore Products Users' Group (ICPUG) is making a large number of disks available to members, covering utilities, languages and even games; these disks are available in 4040 and 8250 format. Interested readers should contact the ICPUG membership secretary, Jack Cohen, at 30 Brancaster Road, Newbury Park, Ilford, Essex IG2 7EP. I also understand that WordStar has been successfully transferred to Commodore disk format.

The small switch on the top of the Brainbox unit permits you to switch from 128 to 64 mode of operation. This will please users of both machines, and also users who wish to use 64-type software on their Commodore 128 — this is particularly attractive while the software flow for the 128 is a little sluggish. Users should be careful when buying software for the Commodore 128, as much of the early software is marked 'C128 and C64'. All this is likely to mean is that the software will run on the C128 in Commodore 64 mode, which may not be what you have in mind at all. After all, if you shell out for a 128 rather than a 64, you expect the programs to exploit the improved facilities. Otherwise, why choose to buy a Commodore 128?

Facilities

There are several interesting features of the Brainbox unit which should not go unnoticed. In particular, all print commands, instead of being directed to the serial port to be sent to one of Commodore's rather slow serial printers, are now automatically sent out through the serial port, the IEEE parallel port or the user port, according to which printer the unit finds is connected.

Many suppliers (such as Microport of Borehamwood, and Brainbox again) will provide you with a relatively inexpensive cable for connecting your Commodore 128 or 64 to a Centronics parallel-type socket; this will enable you to use the much more common Centronics parallel type of printer. If you need Commodore graphics, you can now choose from the full range of Commodore printers, including the early IEEE parallel ones.

In addition, DOS support has been made available in 64 mode. This is particularly attractive, because it means that you don't have to load up the DOS support program from the utilities disk supplied with your disk drive in order to obtain convenient operation of your disk commands while in 64 mode.

Old-timers who are experienced users of early Pets, Vics or 64s with a disk drive will find the DOS support facility convenient. After all, the idea of convenient disk commands is that they should come into your mind immediately, and should not require you to consult the computer's manual in order to deploy them; nor should loading up a program from disk be necessary.

In use

Using the Brainbox unit is simplicity itself. You plug it in, hook the cable on, insert a cartridge if you need to, and away you go.

An extra and unexpected feature is the ability to use this unit, or rather, several of them, as a cheap networking arrangement. People are deterred from networking due to the expense, and this is particularly true in the education sector. Brainbox has come up with a cheap and effective answer. Plug a Brainbox interface unit into each machine, and link the units by means of a cheap ribbon cable which connects 18 pin headers which can be plugged into the boards of the box. This is not intended to be a 100-per-cent safe system for data transfer. However, in the education environment, the vitally important consideration is to connect a large number of computers to a small number of peripherals at the lowest possible cost, so this unit fits the bill admirably.

One of the more interesting design criteria which has been adopted by the designer of the Brainbox interface is that mixing serial and parallel devices is perfectly satisfactory. Some previous IEEE interfaces for Commodore computers have assumed that if you have a parallel device, then you clearly do not also have a serial one as well. This is unreasonable. Users who have bothered to buy a large-capacity and expensive twin drive, such as the 8050 or the 8250 Commodore drives, are quite likely to have also bought a single serial drive in order to be able to load programs from one drive and run data disks on another. This will be essential in any case for users of commercial software who may find that the only disks available are not readable by any of the large-capacity drives just mentioned.

The history of Commodore disk drives, and indeed Commodore computers, has been interesting to say the least. The key word has been 'incompatibility'. First, there was the 2040 disk drive, which was a twin drive of substantial capacity — 170k on each single-sided, single-density drive. This was quickly followed by the 3040, which was really only a label change and the removal of some software bugs. The 4040 was a further step forward, again achieved by a new set of ROMs for the operating system. The step forward was that the disk drive would now automatically examine a disk as soon as it was inserted into the drive, and read its directory and block allocation map into the RAM of the disk drive. (Each disk drive model which Commodore has manufactured has been an intelligent machine, with the operating system contained in the disk unit itself. This is in some ways an advantage, and in others not. The only way you can upgrade earlier models of the disk drive to the new standards is to buy new ROMs, and these are far from cheap.)

However, having an intelligent drive means that the disk unit is really a computer, and in some circumstances can be instructed to carry out an operation and can then be left to its own devices. It can even be disconnected from the host computer and be happily left doing its own thing. The new facility offered by the 4040 is important, though, as the 2040 and 3040 drives are quite capable of splatting new files all over your old ones, as the block allocation map is not updated when you swap disks. The way to avoid danger is to send an initialisation command to the disk unit immediately after changing disks.

The updated Basic in the 128 contains the DCLEAR command which covers the above situation. However, users of the 64 must type OPEN 1,8,15,"IO" or OPEN, 1,8,15,"I". To non-Commodore users, this will no doubt seem strange, but the reason for this quaint procedure is simple. Commodore has not yet produced a drive in which the disk is spinning at all times. Unlike the circumstances which you find when using machines from other manufacturers, when you put a disk into a Commodore machine, the hub does not rotate. This produces two problems: firstly, the disk drive must wait to get to speed before attempting access for reading from or writing to a disk; and secondly, you can't rely on centrifugal force to centre your disk onto the hub.

The first problem is dealt with by the disk operating system, which tells the disk unit exactly how long to wait for the motor to get up to a safe, steady operating speed. This waiting period has a safety margin built into it, so a single line of Basic can be used to shorten the delay time on the drives where this is found to be a problem; notably, the 8050 drive can be subjected to this treatment without undue risk.

Fast reactions

It's also possible to speed up the reaction of the disk system by ensuring that the disk continues to spin for a longer period of time than the designers have provided, after any disk access has taken place. This will increase the probability that the disk drive will still be spinning when the time arrives for the next read or write operation to take place. The unit 'knows' if the disk is still spin-

ning and commences operations immediately in these circumstances.

I will give you the code for this facility later in the article, but it should be treated with some circumspection. If your disk drive is in perfect condition and is correctly aligned, then cutting down on the safety factors supplied by the designers is probably safe enough. However, don't blame me if your 8050 drive obligingly loses data!

The non-rotating hub is a different matter, as it makes it even more important than usual to insert the disk media carefully — it's even worth moving the disk in its sleeve until it is centred. In addition, the really cautious user will gently lower the drive door into position twice before closing it completely. It's also essential for you to use hub-reinforced disks, as the clamping process can carry out an interesting form of modification to the hub of an unreinforced disk.

This all sound rather horrendous, but there are benefits. Commodore has arranged that all its disk drives are extremely forgiving in the matter of the quality of media which they demand. If you are cautious in your selection of media manufacturer, you could probably get away with running lower-quality disks than the unit is supposed to require.

Another feature of the 4040 drive is the relative record system for direct access (random access) filing. This has made possible database programming with a lot of the hassle removed. Anyone who owns an early drive should upgrade the ROM set to 4040 standard by buying a set of new ROMs — the improvement is well worth it.

The next drive to be produced by Commodore was the 1Mbyte single-sided, quad-density unit, the 8050. This was a breakthrough as far as capacity was concerned, but, to the dismay of users, it was rather slow. If you were to pack 500k of data on one side of a 5¼in disk, you would be working right at the frontier of media reliability. Accordingly, the Commodore designers gave the operating system plenty of scope, with multiple attempts at various disk operations to make up for deficiencies in the media being used.

It was this which gave rise to the one line of Basic which speeds up the operation as previously described. (By the way, for the really wealthy, this little bit of code was encapsulated in a speed-up ROM):

```
OPEN15,8,15
:PRINT£15, "MW"CHR$(0)CHR$(16)
  CHR$(3)
  CHRs(6)CHR$(4)CHR$(250)
:CLOSE15
```

The next Commodore disk drive was the 8250 — this is a real 'humdinger'. Firstly, the capacity is a massive 2Mbytes in two 5¼in drives of quad density; and secondly, the speed improvement brought this unit up to the speed of the 4040. The 8250 is very reliable, and is a must for the serious user who needs a twin drive. The drive must have thrown the manufacturers of disketes into considerable confusion. Normally, quad-density drives must not be used with disks with hub rings: the clamps locate the media onto a tube which is parallel-sided, rather than the tapering cone of other, lower-density, drives. This is to ensure perfect registration. However, the Commodore drives eschew such refinements: they *should* be used with hub rings.

Users are happy with the 8250 drives, and it isn't necessary for the media to be guaranteed for 100 years. The drives appear to be remarkably tolerant.

The next drive, the 1001, is half an 8250 — that is, it's a 1Mbyte single drive, and this is just as reliable as its larger brother. The 1540 Vic drive and its successor, the 1541, are the causes of much dismay to serious users of Commodore equipment. They are slow, unreliable, prone to breakdown, and are inclined to go out of alignment. This process is aided and abetted by the kind of software protection against piracy which bangs the read-write head against the stop repeatedly, something which the stop was never meant to withstand.

Below is a line of Basic which will eliminate the above problem, and should be typed in before any commercial program which is DOS-protected is used:

```
OPEN1,8,15:PRINT£1,"M-W"+CHR$
  (106)+CHR$(0)+CHR$(1)+CHR$
  (133):CLOSE1
```

Compatibility of the reading and writing of various Commodore drives is also interesting. Firstly, the philosophy is read-compatibility where possible, but not write-compatibility. Therefore, the 4040 reads a disk which has been formatted on a 3040, but if you attempt to write to the disk, you'll have problems reading the data later.

Similarly, 8050 disks can be read by an 8250, but it's risky to write to them. In addition, an 8050 will read the bottom surface of an 8250 or 1001 disk, but not the top. Therefore, you must be sure that the 8250 or 1001 disks are only half-full if you wish to make them readable on the 8050.

In trying to read an 8050 disk, an 8250 or 1001 drive will go into error condition on the first reading attempt, but after that, all subsequent reads will be satisfactory. Alternatively, you can make your 8250 'think' it's an 8050. Here is the relevant code:

```
OPEN 15,8,15:
PRINT£15,"M–W+CHR$(172)+CHR$
  (16)+CHR$(1)+CHR$(1):
PRINT£15,"M–
  W"+CHR$(16)+CHR$(1)+CHR$(0):
  PRINT£15,"U9":CLOSE15
```

If you want to use serial and parallel disks together, you should ensure that they have different device numbers. Curiously enough, the Brainbox interface manual does not tell you how to change this in software: it invites you to contact your dealer or Brainbox. However, the unit does feature Brainbox's hotline number, so any users can ring up for the relevant code.

I would have thought that publishing the following line of Basic would have been a lot simpler. For changing device 8 to device 9:

```
OPEN15,8,15,"M–W" CHR$(12)+CHR
  $(00)+CHR$(2)+CHR$(41)+CHR$
  (73):CLOSE15
```

In addition to operating with other cartridges, Brainbox's interface is unique in being totally compatible with the Simon's Basic cartridge. If you have the disk-based version, Brainbox will update the disk for you to achieve compatibility. The interface operates satisfactorily with the Simon's Basic Enhancement package, too.

Documentation

A 27-page booklet accompanies the unit, which contains not only the usual information which you would expect, but also a certain amount that you would not. For example, there's some machine language source code for auto-starting 64 programs and 128 cartridge software. In addition, there's a considerable amount of information which is needed by machine code programmers, which covers exactly how the unit works and how such code programmers can make their programs interface with the unit.

I found absolutely no difficulties in using the Brainbox interface unit, which transforms the Commodore 128 and the 64 into really rapidly-operating machines. The unit is highly recommended, particularly to anyone who already owns one of the faster disk drives and wants to get the best out of their Commodore 128 or 64.

The Commodore 64/128 IEEE 488 interface is available from Brainbox at 25 Lynmouth Road, Liverpool L17 6AW, tel: (051) 220 2500 END

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Right and wrong

One of the fundamental human learning processes is the distinction between right and wrong, but can this technique be applied to computer programs? In the second part of his series, David Levy presents decision-making of the digital kind.

The learning process in man is one of simple reinforcement. If you get something right, you remember that the method led to success, and the next time you can do it the same way. If you get something wrong, you will try a different approach the next time you are faced with the same situation. Computer programs can be made to learn using the same fundamental approach — reinforce successful decisions and reduce the likelihood of repeating unsuccessful ones.

To see how this concept works in its simplest form, let's consider a problem situation in which there are two possible decisions. Starting with absolutely no information about the problem, how does man, or a computer program, learn the best decision to make in this situation?

Situation	
Decision 1	Decision 2
Result 1	Result 2

A simple way to think of the learning process is to imagine a decision-making situation being represented by a box. In the box, there is a demon who makes the decision whenever that particular situation is encountered. Let's assume that the first time the demon encounters the problem situation, he has absolutely no information on which to base his decision. He could indicate this by attaching the value 0 to Result 1 and Result 2. He then tries a decision at random (say, Decision 1) and discovers that Result 1 is a failure. He can indicate this by changing the value associated with Result 1 from 0 (meaning no information available) to −1 (which is used to indicate failure).

The next time that the demon is faced with the same situation, he examines the values associated with each decision and sees that one of them, the −1 associated with Decision 1, indicates failure, whereas the other value (which is still 0) indicates that no information is available concerning the merit of Decision 2. As the demon always attempts to avoid failure, he tries Decision 2, and is pleased to discover that Result 2 is a success. Accordingly, he assigns the value +1 to Result 2 (+1 is used to indicate success).

From now on, the demon will never have any difficulty when faced with the same problem situation — he will simply examine the values associated with each decision and make the choice that has associated with it the indication of success — a value of +1.

Complex environments

When the decision-making environment is more complex, the method of learning the best decision also becomes more complex, but the underlying philosophy remains very similar. In a simple environment it is possible to attribute success or failure directly to one decision, and to know that a certain decision will definitely produce success while another decision will certainly result in failure. The principal difference in a more complex environment is that most of the decisions are merely way points on a (possibly long) decision-making path, and it may not always be possible to determine that success or failure is directly attributable to one or more specific decisions.

In order to help the demon make his decision in a more complex environment, the decision box may be thought of as containing a number of balls, each of which is labelled to represent a particular decision that can be made in this situation. When the demon is required to make a decision, he selects a ball at random and examines the decision label on that ball. The decision on this label is enacted, and a note is made of which decision it is. If the result of the whole decision-making process is eventually found to be satisfactory, another ball is added to this particular box with the same decision label as the one just examined. The next time a ball is chosen at random from the box, it will be more likely that the same decision will be made.

If, on the other hand, the first random selection is a decision which eventually results in failure, a ball with that decision label is removed from the box. The next time the same situation is encountered, it will be less likely that the same decision will be made.

You can probably see that this method is merely a more sophisticated exposition of the aforementioned value method. Instead of starting with the 'unknown' values of 0 for Decision 1 and Decision 2, we could start with a box containing one Decision 1 ball and one Decision 2 ball. When the Decision 1 ball is chosen at random and results in failure, it is removed from the box. The next time that the same problem situation arises, the box will be found to contain only a Decision 2 ball. When Decision 2 is made and leads to success, another ball labelled Decision 2 is added to the box; and on every subsequent occasion that a ball is taken at random from this box, it will have a Decision 2 label, so in future Decision 2 will always be made.

The boxes method is unnecessarily cumbersome for situations in which success or failure can be directly attributed to a specific decision, but it is useful when a particular decision-making situation is only one stage in solving a problem. One of the first problems on which the boxes method was tried was the game of noughts and crosses, in which every possible game configuration is represented by a different box (Fig 1).

In the original boxes experiment which was conducted at the University of Edinburgh in 1961, 288 matchboxes were used to represent the 288 different situations that can arise in a game of noughts and crosses. Each of these boxes works as an independent learning device, which is used only when the particular situation represented by that box arises in a game. At the start of the experiment, a number of beads of different colours are put into each of the

Illustration by Dolores Fairman

boxes, each colour representing a different (vacant) space in the noughts and crosses diagram. The whole system of boxes can be thought of as representing a computer program, and the number of beads of each colour in a box corresponds to the program instructions which determine what move is made in the situation represented by that box.

When a particular configuration arises in a game, the program examines the box representing this situation and counts the number of beads of each colour in the box. For example, at the start of the game (Box 1), there might be 100 red beads meaning play in the centre; 100 blue beads meaning play in a corner; and 100 green beads meaning play in the middle of an edge. The program picks a bead at random, and if it is a red bead, the program makes the corresponding move in the centre of the diagram. The program then remembers which colour bead it picked and proceeds to the next situation (and hence the next box) after its opponent has replied to its first move.

At the end of the game, if the boxes program has won, it assumes that all its decisions made during the game were satisfactory and, therefore, reinforces every decision. In this case, part of the reinforcement process would consist of adding another red bead to Box 1. Box 1 would then contain 101 red beads, 100 green ones and 100 blue ones, so that the next time the program has to make the first move in a game, it will be slightly more likely to pick a red bead than a blue one or a green one. If the boxes program has lost the game it would remove one red bead from Box 1, thereby reducing the likelihood of making the same move next time it starts a game. And if the game has been drawn, the program would leave the contents of Box 1 unchanged. In practice, after conducting a large number of experimental trials with this system, you would expect to find a very high proportion of red beads in Box 1.

The same procedure is followed for every box encountered during a game, and as more and more games are played with this program, the whole system becomes more and more accurate. Fig 2 shows how the performance of the system improves with experience. The results are taken from a series of games played against an opponent which always moved first and which always played entirely at random. The score column shows the number of (wins – losses) scored by the boxes system.

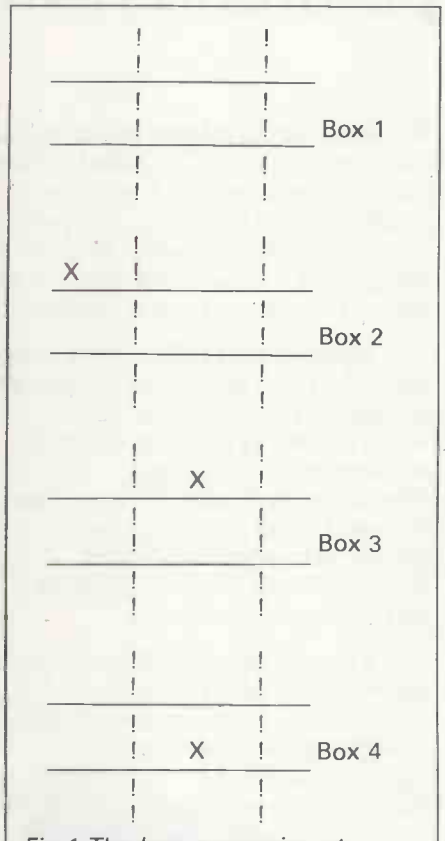

Fig 1 The boxes experiment

It has been calculated that with best play, it is possible to achieve a score of 87 (wins – losses) over a series of 1000 games against a randomly moving opponent who always plays first. The boxes program fails

Number of games played	Score
100	10
200	54
300	63
400	58
500	75
600	70
700	68
800	72
900	76
1000	70

Fig 2 System performance

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to reach this optimal result because it tends to gain a lot of knowledge about how to play in some situations (the ones that it encounters frequently), but very little or no knowledge about how to play in others. In order to learn to play an absolutely optimal game all the time, the program would need to play bad moves deliberately from time to time in order to gain a lot of experience with every single box in the system. (This phenomenon is rather similar to the classic problem of how to reach the highest peak in a range of hills. The obvious thing to do at any stage is to move upwards, but in doing so you might merely be moving towards a 'local' peak rather than the 'global' one which is the target of the exercise. The only way to know that you have found the highest peak is to explore the whole region.) Nevertheless, the performance of the boxes program is reasonably impressive for such a simple system, and the technique can easily be adapted to many other types of problem.

Improving the method

The 'boxes' method described above gives an equal amount of reinforcement to every decision made on a path to success, but in most problem-solving environments this will not truly reflect the relative merits of the various successful decisions. Let's consider the game of noughts and crosses as in Fig 3.

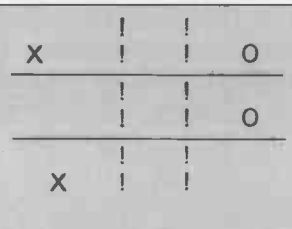

Fig 3 Noughts and crosses

X is to move next, and we can see that X can win at once by playing in the middle of the left-hand edge. But X can also win by playing in the bottom right-hand corner, though in this case victory will be postponed for one move. Using the simple boxes approach, each of these moves would, after the end of the game, result in a one-bead reinforcement to every box on the success path.

In most problems, it is of at least some importance to succeed (or win) as quickly as possible, and for this reason it is logical to give greater reinforcement to those decisions which are on the shortest success paths. We can modify the boxes method in the case of noughts and crosses so that the number of beads of reinforcement added to 'successful' decision boxes is related to the number of moves required to win the game — the quicker the win, the more reinforcement is given. In the above example, when four moves by X are required for victory, this modified boxes method might result in the moves 'top-left', 'bottom-left' and 'bottom-right', each having a reinforcement of, say, two beads, as would the fourth and final move by X. But when only three moves by X are needed for victory (top-left, bottom-left and middle-left), each of these moves could be reinforced by adding three beads to the appropriate box. This modified strategy will result in the example shown above preferring the move which leads to immediate victory to the one which leads to a slower victory.

Another refinement would be to reinforce decisions on a success path by a number which is inversely related to the number of moves required, from that point in the game, to force a win. This would bias the success and failure reinforcements more heavily near the end of the game than near the start, and would speed up the learning process.

Scoring functions

It is well-known in chess, draughts and many other board games that the most important feature is 'material' — that is, the pieces themselves. The player with an advantage in material usually wins the game, other things being equal. We could, therefore, say that the best move in a chess position is the one which leads to the gain of the largest amount of material, the second-best move is the one which leads to the gain of the second largest amount of material, and so on.

It is usually the case in chess that no move can be seen to *guarantee* the win of material, and so other factors come into consideration. The next most significant feature in chess, after material, is mobility — the total freedom of movement of the pieces. This is often measured by counting the number of squares which each piece attacks, and adding the totals. We can then say that if two or more moves lead to the gain of the same amount of material, the move to be chosen is the one which brings about the greatest possible increase in mobility. By introducing knowledge about other aspects of chess, such as centre control, king attack, pawn structure, and so on, it's possible to create a decision maker which combines information about how many of the various features are present in a position with a knowledge of the relative importance of each feature. This decision maker is known as a scoring function (sometimes called an evaluation function).

To see how a simple scoring function is derived and works, let's consider the problem of the commuter who has a choice of two ways to get to work. He may travel by bus for five miles to the nearest station and then by train for 20 miles; or he may travel by bus for eight miles to a station on another line, and then by train for 15 miles. The bus moves at 10mph and the train runs at 60mph. Which is the fastest way to get to work?

We can represent this problem by means of a simple scoring function

$$\text{Score} = \frac{\text{bus miles}}{10} + \frac{\text{train miles}}{60}$$

Fig 4 A simple scoring function

(Fig 4). It isn't difficult to see that the score represents the number of hours taken to complete the journey, and that the journey with the lower score is the faster. In this example, the features of the scoring function are bus miles and train miles; the amount present of each feature is the number of bus miles in the journey and the number of train miles; and the relative importance of these two features is 1/10 to 1/60.

In any kind of problem-solving environment, a computer program needs to know which features are sufficiently relevant to be incorporated in the scoring function, and it must also be able to measure how much of each feature is present; all this information is supplied by *homo sapiens*. But although most programs are also provided (by humans) with the relative importance (or 'weighting') for each of the features in the scoring function, it is possible for a program to learn to improve its own weightings or even to learn them from scratch.

One way in which this can be achieved is the use of multiple regression analysis, a well-known method in statistics. What multiple regression can do for us is to consider a number of decisions made by human experts and use this information to determine how much importance the human experts give to the various features in the scoring function. In the case of chess, for example, a program could observe how a Grandmaster acts in a number of different positions.

Let's assume that a chess program can measure six features in a chess position: material, mobility, king safety, pawn structure, centre control and king attack, and that associated with each feature is a numerical weighting which has been designed

to represent the relative importance of the features to each other. We'll refer to these weightings as Wma, Wmo, Wks, Wps, Wcc and Wka respectively. The merit score for any chess position can then be calculated from:

(Wma × material) +
(Wmo × mobility) +
(Wks × king safety) +
(Wps × pawn structure) +
(Wcc × centre control) +
(Wka × king attack)

When faced with a choice of moves in a chess position, a program could use this 'scoring function' to compute a score for every single position that could arise after making its next move, and it could then select the move leading to the position with the highest score.

In order to arrive at the best possible set of values for the weightings Wma, Wmom and so on, the program could consider the moves made by a strong human player and assume that his moves will always be better than the alternatives available. Just one assumption of this type can provide a whole wealth of useful information. For example, if the program sees a human chess master opening with the move e2–e4, it might assume that e2–e4 is better than all other moves available. It then produces a set of inequalities such as :

score after e2–e4 › score after a2–a3
score after e2–e4 › score after a2–a4
score after e2–e4 › score after b2–b3,
and so on,

where 'b' means 'is greater than'.

Each time the strong human player makes a move, the program acquires another set of inequalities, and each set of inequalities allows the program to increase the accuracy of the various weightings. (There are standard methods for solving large numbers of inequalities.) The program is simply observing the actions of the human expert and then trying to modify its own play to be as close as possible to that of its 'teacher'. The result would be that the weightings of the features in the program's scoring function would approach some 'local' optimum — local in the sense that the weightings would be optimal for the set of positions that have been used for the regression analysis.

Computer learning

Up to now we have considered how computer programs might learn in a static environment such as a game of chess or noughts and crosses, where the laws of nature (the rules of the game) are constant. However, there are many real life situations in which the laws of nature change, and an intelligent program should be able to monitor such changes and learn how to adjust to them.

A relatively simple example is a program designed to predict how far a ship will travel in the next 24 hours, assuming that no weather forecast is available. The program might make an assumption about the weather based on some kind of average during the previous 10 days, but it should place more weight on the weather for the current day than it does on the weather 10 days ago. It might assume, for example, that the wind speed tomorrow will be as shown in Fig 5.

$$\frac{(\text{wind speed today} \times 4) + (\text{average wind speed for past 10 days})}{5}$$

Fig 5 Calculating wind speed

This formula gives four times as much weight to recent information than it does to older information, and hence is rather susceptible to recent changes in the environment.

Another more complex example is the following problem. Assume that we have a chess-playing program whose task it is to learn how to play in the style of its human opponent. It learns to optimise its scoring function in exactly the manner described above, but instead of considering every set of inequalities as being of equal importance, it gives, say, three times as much weight to the inequalities provided by its present opponent than it does to those of the past. In this way, the program's learning process does benefit from all its past experience at the game, but its 'style' will quickly come to resemble that of its present opponent. If its present opponent likes to advance on the wings, the program will soon find its scoring function modified to give more emphasis to the wings (and, therefore, less to centre control). If its present opponent enjoys sacrificing his pieces, the program will quickly learn that material is not quite so important as it originally assumed, and it too will begin to make sacrifices.

Similar learning techniques have been used to teach a computer program how its opponents at the poker table change the style and the frequency of their bluffing, and a friend of mine who is a professional poker player even lost 'money' to such a program during a rather long session.

Further reading

Michie D and Chambers RA (1968). Boxes: An Experiment in Adaptive Control; *in Dale E and Michie D (Eds)* Machine Intelligence 2, *pp 137–152.*

Samuel AL (1967). Some Studies in Machine Learning Using the Game of Checkers II — Recent Progress; IBM Journal of Research and Development, *vol 11, pp 601–617.*

Selfridge OG (1959). Pandemonium: a Paradigm of Learning; *in* Mechanisation of Thought Processes, *vol 1, pp 511–531. National Physical Laboratory, Symposium No 10.* END

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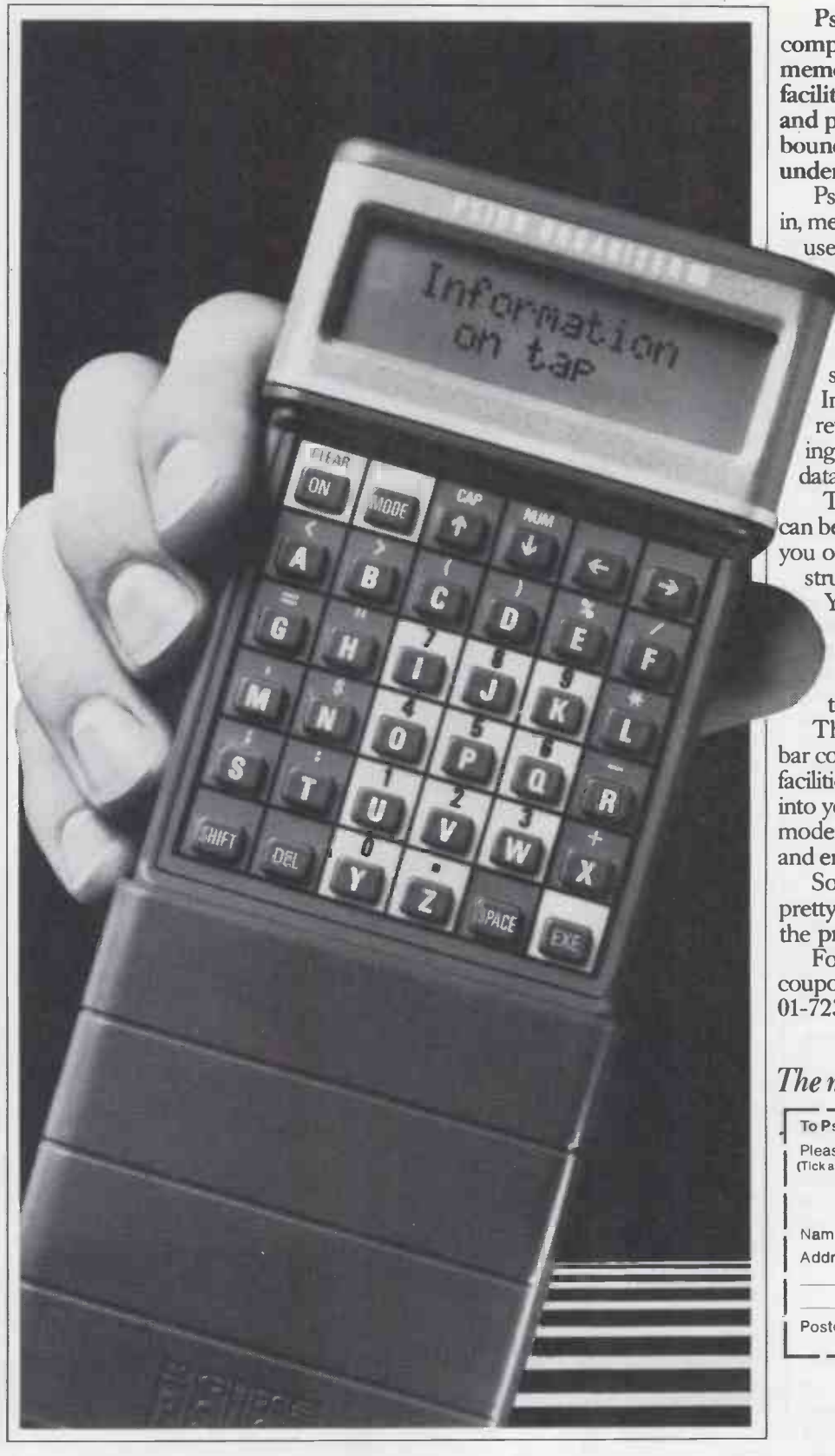

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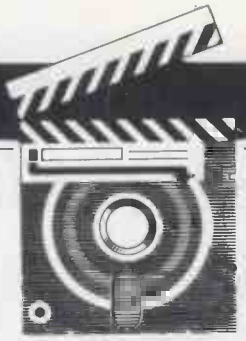


SCREENTEST

Q&A

If you're overwhelmed by myriad applications and just require a simple, down-to-earth data management system, Q&A could be for you. Kathy Lang assesses its facilities.

Anyone who occasionally looks at the best-seller lists for software on business computers — meaning IBM PCs and Apricots rather than 'cheap and cheerful' systems such as the Amstrad PCW8256 — can hardly fail to be struck by the complete absence of packages aimed at those who just want to do simple things using an 'automated card index'. Among those that appear regularly, all the data management systems are packages such as dBaseII and III, Delta and DataMaster, which, despite the efforts of their advertising agencies, are more likely to appeal to those with large and relatively complex requirements: price alone would suggest that conclusion. Among new launches, too, such products as Paradox are targetted at those who are prepared to spend upwards of £400 and want facilities to match.

What do those who need to handle simple lists and tables use? Some may, perhaps, have started computing with a spreadsheet, and use the very basic features of packages such as Lotus 1-2-3 and SuperCalc to handle simple tables. In the US there are simple packages which have a substantial following, though none seems to have caught on in the UK. Into this arena, then, comes a new contender, intent on using the current artificial intelligence bandwagon to meet the needs of people who have simple requirements and want them met in a straightforward way — Q&A. Q&A is an American product: it is distributed in the UK by Paradigm.

Q&A is essentially an automated card index system, as it does not allow you to connect files together when extracting information or amending records: such packages are often described as using a 'flat file' approach. Within that limitation, it offers a wide variety of facilities in a fashion that I found extremely easy to use. Apart from some limitations in the search facilities, Q&A probably takes flat file handling about as far as most people will want to go.

Beyond that, Q&A's chief claim to fame is that, in addition to a conventional method of operation through menus and options, it also allows you to interact with its 'Intelligent Assistant' to phrase queries in as natural a form of English as possible. The Intelligent Assistant comes with a battery of pre-defined words and phrases; in addition to 'teaching' it about the nature of your sets of records, you can also add to its vocabulary of nouns, verbs and adjectives to include your own terminology. The aim of this approach is to make it easier for novices to frame questions. Whether this aim is achieved in practice I leave to your judgement when you have read my review, but I should warn readers that I remain sceptical about the benefits, in the current state of the AI art, of taking this 'natural language' approach.

In addition to the extensive data management facilities, Q&A also has a word processor, adequate though not startling in its features, but including the ability to create personalised documents.

At present, Q&A is available only for the IBM PC and close compatibles. It requires a minimum of 512k memory; if you have exactly 512k, the manual warns you to use the DOS defaults of two buffers and 10 files, since you may run out of memory if you use more. This could be an almighty nuisance if you use other programs alongside Q&A: many packages will not run unless you use a CONFIG-SYS file to set higher limits, and to change the limits cur-

Max file size	NS
Max no fields	?676
Max digits	NS
Special disk format?	
Link to ASCII files?	YV
Fixed rec structure?	Y
Amend rec structure?	Y
Link data files?	N
No sort fields	NS
Max key length (chars, fields)	NS,1
Data validation	G
Unique keys	N
Store calculated data	IN,BA
Store selecn criteria	P
>1 criterion /field?	Keyword fields only
Browsing methods	AF
Reference manual	****
Reference card	***
Hot-line?	F
Max record size (chars)	NS
Max field size	1677
Max prime key length	NS
File size fixed?	N
Data types	N,C,D,T,L,£, Ref,List
Fixed record length stored	Y
No data files open	NP
No keys	120
Subsidiary indexes kept up-to-date?	UTD
Screen formatting	P
Report formatting	D,C,I
Totals & statistics	Y
Combining criteria	A
Wild-code selection?	SW
Interaction methods	M,LT
Tutorial guide	****
Online help	*****

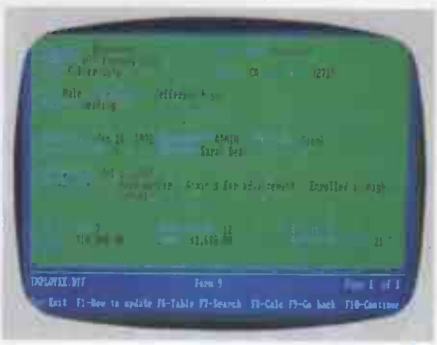
Note: Maximum five stars possible

For a full explanation of abbreviations, see 'Database dossier', page 188, January 1985 issue

Fig 1 Features and constraints

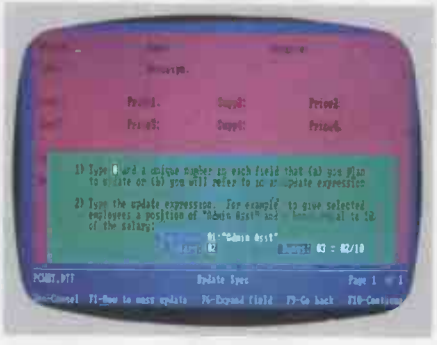
Help on the main menu

Specifying field types

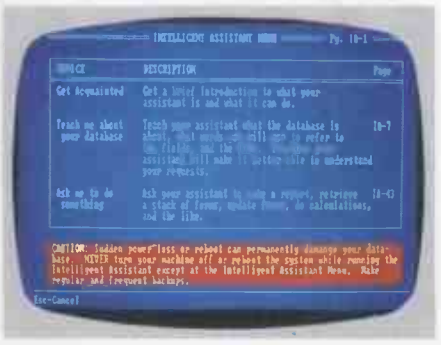


Typical data entry form

A range of search options



Setting up a mass update



Intelligent Assistant options

rently in use involves rebooting.

The other area to watch is disk space. Q&A's four program disks (not copy-protected, thank goodness) copy onto about 1Mbyte of hard disk space, not excessive by current data management system standards: but the index files (one per data file, however many indexes you have) are remarkably large. On my Benchtest file of 1000 records, I use two indexes; one index field has five characters and the other three. The Q&A index of these two fields uses 50k, one-third of the space taken by the data file. And when Q&A's Intelligent Assistant has been 'trained' to allow the use of the 'natural language' interface, the space requirement grows larger still — 180k for the data file and 170k for the index file.

Constraints

Q&A's main data-handling features and limitations are shown in Fig 1. Apart from the limit to a single data file in use at any one time, the package is remarkably free of constraints. I could find no reference to the conventional limits on size of file, record or field; the only stated limit seems to be a maximum of 10 screens, each of at most 21 lines, to describe each file. Internally, Q&A uses a two-letter code to identify each field, giving a possible maximum of 5356 fields, though I strongly suspect that you would run out of memory before reaching such a limit. A field may not span more than one screen, giving an effective limit of 1677 characters (21 lines of 80 characters, less one character each for the field name and two delimiters).

A fair range of data types is allowed, including time; dates may be entered and displayed in a variety of formats, including the common UK form of DD/MM/YY, while times may be 12 or 24-hour clock. Currency symbols may be dollar or pound, and the decimal indicator may be period or comma. All these variants are specific to individual data files, rather than applying to the package as a whole.

File creation & indexing

The first step in creating a Q&A file is to design a screen form on which the records are to be displayed. (The form may span up to 10 physical screens.) Each field is entered as a name followed by either a colon or a ‹ sign, with the maximum length being determined by another field name or a › sign. Several fields may be entered on one line, or a field may span several lines. Simple line drawing is provided, so that you can draw boxes round sets of fields.

'. . . in addition to a conventional method of operation through menus and options, Q&A also allows you to interact with its 'Intelligent Assistant'. . .'

When the screen design is complete, you are presented with a screen showing the blank record layout, with a T in each field (for Text). If all your fields are to contain characters — no dates, numbers, and so on — you can just accept that definition; otherwise, you change the definition letter to that appropriate for each field — N(umber), D(ate), and so on. An unusual field format is Keyword, which may have several values within a particular record; for example, you might want to record all a person's hobbies, or all the special abilities of a member of staff.

Finally, you can set the formats for date, time and currency fields, and the specification is complete. Should you want to change it later, some alterations (such as adding a field) can be accomplished without file reorganisation, while others oblige Q&A to change the data file. In either case, the operation is smooth, and this flexibility is a good feature.

Q&A automatically creates an index on the first field. If you wish, you can index other fields (Q&A calls this 'speeding up'). The index is used to speed searches of all kinds, including those requesting partial matches, such as 'field starting with' certain characters. Indexing is carried out as part of the 'customisation' option; many other record checking features are also included there. The index (to all indexed fields) is kept up-to-date when records are amended.

Data input & updating

Records are added and amended through the screen form which is set up when the file is created. Q&A allows you to customise this form in a variety of ways, to make it easier to get the data right. Possible enhancements include data validation, control over the order in which fields are entered, calculated fields, and the ability to reference a look-up table in another file (perhaps to amplify abbreviated codes to their full value).

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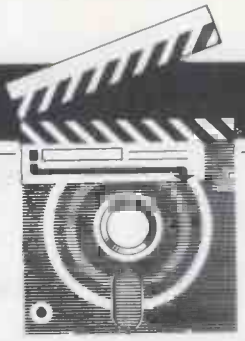


SCREENTEST

Initial values may be set for specified fields.

Some aspects of data entry can be controlled by simple program-like commands; for example, if the value entered for one field determines whether it is relevant to request data for other fields, this can be programmed into the form. (It might, for instance, become relevant only to ask questions about a spouse if the subject of the record is married.) You can also define help screens which will be referenced when the form is being filled in, a very helpful feature for people designing systems for others to use.

Another feature controlled by the customisation option is screen colour (unfortunately, Q&A is very restrictive here). Despite the provision on IBM colour monitors of eight background and 16 foreground colours, which can be combined in a variety of ways to vary the colours used for field names, values and the backgrounds upon which they are entered, Q&A allows only seven colour combinations.

Several of these do not provide good ranges of contrast — for example, red field names and white field names on a black background — so that I was hard-pressed to find a combination I could live with, let alone enjoy using. Among my pet hates is the bossiness which deprives users of facilities they have paid good money for! If you have a colour monitor, it would certainly be worth checking that you find at least one of the available colour combinations acceptable. And do check on a monitor like your own — the variation among different makes of monitor is astonishing.

When entering records, in addition to the facilities provided through customisation, you can use a 'ditto' mark to echo a value from the preceding record. Records can be selected for amendment using the full range of selection criteria described below under 'Selection & sorting'.

In addition to amending records interactively, you can also carry out what Q&A calls a 'mass update', in which all or a selected group of records are amended in the same way, perhaps to raise a price by 10 per cent. And this operation can be carried out using the Intelligent Assistant, too — more on this under 'User image'.

Screen display

Records may be displayed one at a time, using the form created with the data file, or they may be shown on a list. In addition, any report destined for the printer may alternatively be shown on the screen, and this includes, for example, summary reports giving just totals or counts — a useful but not universal feature.

Printed reports

Q&A provides two main ways to produce reports. You can set up simple reports and print or display them at once from within the File section of the package, or you can design and save a full columnar report specification for subsequent printing.

The latter can include selection and sorting specifications, instructions about the handling of sub-totals, and so on. It can also allow you to produce reports on 'keyword' fields, provided only one is included in the report and it is the first to be specified.

Selection & sorting

Records may be selected for display, printing or updating in two ways: by filling in a blank form on the screen with the criteria to be used; or through the Intelligent Assistant (see 'User image').

A good range of selection operators is provided, and the matching of values for keyword fields can use OR (any of these values will do) or AND (the keyword field must contain all these values for the record to be chosen). I could not, however, find a way to specify OR *between* fields — all criteria are cumulative — or to accept several values for non-keyword fields (though you can specify ranges). These specifications are notoriously hard to set up in such a way that inexperienced users can make sense of the instructions, but the absence of this flexibility does limit the kinds of search you can make.

Displays and printed reports can be ordered by one or more fields, with the sorting being in ascending or descending order. Such orderings are maintained only for the display or report requested, and have to be re-established each time the report is produced; nor are the records themselves physically re-ordered, so sorting is fast.

Calculation

At data entry and during a mass update, fields may be calculated from the values of other fields within the same record.

Q&A allows the usual range of arithmetic operators. In reports, totals and counts, plus some additional functions such as average, maximum and minimum are provided.

Multiple files

Q&A allows you to work on one data file at a time; there are no multiple file features, apart from the ability to use a table to look up substitute values of fields filled in data entry.

Tailoring

Apart from the ability to customise data entry, Q&A's tailoring features are limited to simple macros which record sequences of keystrokes. These can be recorded directly from the keyboard; once saved they can be edited using 'visible equivalents' in Write, Q&A's word processor.

Links with outside

Q&A allows you to import from a range of data formats, including pfs: File, Lotus 1-2-3, ASCII text and DIF

BM1	Time to add one new record	5secs
BM2	Time to select record by primary key	4secs
BM3	Time to select record by secondary key	16secs+
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	26secs+
BM5	Time to access record using wild-code	39secs+
BM6	Time to index 1000 records on three-character field	2mins 8 secs
BM7	Time to sort 1000 records on five-character field	48secs
BM8	Time to calculate on one field per record and store result in record	6mins 6secs
BM9	Time to total three fields over 1000 records	1min 16 secs
BM10	Time to add one new field to each of 1000 records	1min 16secs

Time to import a file of 1000 records: 2mins 55 secs

Notes: NT = Not tested; NP = Not possible; + = including scrolling. Where two times are given, first is access to first record, second is access to each subsequent record.

Fig 2 Benchmark times recorded on an IBM PC/XT/H

files. You can also export data from Q&A to ASCII text formats and to DIF, the format used or readable by most spreadsheets.

User image

Q&A's basic approach is to use menus, with a lot of automatic prompting plus plentiful extra help on request. This works quite successfully — I generally make a point of using the manuals as much as possible, but this really is not necessary with Q&A.

My only real grumbles are perennials: too many keystrokes to move between menus, and no choice of colour. You can choose from a restricted range of colour combinations for data entry forms, but for Q&A's own displays, including table views of data files, there is no choice. This is the more irritating in that the designers, Symantec, have chosen a colour combination which can be admirable, but on my monitor (a very popular make) is very lacking in contrast; cyan on blue is, in my experience, the most variable in its effects of any of the available combinations. (In case you think I'm carrying on rather, try using a screen for several hours a day that has an unappealing colour combination, and I think you'll agree. And what few designers seem to realise is that this judgement is highly individual — in an office of two, my partner and I differ markedly as to what we find acceptable, let alone pleasing!)

The alternative to menus and options, for many of Q&A's facilities, is to use the so-called Intelligent Assistant. This is accessed from the main menu, and allows much greater freedom in specifying queries and retrieving records for display and amendment (including mass updating). You can specify queries in such terms as: 'Show me the average age of all the people who live in Yorkshire and have two dogs.'

Q&A comes with a long list of built-in keywords, such as 'show', 'is', 'not', and so on. It also customises its approach to your forms set; you have to 'train' it on your file before you can use it, an operation which took about 25 minutes on my 1000-record Benchtest file. You can then add other keywords, such as 'folk' for 'people', units of measurement for numeric fields, alternative names for fields, and so on. When this has been done, you can start to phrase your queries: if Q&A does not understand, it asks you to define the offending words. It also asks about ambiguities, which it finds in some odd places — for example, being concerned about confusing a field *value* with a built-in keyword (the word IS, as it happens).

I found two problems with the Intelligent Assistant: speed and clumsiness. A search which took 16 seconds (using an indexed field) in the File Search option took just over a minute using the Intelligent Assistant — and that without having any apparent problems parsing my request. (A mass update took only a few seconds longer than the equivalent File menu operation.) I also found it hard to phrase requests which were simple in the unambiguous if disciplined world of menu-and-option. For example, I could not find a way to total three fields without using the word 'total' once for each field name; the request to 'total fields price 1, price 2 and price 3' was clearly ambiguous to a degree which the Intelligent Assistant could not unravel, though to a human being the intended meaning is quite obvious. You should approach claims of the 'intelligence' of such 'assistants' with caution.

Package	Cost (£)	Summary
DMS+	195	Stripped-down version of Delta from same supplier — one file open at a time, no tailoring. Good letter-writing. Usable manuals, but no road map of menus. Separate set-up and execute (for example, in selection) tedious. Good value for money at this price
File	190	Data management system designed to make use of special Mac features, so very visual approach. Provides good basic data management features for single-file, fixed-format records, stored as variable length. Links to Word, Chart and MultiPlan
PC Promise	175	Powerful file & screen handling, using variable length records. Allows design of tailored systems including screen help and error messages. Very easy to use (selection rather clumsy). Selection, reporting not very powerful. Excellent value, British product
PractiBase	99.95	Cheap package for handling fixed-format records in up to three files at once. Very similar to dBasell in features: good indexing, reporting, programming language (though no PL editor). Can control through menus or enter keyboard commands directly
Q&A	250	Flat-file-with-lists, adequate searching, good indexing and data checking, screen and batch updating, good columnar reporting, large records and fields allowed. Includes word processor with mail-merge, also natural language interface of limited value

Fig 3 Comparison of similar data management packages

Documentation

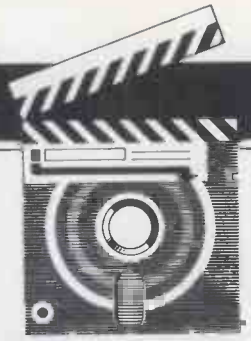
Q&A comes with an excellent manual which includes an abundance of illustrations and a full 'road map'. My only failure with the index was in looking for the word 'colour' (or 'color', for that matter) which is referenced under 'palette'. Therer is also a reference summary, a set of examples and a tutorial disk.

Conclusion

Q&A provides a good range of facilities for flat file records, though the specification of search criteria is rather limited. For people who want a system which is really easy to use, to handle lists, tables and the like, Q&A would be pretty good; word processing facilities provide an added bonus, making the whole package good value for money. I would regard the Intelligent Assistant as an interesting extra rather than as a main reason for purchase. END

Summary

Supplier:	Paradigm
Telephone:	(01) 228 5008
Cost:	£250
System:	PC
Version reviewed:	1.1
Type:	N,S
Features:	Handles flat files, though records can include lists as single fields. Very large records and fields allowed. Good data checking, flexible retrieval for editing, table and form view of record. Natural language mode for searching, amending, and so on
Drawbacks:	One file only at a time (apart from table look-ups) Search capability limited. Natural language searches slow
Ease of use:	Excellent. Menus, lots of prompting (not intrusive), good extra help (plus you can add your own). Colour range limited



SCREENTEST

Business Filevision

Business Filevision provides sophisticated database facilities for those Macintosh users who are not familiar with intensive business computing. Mick O'Neil tests its capabilities.

When the Macintosh made its entry onto the micro scene in 1984, there were more than a few sceptics who considered the icon-based user interface (WIMPs) to be cute but cumbersome, and certainly a passing fancy. Now, with the introduction of Digital Research's Gem operating system for MS-DOS machines, Commodore's AmigaDOS and Apple's own refinement of the Mac's interface, an industry standard, based upon icons and Mac-like graphics, may be evolving. Business Filevision, a new and powerful version of a visually-orientated information management system on the Macintosh, extends this desk-top metaphor and threatens to overcome the most intractable sceptic of all — the database administrator!

Business Filevision is an update of Telos Software Products' innovative file manager, Filevision, and is a significant improvement in both power and scope. The original program allows the manager to create a graphic by using drawing tools provided within the program, and relate parts of the drawing to information files. The new version substantially enhances the power of Filevision by allowing for the importation of MacPaint, MacDraw, MacDraft and digitised graphics, and by increasing the potential file size, the number of objects in a file, fields per type, characters per field, and so on (Fig 1). In addition, a separate Import/Export facility is now available which will allow Business Filevision to exchange data with existing Macintosh

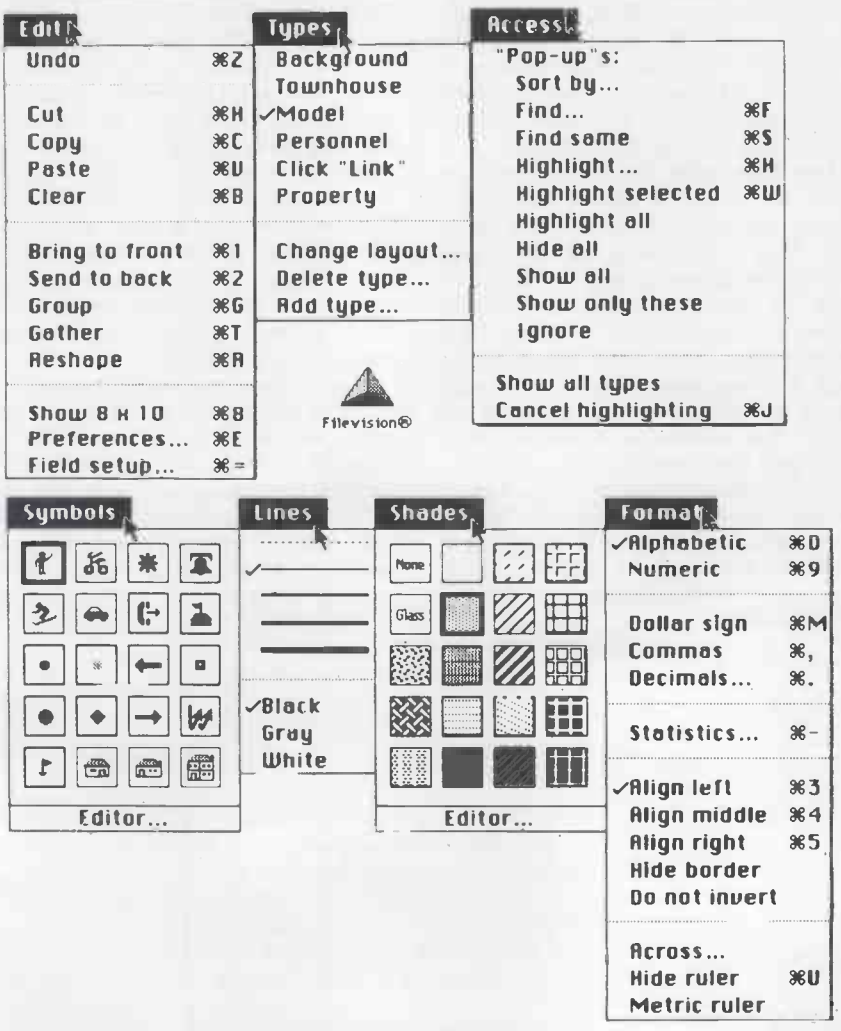


Fig 3 The pull-down menus contain many options

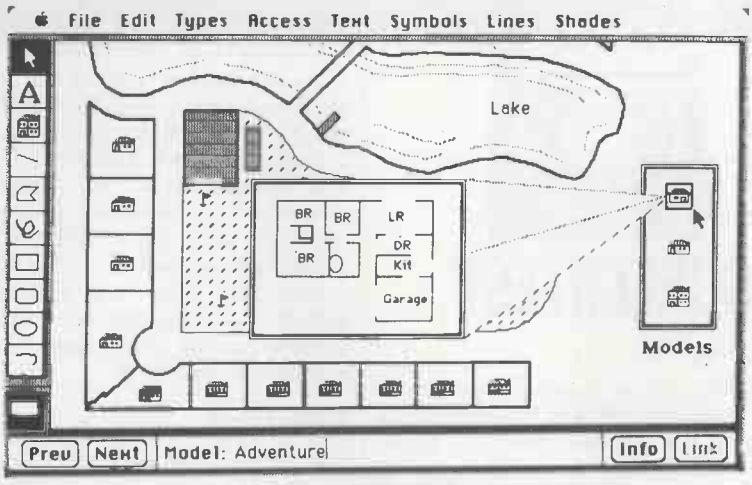


Fig 4 Double-clicking the house icon generates a pop-up floor plan

Files	
Maximum file size:	4Mbytes
Minimum file size:	4k
Max types per file:	16
Max objects per file	32000 (depending upon memory size & disk space)
Max fields per type layout:	99
Max characters per record:	4000
Max length of field name:	31 characters
Field:	Size adjustable at any time, selected fonts, graphics
Field types:	Standard (numbers, text or pictures); calculated; initial text; copy from previous record
Max freehand or polygon graphic size:	100 points
Max size of type or print layout:	30ins × 30ins
Max text characters allowed as one object on the graphic display:	400
Records without graphics allowed:	Yes
Drawing and graphics	
Drawing area:	8inx × 10ins, with 6in × 4in close-up window view; accessible via page miniature and Edit menu
Graphic objects:	Text (selectable sizes, fonts and styles); symbols (16 × 16-dot editable from a palette of 20); lines (constrainable to 0, 45 and 90 degree angles); polygons (constrainable as above); rectangles (constrainable to squares); ovals (constrainable to circles); arcs (constrainable to circular arcs)
Imported graphic objects:	Pictures (MacPaint or ready-made); text; Business Filevision pictures; Business Filevision symbols and symbol palettes
Lines:	Adjustable width (0 to four dots)
Shades:	18 editable
Selection:	Shown with handles, blinking, black or nothing
Multiple selection:	Like finder — can be constrained to proportional unlimited layers. Objects can be permanently, or temporarily grouped graphics can be selected and deselected with button
	Can be set to go to record, activate link, or be ignored
Grid:	Optional; adjustable in 1/12in increments
Also:	Overlap; grouping; pop-ups; double-click; stretch & shrink

Fig 1 Specifications

and MS-DOS programs or, for that matter, any programs which use DIF, SYLK, SDF or ASCII files (Fig 2).

Picture this

The first step in using Filevision is to analyse information requirements and determine how data is related graphically. This process requires some imagination and ingenuity, particularly for those who have grown used to staid databases with cryptic prompts or sterile menus. Once this barrier has been overcome, however, the program literally flows. If your data doesn't seem to benefit from graphic representation, Business Filevision allows you to create standard data files.

A master drawing can be created using tools provided by the program (Fig 3) or imported via the clipboard from other Mac software. This could take the form of a map, an office layout, a factory floor, a wine cellar, a parts schematic, and so on. This object can be assigned as 'background type', and Filevision makes it easy to add individual graphics to the background which can be typed to associate with data files. Alternatively, parts of the original background can be fenced for the same purpose.

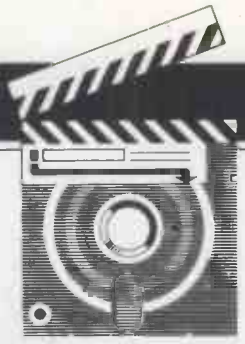
For example, an estate agent might use specially tailored icons to show rural land sales, while fencing towns and cities in which housing is available. By double-clicking a land sale icon, imformation on land sales in that particular area could be displayed. Double-clicking a town could link the agent to a file which displays a detailed map of a housing area, with each house icon associated in turn with its own data file. Filevision allows linked files up to five deep.

When you have started to create the graphics layout, you can easily find yourself overdoing things with informational 'clutter'. In order to avoid this, the program includes the option to create 'pop-ups'. A pop-up is a graphic display which shows important information which won't fit on the background layout. Pop-ups are triggered by clicking a specially designated graphic (called a 'button') and are just as easily removed by clicking the toolbox (Fig 4).

Data files

Creating a data file couldn't be easier (Fig 5). After giving a file an individual type (for example, 'land' or 'housing'), you then design a layout for all the records in that type. Up to 99 fields can be added and sized to fit a 30in by 30in format. Field names can be up to 31 characters in length, while the field size can be as long as 2000 characters.

Each field comes with a handle for easy placement, and fields can contain virtually any kind of information including graphics, text and num-



SCREENTEST

bers. In addition, computed fields are permitted. An important feature is the ability to change field placement and design even after data has been entered.

It should be noted that despite the flexibility in file set-up and the sophistication of the graphics interface, Business Filevision is not a relational database program in the traditional sense. Only one file can be open at a time, and without the Import/Export facility, it's quite impossible to update one file by using information from another. Stock management, for example, might require a transaction file entry as well as a stock file entry, so giving rise to duplication of effort which is easily avoided using a relational database.

Highlights

A datafile can be queried with up to four conditions; this is accomplished by using the Access menu to 'highlight' those records which meet a given set of conditions (Fig 6). After you have entered conditions using standard Boolean operators which are provided in a dialog box, the program returns you to the drawing display where you observe that any graphic objects which meet those conditions have been highlighted. The Access menu also provides a powerful Find command which will function with up to 22 significant characters as well as wild-cards and constraints. Files are automatically sorted according to the name field, but this can be overridden to sort on any designated field.

Printing

One of the strongest features of Business Filevision is its flexibility in printing. Filevision can easily generate labels, merge information into reports or form letters, and produce tables of your own design. The ability to save up to 16 re-usable report formats and to preview a report on-screen sets a new standard in database reporting.

Documentation

A first-class tutorial, a superb reference manual, an online help feature, a glossy and informative quarterly magazine, a toll-free support number, access to public domain Filevision templates, discounts on related products, a Filevision Developer option — there is the distinct impression that Telos is selling much more than an isolated piece of software. The documentation and support makes learning Business Filevision easy and pleasant. Disks are covered by a 90-day warranty, and a back-up program disk is provided upon registration. Though the program is copy-protected with the standard Macintosh disk insertion system, it can be completely installed on a hard disk, eliminating the need for insertion of the key disk. A nice feature is the capability of uninstalling Business Filevision to allow hard disk back-up. Ironically, the close publisher/client relationship fostered by Telos is a much more effective deterrent to software piracy than any protection scheme.

An additional service provided by Telos is access to dozens of public domain Filevision templates. For a $3 charge per diskette and a $1.50 handling charge per title, Telos will send registered users software ranging from Cabinet File to Walt Disney World. As part of the service, a brochure briefly describing each of these applications is included. Though you may find that none of these templates exactly fulfills your needs, some may come close, and, with a little editing, you may save hours of work.

And if that's not enough, you're also given information on obtaining templates for sale. One such tem-

Process ASCII files from the following programs:
- DB Master (Import only)
- Filemaker
- Helix
- Microsoft File
- Overvue 2.0 (Export only)
- PFS:FILE (Import only)
- Omnis 3
- Excel
- Jazz
- MacWrite, and so on

Process imported data records based on the following:
- Add all imported data as new records
- Update matching records; otherwise add new records
- Update matching records; otherwise disregard
- Replace matching records; otherwise add new records
- Replace matching records; otherwise disregard

- Do not change highlighting
- Highlight all new or changed records
- Highlight only new records
- Highlight only changed records
- All new or changed records *not* highlighted

What you can do:
- Build a mail-merge file with your word processor
- Automatically enter a customer list from another database program
- Update production costs as calculated by your spreadsheet or custom program
- Prepare sales data for your corporate computer
- Keep stock prices current with data received from online retrieval service
- Extract columnar data for inclusion in report
- Exchange data with other Business Filevision files

What Import/Export can do:
- Import and export data in standard industry formats: ASCII, DIF, SDF and SYLK
- Add new records to your file or change selected information in existing records
- Convert data along the way, using several options: convert all characters to upper-case; translate special characters; ignore characters; convert numbers in scientific format to normal format
- Switch among different Business Filevision files and types
- Build a standard set-up file to automate the import or export process
- If your program doesn't run on a Macintosh, exchange data between the computers by using a communications package such as MacTerminal

Fig 2 Import/Export specifications

Business Filevision details

Supplier:	Telos Software Products
Address:	3420 Ocean Park Boulevard, Santa Monica, California 90405
Telephone:	(213) 450 2424
System:	512k Macintosh, Macintosh Plus
Type:	File manager with sophisticated graphics interface
Package:	Start-up diskette, program diskette, second program diskette upon registration; hard disk support; Filevision file conversion; quarterly magazine; access to public domain templates; excellent 250-page manual including superb tutorial
Cost:	$395 (approximately £275)
Features:	See review
Drawbacks:	None
Ease of use:	Sophisticated data relationships made available to users unfamiliar with business applications

Mapvision details

Supplier:	Pitman Publishing Limited
Address:	128 Long Acre, London WC2E 9AN
System:	128k Macintosh, 512k Macintosh, Macintosh Plus plus external drive; Filevision or Business Filevision required
Type:	Filevision template includes maps of the UK, Europe and other parts of the world, as well as data
Package:	Two diskettes with 90-page manual; manual consists mainly of print-outs of available maps
Cost:	£99.95 (inc VAT) plus £2 for postage and handling
Features:	Detailed maps of the UK, the EEC, some US states and general world regions
Drawbacks:	Contains only limited census-type data
Ease of use:	Templates are in Filevision format and must be upgraded by using the Business Filevision conversion program. This increases the size of each template and takes up about three diskettes

plate, Mapvision, written by Basil Dimitriou and published by Pitman Publishing in the UK, may be of particular interest to UK users. It includes detailed maps of the UK, some data on UK counties, and general maps of other parts of the world. Some of the features of this package are shown in Figs 7 and 8.

Conclusion

If Business Filevision is viewed as a stand-alone database, its graphics interface, flexible file design and extensive print options make it well worth consideration. It also compares favourably with other Macintosh file management programs. Still, it is not a full relational database in the style of dBaseIII on the PC or Omnis III on the Macintosh, and it would be wrong to consider Business Filevision by itself in the same light.

It is in combination with a full relational database that Business Filevision may have its most important role. Relational database systems are notorious for their complexity, and it's the user interface which usually requires the most design time. In combination with its announced Import/Export program and a network, Business Filevision may offer a user-friendly shell that makes the power of dBase accessible to 'the rest of us'. It could do for data management what MacPaint has done for computer graphics! END

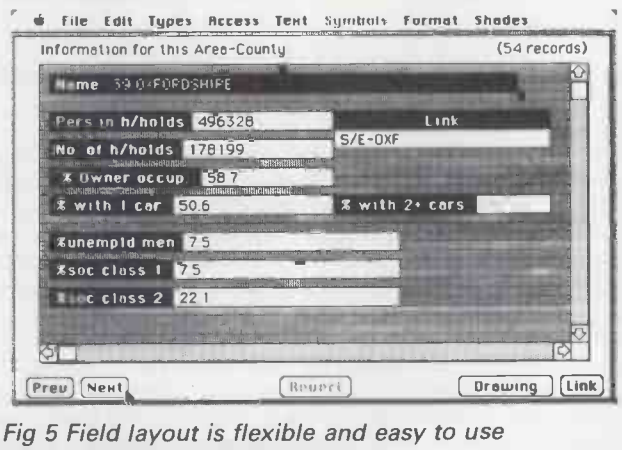


Fig 5 Field layout is flexible and easy to use

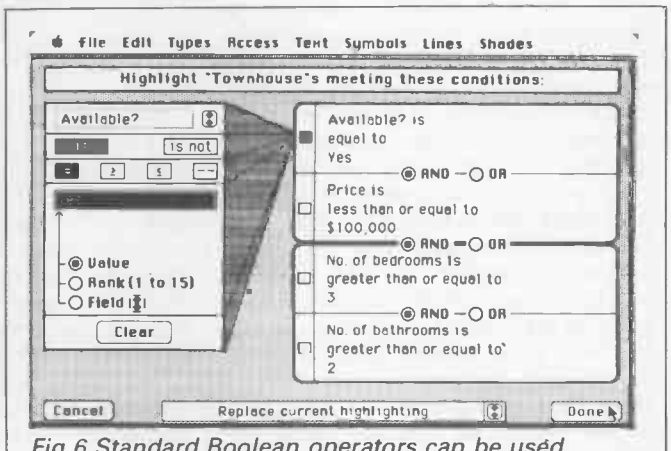


Fig 6 Standard Boolean operators can be used

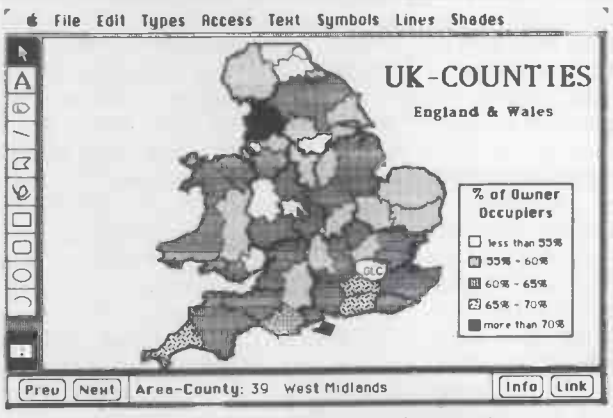


Fig 7 Mapvision can display some interesting data relationships

Fig 8 A blown-up map of the West Midlands generated by Mapvision

Building structures

In the first part of a six-part series on programming methods and the creation of programs, Mike James examines the role of data structures in determining algorithms.

A revolution is taking place in programming methods and programming languages, and I have no doubt that it will eventually make itself felt by every programmer. This revolution is mainly driven by the desire to make programming more precise and mathematical and is typified by the new languages based on logic (such as Prolog).

The desire to make programming more like mathematics goes back a long way. Many earlier programming methods — structured programming and modular programming in particular — certainly help with the task of constructing a good program with minimum effort. The success of these programming methods and the languages which they have spawned (for example, Pascal) has continued to focus attention on the part of programming which is usually refered to as *coding* — that is, given that you know exactly what a program should do, most programming methods are designed to help you realise your ideas as a bug-free program as easily as possible.

What programming methods have ignored completely is the process which precedes the stage of coding — that is, getting the ideas for the program in the first place. This important area has been ignored because it's difficult and not as neat and clear-cut as the coding stage of programming. However, there's much more that can be learned about program creation than is generally realised. In this series, I'll be sharing some of the insights I have gained by my own programming experiences and talking to programmers, both beginners and advanced, about the way they go about creating a program.

As the initial conception of a program is mostly independent of which language you later use to code the program, this series is relevant no matter which languages you are familiar with. As Basic is such a universally well-known language, it will be used to code the example programs and as an aid to describing the problems of program design.

Before launching into the subject of program creation, it's worth summarising briefly the currently accepted state of programming methodology.

Programming methods

Perhaps the first step on the road to constructing better programs was the introduction of high-level languages such as Fortran and Basic. Although machine code and assembly language give a programmer more freedom in the way the machine is used, they also give the programmer more scope for making complex and subtle errors in coding. For example, in machine code you can use any area of memory to store data, and in any format, but in a high-level language, all you can do is create variables, and the language implementation decides where and how the data will be stored. Nearly all improvements in programming are about trading off some freedom of choice for simplicity and clarity.

The advent of high-level languages solved many of the problems of programming data storage, but early high-level languages contained the same types of control commands that were found in assembly language. In other words, the early high-level languages (including Basic) gave the programmer statements to test conditions and transfer control to another part of the program. For example, in most assembly languages, if you want to skip a section of the program if a value is zero, you use something like:

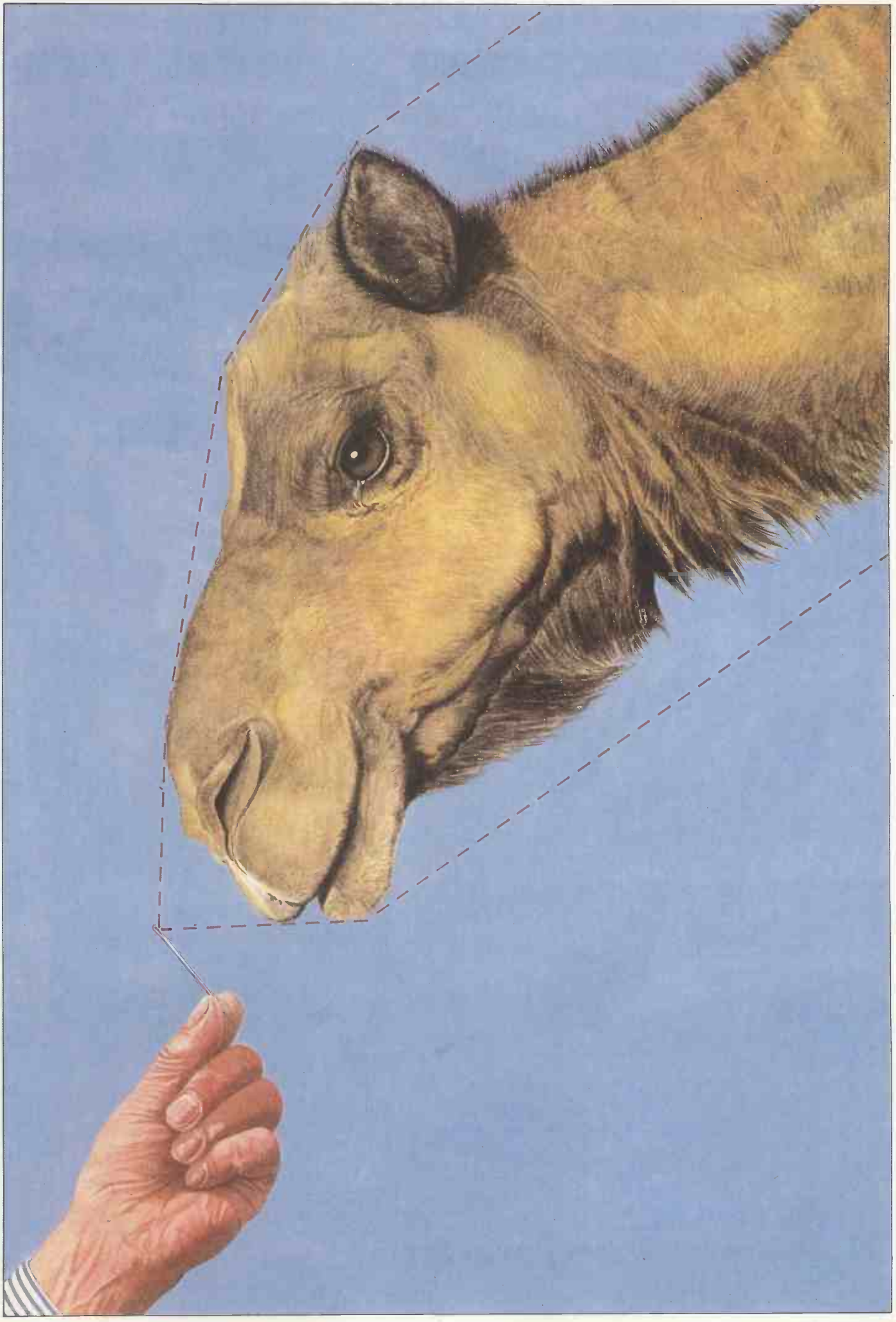
```
        TEST VALUE
        JUMP SKIP
        . . .
        section of program to skip
        . . .
SKIP    remainder of program
```

which is almost identical to the Basic version:

```
        IF VALUE=0 THEN GOTO
        100
        . . .
        section of program to skip
        . . .
100     remainder of program
```

The trouble with this type of control is that it allows the programmer the freedom to use the GOTO statement (or whatever the language calls its unconditional transfer of control statement) to transfer control to any point in a program without any regard for the effect that this might have on the program's clarity. The GOTO statement allows a programmer to tie a program into knots, making it impossible to follow; a program which is impossible to follow is sure to contain bugs.

The first reaction to the above problem was the invention of programming languages such as Pascal which removed the need for the GOTO statement and then placed a complete ban on its use. This restriction on the use of the GOTO statement is generally referred to as 'structured programming'. Many programmers now feel that to think of structured programming as just GOTO-less programming is a little naive. It's possible to write well-structured programs using Basic, assembler or any language, with or without the use of the GOTO statement. Structured programming can



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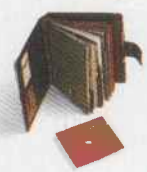

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be much better thought of as a method of producing programs which have a clear and simple flow of control, by restricting the use of the GOTO statement to the selection between alternatives and the formation of loops.

The final great step forward in programming methods takes us back to data storage. Basic programmers have become used to the idea that when a variable is defined, it's accessible from any point in a program: that is, if you use a variable called TEMP in a subroutine, it will be shared with any other subroutine using a variable called TEMP.

A variable which is accessible from any part of a program is called a 'global' variable, and it's generally agreed that global variables cause bugs. The trouble is that if two or more subroutines use the same variable name for a variable which does a different job in each subroutine, there will be unwanted and unexpected interactions between these subroutines.

The solution to this problem is the introduction of 'local' variables — that is, variables which exist only within a specific part of a program, usually within a single subroutine. The existence of local variables allows a program to be broken down into individual subroutines, or modules, which interact only through the parameters that are passed between them. This idea is called 'modular' programming and has been incorporated into some of the more advanced versions of Basic, such as BBC Basic and QL SuperBasic, as well as being standard in most other languages. Even in standard Basic, it's possible to use variable naming systems to create the same effect as local variables, and so to use modular programming.

The current state of programming can best be characterised by the use of high-level applications-orientated languages and structured modular programming. Programs produced in this way tend to be easy to understand and consequently bug-free.

Algorithms expressed

The great success of structured modular programming has encouraged computer scientists to concentrate on improving the clarity of a program's text. The principle is that the text of a program is an expression of an idea of how the program should work (its algorithm), and this expression should be as clear as possible in order that other programmers can understand the algorithm, and in order that the program can be checked for accuracy. If you find it difficult to see the difference between a program and an algorithm, think of a number of programs, each one written in a different computer language, but all doing the same thing. Each program is different, but they are all expressions of the same algorithm.

Currently, emphasis is being placed on how to best express an algorithm, and the rather more serious question of where the algorithm comes from in the first place has been more or less ignored. When you know the algorithm, programming is a matter of coding, and this is comparatively easy. We need to take some time to study the way algorithms are created by programmers before they are expressed as finished or partially finished program texts.

Studying programs

The first problem with trying to investigate the way that programmers create algorithms is that algorithms don't exist unless they are expressed in a language. For example, if I ask you to write a program that will find the average of a list of numbers, the algorithm exists in your head as a sequence of steps even before you code the program. Perhaps you think something along the lines of:

read-in each number in turn
add each number to a 'running sum'
count each number
at the end of the list divide the running sum by the count

This is already a primitive program. It's the expression of the algorithm in English, and from this point of view coding can be seen as a process of translation rather than creation. However, if you examine this expression of the proposed algorithm for finding the average of a list of numbers, you'll find that it's far from crude. The statement 'read-in each number in turn' implies some kind of loop, and 'at the end of the list . . .' implies that this loop comes to an end when there are no more numbers to be read. The statement 'add each number to a *running sum*' implies that the programmer has come across the basic mechanism of the running sum, and knows what it is and how useful it is. (A running sum is an expression of the form SUM=SUM+VALUE found inside a loop). Also, something which is not obvious is that the algorithm requires that the running sum is initialised to zero before the first iteration of the loop.

Even this English description of an algorithm is already a program in the sense that it's an expression of what should be done to work out an average. It's a vague expression of an algorithm which will be made more precise and explicit during coding. It's clearly impossible to discuss an algorithm without using some expression of it, which makes it difficult to get at the essential details of the algorithm. For example, how has it become clear that the working out of the average of a list of numbers needs a loop? Once you know that a loop is involved, you can start asking more specific questions such as exactly what happens in the loop and when should the loop come to an end? What is mysterious is how any programmer ever knows that a loop is involved at all!

Obvious loops

If you are having difficulty in seeing what all the fuss is about — finding the average of a list of numbers obviously involves a loop — let me state that I have given this problem to a great many beginners without any hints, and watched them make no progress at all. There is nothing naturally *loopy* about forming an average from a list of numbers. For example, if I ask you to add 3, 5 and 10, you will think of it as 3+5+10 which is a single arithmetic expression, not a loop. If you use a spreadsheet, you will find that you can add up lists of numbers by using a single function — something like SUM(A1:A15) which is, once again, not a loop. If you have the kind of programmer's mind which can cope with recursion, you can total a list of numbers using a recursive function in the form of SUM(N)=SUM(N–1)+A(N) and SUM(1)=A(1) which is not a loop.

Inside information

Two standard things happen inside loops — running sums or running products. In general, most programmers meet the concept of a running sum early in their education. For example, to add up the first N whole numbers, you would use a running sum as in:

```
SUM=0
FOR I=1 TO N
SUM=SUM+I
NEXT I
```

Running products are far less common, but are just as easy once you have seen an example. To multiply the first N whole numbers, you would use a running product as in:

```
PROD=1
FOR I=1 TO N
PROD=PROD*1
NEXT I
```

The detail which catches out most beginners is that SUM has to be set to zero before the loop, but PROD has to be set to one — why? Apart from the running sum and the running product type of operation, not much else happens inside loops!

My best guess, judging by what beginners try to do, is that non-programmers tend to see forming a sum of a list of numbers as a single piece of arithmetic such as A+B+C. Only programmers skilled in the art of using loops see that forming a sum of a list of numbers is a repetitive process, and even then it can sometimes be difficult to see exactly what it is that is to be repeated. For example, try this simple problem: write a Basic program which will form the product of the first N whole numbers: that is, if N is 5, work out 1×2×3×4×5. By comparing this problem with the problem of forming the sum of a list of numbers, you can see that it should be possible to use a loop, but what takes the place of the running sum? (See 'Inside information' for the solution.)

Data neglect

While there are no rules which state that the sum of a list of numbers has to be worked out using a loop, nearly every programmer working in a standard high-level language would recognise that this is the simplest and best way. The reason for this comes from a consideration of something which is not made clear in the statement of the problem — what is a *list* of numbers?

A programmer will naturally think of a list of numbers as a sequence of numbers entered one at a time in response to an INPUT statement. A non-programmer will think of a list of numbers as something static — more like a list written on a piece of paper. This is a crucial difference, as the idea of using a loop only arises when you think of each number being read in turn. It's not so much that a loop is an obvious part of the process of forming a sum, but rather that it's suggested by the form of the data.

This is a surprising observation. It is generally assumed that the major part of writing a program is concerned with finding out *how* to do something, but the above example shows that the way in which you think about the data is a first step towards constructing an algorithm.

It has long been recognised that programs are composed of two related elements: data, and the process to which the data is subject. A program is like any recipe for action — it tells the computer what to do and what to do it to. Nearly all programming methods to date have concentrated on the 'what to do' part of programming, and have more or less ignored the role of data in determining the algorithm. After watching beginners learn to program and by examining the way in which I generate algorithms internally for consideration, I believe that the way we think of data is a key factor in the creation of algorithms. Of course there are other factors, but these are much simpler and are concerned with our knowledge of the problem and of the programming language being used.

Creative challenge

The way in which you think about the data you are working with influences the algorithm you will create for any given task. With this in mind, write a program which will draw a histogram (composed of asterisks) of values in the range zero to 40 stored in an array D(5). That is, if D(1) contains six, draw six asterisks on the first line; if D(2) contains 10, draw 10 asterisks on the second line, and so on.

First, try the most obvious solution to this problem which involves using a pair of nested loops: one to draw a line of asterisks of a given length; and one to draw such a line for each element of the array. If you think about the data (in its broadest sense) used by this program, it's possible to achieve the same result using only one loop. How?

The answer will be given next month.

'When you first learn to program, it's rather like learning to drive a car. You know how to change gear, but you still have to think about it, and this leaves little room for any higher-level activity.'

Conclusion

Experienced programmers do think differently from beginners. Good programmers certainly make use of the data properties with which they are involved (this is the subject of next month's article), but as well as this, they have a clearer understanding of the process of computation. In particular, they seem to carry around inside their heads clear models for loops and ways of selecting between alternative sections of a program.

When you first learn to program, it's rather like learning to drive a car. You know how to change gear but you still have to think about it, and this leaves little room for any higher-level activity such as thinking about where you are going. Later, changing gear becomes second nature, and you are free to think not only about where you are going, but which route is the best. When the fundamentals of computation — the loop and the select — become second nature, you will be sufficiently competent to solve real programming problems. END

Selling yourself

It's one thing writing what you consider to be a bestselling program, but do you need a major company to handle the product's marketing, or should you go it alone? Wendie Pearson presents the experts' advice.

Written a bestseller recently? If you've invested time and effort in a product you believe has a good chance on the open market, don't hang around. Work out a business plan and decide whether you want to market your title yourself or through a software house.

There are many areas to consider, including duplicating, artwork, distribution, advertising, marketing and accounts, all of which could do with specialist knowledge. If you're going to trample the competition and come out a winner, you'll need to be methodical and have other people handle the areas in which you lack experience. Whether your product is a game or a small-business program, the following words of wisdom from the industry should help you on your way.

Strategy

Tim Moore, Kuma's managing director, warns against marketing a program on your own without help from a software house. 'There are problems doing it yourself,' he says. 'The cost of launch is very high and by no means guaranteed to make the product successful.

'If you don't have an established reputation, there is no guarantee that a distributor will take on the program, even if it's wrapped superbly. It may not even get past the front door of a purchasing manager.'

Moore advises would-be software authors to make sure their program comes from an established company — preferably one of the top five brand leaders. Alternatively, choosing a software house that's geographically close to you is the next best idea.

When it comes to money, a lot depends on the machine your program has been written for and how popular the machine is. 'You'll get between five per cent and 50 per cent, depending on factors such as the market-place, distribution and selling price,' says Moore. 'It also depends on what percentage of the purchase price goes on materials. If the product goes in high volume through distributors, you'll get a small percentage. If you only sell to retailers, your return can be a bit more, although your volume will be smaller.'

If this all sounds too much like hard work, it's worth talking to a company like Kuma which is used to the different procedures. 'We would shoulder all the responsibility for a product, although obviously we are flexible. The commitment to accept a product is quite horrific, and considerable cost goes into packaging, for example.

'Find out who you want to work with at the earliest possible stage so that you can get your product ready for the market-place on time,' he advises. 'Look at which software houses the distributors favour and approach them, for your own good.

'Generally it's impossible and too expensive to do it all yourself, although I'm sure there are exceptions. You're up against a lot.'

If that hasn't made you shrivel up and crawl into a corner, or at least change your marketing strategy, there is more — this time from Bubblebus. 'It's extremely difficult to get into the market without some sort of backing,' says marketing director Anne Lovejoy. 'Take your game to someone with an established name.'

Bubblebus has a number of programmers working freelance or in-house who have tried to make it alone in the past. Lovejoy stresses that if you are essentially a programmer and know little or nothing about production, printing or marketing, you might be taking a risk in doing things alone.

'We like people to be at home with the machine they work with, so stick to what you're used to. Financially, your return will depend on the breakdown of production, but generally, freelancers get a percentage royalty or an outright payment.'

Bubblebus is expanding and is looking for new programmers, so anyone with games or small-business programs for the Amstrad, the Einstein, the Commodore 8000 or the Commodore 64 should consider the company. One example of small-business software is Bubblebus' Supernews program, written specifically for newsagents.

If you have any specialist knowledge — for example, insurance, medicine, the chemical industry or engineering — it's well worth getting into vertical-market software. As well as cutting down the level of competition, you'll learn a lot from doing your own market research, and a few well-placed phone calls to establish what gaps exist in the market for specialised software can only improve your chances.

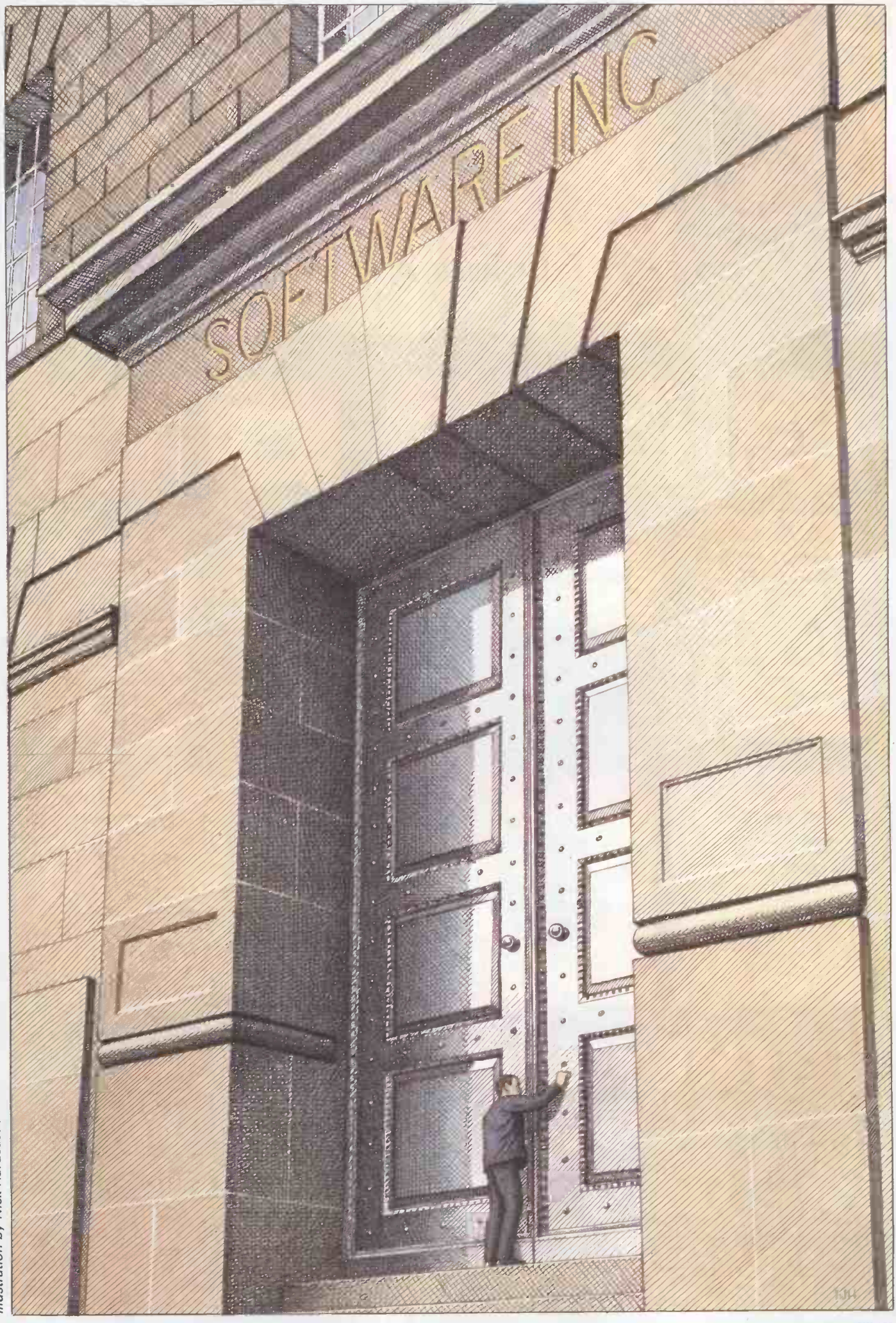
Andrew Hewson, managing director of Hewson Consultants, was being crushed under the weight of unsolicited games pouring through his letterbox when I phoned. Despite the chaos he was very optimistic, and offered various constructive hints.

'If you're worried about copyright, you have to hope that the software house is respectable and won't rip off your program,' he said, zooming in on the likely fears of every software author.

'If you have any doubts about this, don't touch the company — the contract must be backed with mutual respect, so make sure you start off on the right foot.'

Hewson's recipe for avoiding ripped-off software is as follows: 'Seal up a listing of your program and have it franked on your office franking machine, which will stamp the date on it. Have it sent to someone like a solicitor for safekeeping. Alternatively, send it to yourself, using stamps if you can't get hold of a franking machine — as long as the date can be read, it's OK. Whatever you do, make sure that the person receiving it *doesn't* open it, or all your evidence will be lost. This procedure will prove that you wrote the program at that time. If you need to prove things, it is best to have a hard copy like this rather than just something on disk, as the law on written copyright has always been the best.'

Hewson emphasises that a game must grab the viewer within the first



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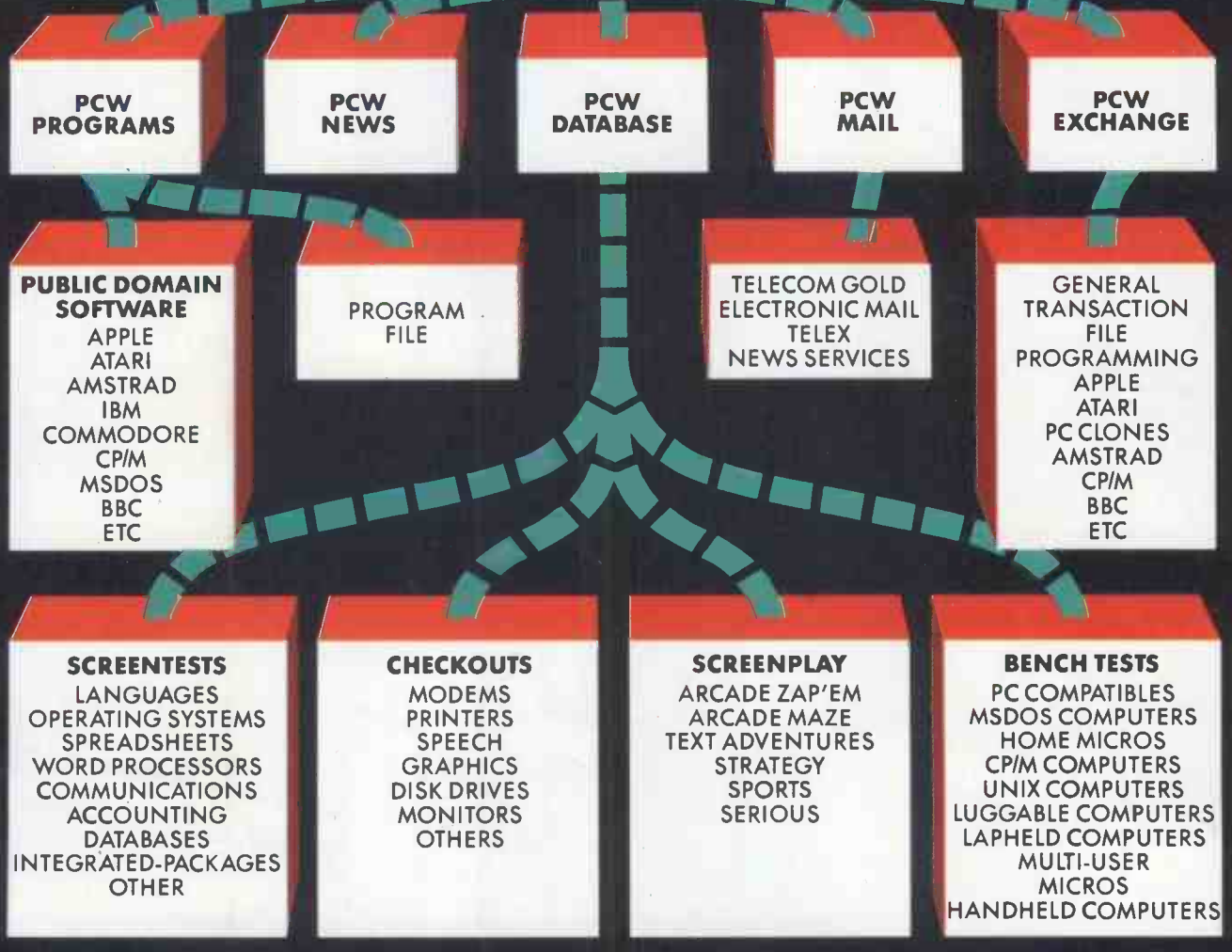

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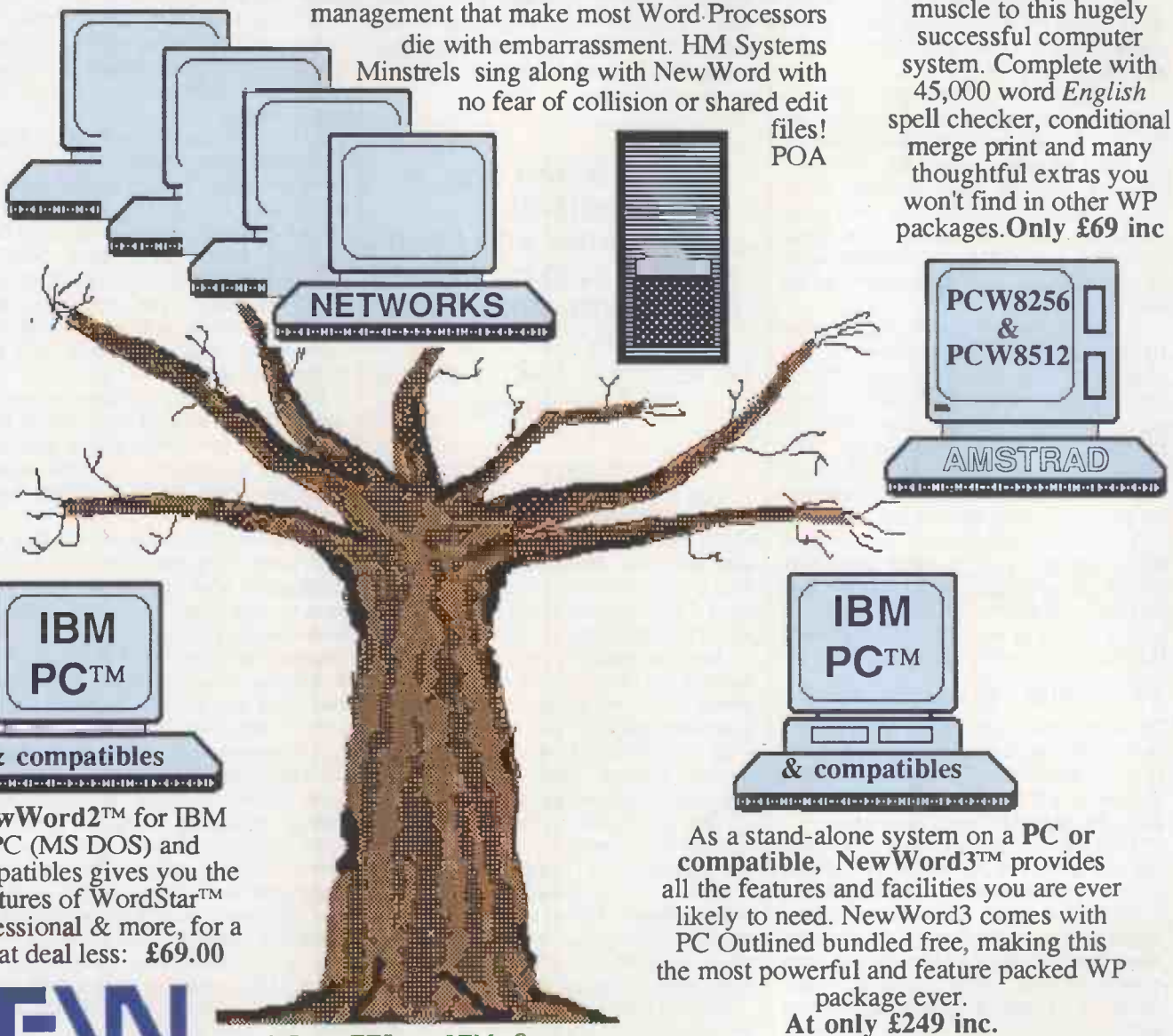

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15 minutes, or it's a loser. 'If it passes our initial screening, we will do a serious evaluation to get the background of the program and an idea of how it's structured. We will also look at modification, as there are always things an individual has missed,' he says.

Hewson stresses that his company isn't interested in fly-by-night authors who just want to have a one-off success. 'We want to develop long-term relationships with software authors and invest in the right writers. We like to look at someone's style to see if we approve of the way they work. They must be disciplined, have good graphics ability and the right approach to work.'

Strategy-wise Hewson concentrates on the strongest machines in the market-place. 'You must think of the kind of return you'll get for your product, and all this requires planning,' he says. 'Packaging and presentation must be perfect, and we'd want full-page colour advertisements in magazines and a proper sales strategy.'

A product takes about six months to emerge from conception to the shopfloor, Hewson estimates. 'You'll need a minimum of £10,000 to produce a title, taking into account things like sales, marketing, PR, accounts, production, and so on. If you're a good programmer, there's no point in doing the job yourself.'

If you're inexperienced you should allow about a year to write your first game, as you can expect to go up a few blind alleys at first. After that, if you're good at it, each game should take you six to nine months.

Financial rewards

At worst, you can expect to earn about £500 for a game, and at best, tens of thousands of pounds if it's a bestseller. 'It's not quite like being a pop star, though,' says Hewson.

The method of payment is negotiable. If you opt for royalties, expect to receive between five pence and £1 a copy for each game sold. Many firms pay a combination of an advance *and* royalties, which is the best option if you can't make up your mind. If a game does particularly well, royalties will bring in more cash, but if you're buying a house or taking a trip round the world, a lump sum payment would be more useful.

Competition, however, remains intense, and you must be capable of writing a top-quality product that is better than anything that has been seen before. If you're capable of keeping up the quality, you can make a good living writing software.

If you favour writing business applications, Ashton-Tate's advice may prove helpful. The company has an applications register which contains details of any applications written in dBaseII, and this goes out to dealers, distributors and the press. A register which caters for applications written in dBasell, III, III+ and Framework is currently being developed, and although Ashton-Tate doesn't evaluate any of these applications, the company considers it to be a good venue for marketing your application.

In addition, Ashton-Tate has been running an applications competition since May finishing at the end of July, so put your nose to the grindstone if you're interested. 'We will have a panel of judges who will judge the competition under various categories,' says Caroline Tanner, product manager.

'. . . if you are essentially a programmer and know little or nothing about production, printing or marketing, you might be taking a risk in doing things alone.'

'The first category will be for originality and inventiveness, the second category will cover customer savings and benefits, and the third category will be for the most marketable product. Developers should write in with a brief description of their application — the competition will act as an incentive for developers to show their versatility.' The person who wins the second category will no doubt do well – anything that will save companies money should prove very popular in the market-place.

'The developer must have a good market plan and be very clear about the avenues he needs to follow to market the product successfully,' says Tanner. 'There must be a good product description of who it's aimed at in market terms, and the documentation must be clear.'

Russell Altendors, managing director of Complete Software, is one example of someone who started out small. A specialist in applications for the music business, banking and the money market, he says: 'Distribution channels are haphazard, but the business market is more organised, and there are more protection societies geared to helping you protect your software. We have marketed products in the past without protection, and have lived to regret it.

'You don't need a great deal of money to produce software. Even big companies market first and produce second,' he says.

'It doesn't cost a lot to research your market — just get on your bike and approach large companies and distributors. Go through the motions of making a product — people will always talk. What you're doing is market research, the back way.

'It's easy to sort out printing: there are dozens of printers who will duplicate your work in bulk when you are ready. Up until that point, though, you are better off doing it yourself.'

If you do decide to go solo, Altendors' advice is to aim for a small, specialised market rather than the main market. Complete Software deals with applications in dBasell and Cobol, and has specialised, with good results.

At Lotus, spokesman Phil Peters says that the company encourages people to get in touch with applications ideas. 'We've introduced a scheme called Lotus Authorised Consultants for anyone who has developed products around Lotus, Jazz or Symphony. We are into joint marketing here, and we'll work with authors towards marketing their products with them.'

Lotus prefers companies which already have clients and which have experience in custom-made software, although someone with little experience wouldn't have the door slammed in their face.

What this boils down to is that you sell your own product, while Lotus markets it and pushes it. This helps spread the cost, and the idea has been well-received in the UK and abroad, particularly in the US where a number of consultancy contracts of this kind have been entered into by Lotus. Another advantage is that Lotus already has good relationships with dealers and distributors.

At Firebird, back in the games camp, marketing manager Phil Pratt says: 'Writers should go for a publisher whose style they like, and approach that company. Go slowly and approach one firm at a time — software houses don't like to think you're approaching everyone at once. They reckon that other companies have the code and that everyone has seen it.

'You must also have commercial sense, and realise that a game you share with your friends and something commercially viable are two different things.'

Firebird offers a good deal in that it pays a royalty rate based on the recommended retail price rather than the cost price. As the cost price varies, and the RRP doesn't, you're on to a good thing if Firebird is paying your royalties. The company advances 50 per cent of the product's

total sales potential at whatever royalty range is applicable, depending on which Firebird range your product falls into. Budget-priced software, on the other hand, only fetches an advance of five to ten per cent of total sales potential. Most of the Firebird Silver range is written by outsiders who submit their own programs, while the rest of the company's software is written by people doing contract work. None of Firebird's games are written in-house.

Pratt's advice on going it alone is: 'Madness, in the present climate. The costs would be phenomenal.'

Distributors

What about the distributors — how helpful are they? Quite a mixed bag, it seems, especially in terms of attitude. Microdealer scores zero out of 10 for a sullen attitude which is guaranteed to put off even those with a cast iron stomach. Spokesman Lee Gimsky, who didn't even want to spell his name, said: 'We don't have anyone here who handles press enquiries.' Further investigation revealed software buyer David Kahill lurking in the background, but even he sounded as though he was sitting on a rusty pin, growling about *PCW* 'doing an article with quotes in it.'

Over at distributors Geof's Records, managing director Geof Young took time out of a meeting to say: 'We're a great place to send games to, and we've taken quite a few titles from individuals. Programs need to be marketed properly, and we'll do that for people.'

And at R & R, managing director Roger Hulley says: 'The primary distribution system is becoming more and more important. The small, independent person can't do it properly. He can't supply small orders cost-effectively, plus man the office *and* do advertising, for example. If he can't respond as quickly as he should to keep the product flowing, we'll distribute it for him.'

R & R will look at a product and if the company thinks it's good, will recommend it to its retailers. 'We don't look for financial commitment in terms of advertising, but packaging must be good, well-designed and attractive,' he says.

'We are well-known for handling original titles, and we are the largest distributor in terms of range, carrying 4500 titles.'

Hulley points out that duplication is the most expensive part of the production process and, being a fixed cost like distribution, is something you can't avoid. Only doing a smaller run on duplication will cut down on that cost.

Rather like having a mortgage, costs decrease with time, but the initial outlay is horrendous. Primary distribution means getting the product from the duplicator to the distributor, which can cost a packet in terms of packaging, transport and Securicor. R & R will deal with all this for you.

'Go slowly and approach one firm at a time — software houses don't like to think you're approaching everyone at once.'

Satin-voiced Nick Alexander at Virgin sums it up for all the games software houses when he says: 'These days, it's very tough. Getting into the distribution network and funding the advertising is difficult. Major distributors may not take you seriously, and without them you are restricted to selling mail order.' Unless you want to sell 200 items that way, don't do it alone.

Alexander explained that the numbers you can deal with, mail order, are limited to a few hundred copies at best. He advises taking your program to a company like Virgin where you would get an advance on royalties based on the wholesale price, which works out at around 40–45 per cent of the recommended retail price after VAT. With regard to royalty, you could expect to get 10–15 per cent of net sales on a game.

Taking the plunge

If you do decide to go it alone, don't forget the colossal costs in terms of postage, phone calls and stationery which any freelance worker must shoulder. Even though you can set all this against tax, you have to pay for it initially.

You'll need a decent bank manager who is willing to give you a realistic overdraft facility – if you don't get this, go to another bank. You'll also need a decent cashflow, and reviews in the computer press won't hurt (as long as they're good).

Being a limited company will give you some degree of protection against financial damage, should it occur. But if you're a sole trader, make way for the debt collector, as you'll be personally responsible for any debts incurred.

As a limited company, you are only responsible for the money you have invested in shares. As limited companies can be bought 'off the shelf' for about £100, contact a company registration agent, listed in the *Yellow Pages,* who will fix things up for you.

Setting up your own company may be a nice idea, but it's expensive. If you choose this avenue, contact Companies House in Cardiff for details. Partnerships are rather like marriages — you will be responsible for your partner's debts, so tread carefully.

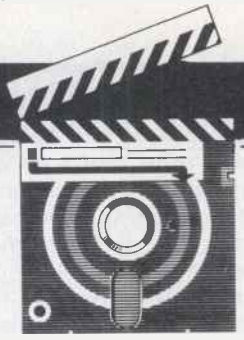
The basic points are:

- Unless you can produce a minimum of £10,000 (and preferably much more), plus a salary for yourself, don't bother.
- If you're content with selling small numbers mail order, you may stand a chance. But anything involving distributors may mean trouble unless you go to a company such as R & R which doesn't expect you to sink vast sums into advertising before it will take you on.
- If you're thinking of throwing in your lot with a software house, make sure you trust the company and that it isn't about to go bust.
- Arm yourself with a decent accountant and solicitor.
- Try the Enterprise Board, the Manpower Services Commission, the unemployment benefit office and the Citizens' Advice Bureau to see if you qualify for government backing.

Good luck! END

Software houses' requirements

Bubblebus:	Small-business programs, and games for the Commodore 64 and the 8000 Series, the Einstein and the Amstrad
Kuma:	Mostly entertainment programs for the MSX, the Amstrad and the Atari
Hewson Consultants:	Games for the Spectrum, the Commodore, the Amstrad and the BBC Micro
Firebird:	Games for the Commodore 16, the Amstrad and the Spectrum 128
Virgin:	Arcade games for various machines



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NewWord 2/3

Owen Linderholm takes a look at NewStar's NewWord version 2 word processor on the Amstrad PCW8256 and NewWord version 3 on the IBM PC.

Word processing is still the most common computer application and the one which almost every user has some interest in. There's always room for another word processing program in the market-place, but most people don't realise that there's word processing and there's *serious* word processing.

Word processing is the application most people start with. They buy their shiny new techno-toy micro and instantly want it to do something. Word processing sounds like a good idea; a chance to play with the new machine and to do something serious at the same time. At once, a word processing package is bought with, at most, a little thought to the future. Thoughts go as far as: 'Will it be able to do spelling checking?' Can I write a stunning new literary masterpiece?' Not surprisingly, the salesman says yes and shows you the first page of a sample masterpiece. You pay out your money and leave, contentedly clutching the package. When you get home you set up the machine, and you're ready to start work after a few hours wrestling with technical terms in the manual. At one o'clock in the morning you triumphantly produce a sample rude letter to the boss, and are convinced that you and technology are on the path to a successful partnership.

This dream of a brave new world begins to fade a few months later as you start to integrate the word processor into your work. Why can't it do underlining with my printer? How can I automatically get 10 copies of this letter? You call the salesman, who can't and won't help; you call the distributor who not only won't help, but won't even talk to you. Finally, you call the overseas company who wrote the program, when you're informed that to get underlining on your printer, you need an update of the program which the company will send you if you return the old version. As for lots of copies of letters, there's a wonderful program called Mailmerge which can be yours if you pay the same amount of money as you shelled out for the word processing program. After some consideration, you hang up.

By now, you have realised that there's more to this word processing lark than you had imagined. Some research shows that there are a huge number of features to look for in a word processor; some you'll want, some you won't. A month later, you feel sufficiently confident to buy your second word processing program — this costs less than the first and does quite a lot more.

This cautionary tale is obviously exaggerated, but it does illustrate the point that too many people leap before they look and often get hurt. Some word processors are suitable for business and letter writing, others for longer texts such as manuals or books. The machine on which the word processor runs obviously affects what it can offer in terms of facilities.

The old master of word processors is WordStar, which provides a lot of power and can do almost any task that is asked of it. However, it's fairly expensive and has fallen behind a little in terms of modern technology. The most recent and interesting arrival on the word processing hardware scene is the Amstrad PCW8256 (Benchtest, *PCW*, October 1985). This machine provides a micro, a monitor, a printer and word processing software for an astonishingly low price — £399 plus VAT, and as an added bonus it can run all kinds of other software.

What is not immediately obvious is that the word processing software on the 8256 is not suitable for all purposes, and some people find it difficult to use; on the other hand, some might think that any other company which tried to market an 8256 word processor is bound to fail. This is not so. NewStar has produced NewWord 2, a successful WordStar-compatible package in the MS-DOS and CP/M markets. NewStar is also selling the latest version, NewWord 3, for this range of machines.

NewWord 3

NewWord 3 is the direct descendant of NewWord 2, and is essentially an enhancement. Almost all its facilities act in the same way as NewWord 2's, except that some of the original functions have been rationalised due to the new package's extra functions. In operation, all versions of NewWord are similar to WordStar and feel almost identical in use.

But there's one significant difference — NewWord is much faster than WordStar.

NewWord 3's large, ring-bound manual is over 700 pages long, and is a comprehensive guide and tutorial to NewWord 3 and its accompanying word manipulation package, written by Oasis Systems, called The Word Plus. The software comes on two disks and includes the program, two installation programs, various example documents, and overlay and driver files for NewWord, The Word Plus and constituent modules.

The amount of information included with the package is bewildering at first, but it's easy to follow and leads you into using the program step by step. The information is not

entirely clear if you haven't used a computer before, and if you are a novice, you may experience some difficulty in understanding the rudiments. On the other hand, users familiar with WordStar will immediately feel at home.

There is little explanation in NewWord 3's documentation of the differences between computers and typewriters but, to be fair, it's quite difficult to describe the difference between ordinary typing and word processing, and ideally you need a guide or a mentor on hand to help you. As long as the initial confusion is passed, there is little doubt that most people will infinitely prefer the superior facilities of word processing.

When NewWord starts up, the display is similar in form to that which appears with WordStar: that is, a menu of commands appears alongside single letters whose keys should be pressed in order to use these commands. Below this menu is a list of files which are currently available on disk. This list features all files except certain system files; in fact, NewWord allows you to exclude all kinds of different files so that only those to be used for documents appear. When a command has been given, a message relating to that command appears with a request for further components of the command.

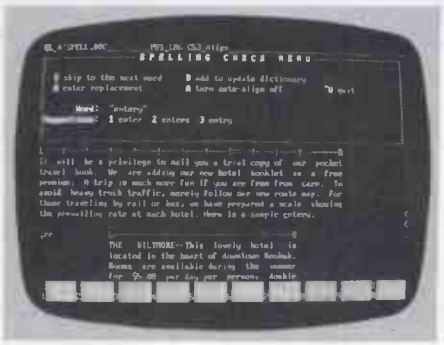
Editing

The command to begin editing a document is D. When this is pressed, instructions for using the command appear and you are asked for the name of the document to be edited. You are then presented with a large amount of information which surrounds the document editing area in the centre of the screen. The top line of the screen shows the file which is being edited, the location of the document within the cursor, and some information regarding program modes. Below this line is the main editing menu which shows you how to access the available editing functions; these functions range from moving the cursor, through deleting and inserting, to how to access the other menus. NewWord 3 has six menus which can be accessed while editing, apart from those which are available from the main menu.

Below the editing menu is a line which shows margins and tab stops, and below this is the document text. A display showing which commands have been assigned to the function keys is at the bottom of the screen.

You may think that there can't be much room onscreen for the document, and this is true to some extent — there are 12 lines remaining for display. The menus can, however, be switched off, as can the function key display, to leave 23 lines of text visible.

Text editor screen



NewWord's Installation program

In-document spelling checker

Main menu on Amstrad PCW8256

All the above editing details will be familiar to people who have used WordStar or NewWord 2, as will most of the commands. The standard NewWord 3 commands are:

Cursor movement: this can be done in several ways, either using the cursor keys, or a combination of the control key and a logically oriented set of letter keys. The movement can be as minimal as one character in any direction, or a page, or the whole document.

Erasing: the Delete key deletes characters to the left; Control-G deletes characters to the right. Words, lines or marked blocks of text can also be removed. There's an option to unerase or remedy mistakes, but this can only put right a certain amount of errors that are set in a buffer.

Other: also available from the main menu are help, paragraph alignment, insert on/off, and other menus. These menus deal with onscreen formatting; saving and dealing with large blocks of text; printer controls; shorthand commands; quick find/replace; spelling checking; and miscellaneous functions. (Some of these options and enhancements will be unfamiliar to the seasoned WordStar user.)

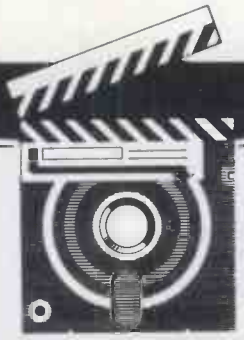
Another set of commands, printer commands, are embedded in the text and perform such functions as setting up headers and footers; turning specialised printer functions on or off; plus numerous other things. Printer commands are available in WordStar, but NewWord contains the greater number of them.

Advanced facilities

The advanced facilities in NewWord 3 which set the package apart from being just a WordStar copy are extremely powerful and useful — the *most* useful being a spelling checker. While you are editing, the whole document can be checked, or just one word, or even a word that is not part of the document. The dictionary which is provided contains 45,000 words in a compressed form. Words can be added to this dictionary as well as removed with an extremely unusual NewWord utility. The great bugbear of English users is at last removed — there's no more 'color' or 'realize'. At last, 'colour' and 'realise' won't upset a spelling checker — in fact, NewStar has already made the conversion from many Americanisms. There are two other dictionary files; an update dictionary, which holds words that shouldn't be in the main dictionary but which are often used, such as proper names; and a quick dictionary of commonly used words, which is held in memory and is used to speed up spelling checks by reducing disk access.

A marker facility for indexing to a file can be provided. This marker is invisible, but is used by the index command on the main menu which produces another document with the extension .IDX, which in turn holds an index of the document which is using the marked words. It's also possible to produce an index from all words except those given in a special file of exclusions. In a similar way, tables of contents can be produced using a different marker and the table of contents command at the main menu.

Another unusual feature of NewWord is its mathematical capabilities. The first of these is a calculator; this operates from within the menu area, and will work out a line of calcula-



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tions and provide the answer. The other capability adds all the numbers in a marked block and displays the result, which is useful for totalling columns of figures as you go.

Yet another addition to NewWord 3 is the shorthand option on the editing menu; this allows the user to define various keys to hold sequences of characters. The shorthand option is accessed via the ESC key, so ESC-N can be defined as shorthand for 'NewWord', and whenever this is typed, the whole word will appear. Several versions of NewWord could be set up for various purposes, with different shorthand definitions and even different dictionaries or exclusion files.

One important thing to note about NewWord is that all these facilities come as part of the basic program, as well as other facilities such as mailmerge with conditional merging. This allows you to send various versions of a standard letter to different people, so the letters are tailored to the people to whom they are addressed.

Another important point about NewWord is the way in which it interfaces with the machine on which it is running. All the calls to routines within the machine are documented, so they can be moved to different addresses or patched and customised in various ways. NewWord 3 should run on any machine that has even the slightest pretensions to IBM compatibility. Software writers seem to have forgotten that the non-IBM market is as big as the IBM market, and is usually more knowledgeable. The more complex of the two NewWord installation programs even makes the process of modification simple, and gives all the help that could possibly be provided.

NewWord 3 does, however, suffer from many of WordStar's faults. There is a bewildering array of commands, some of which aren't really necessary and can easily confuse people. This is compounded by the fact that a lot of the keys used for the commands are not those that you would intuitively guess to be correct. Neither does NewWord 3 have the feel of a real screen editor: cursor movement around the screen and editing area is not as fast as I would like. There's some delay between action and result, despite the fact that the program runs at least twice as fast as WordStar.

In the *PCW* office, I have NewWord installed with Turbo Lightning, Borland's memory-resident spelling checker and thesaurus, and with a mouse installed to drive the cursor and mark blocks of text. This is partly in an attempt to get an IBM-compatible to emulate more modern, faster micros which use WIMP interfaces. Unfortunately it doesn't really work and I won't be satisfied until I see a word processor that practically reads my mind and shows onscreen exactly what I want to appear on paper.

This review has been done on a very fast hard disk system, a 640k HP Vectra. When NewWord 3 runs on a floppy disk system with less memory, the program slows down considerably. This is especially true of its additional features like indexing and spelling checking. I imagine that the program would also run more slowly on an IBM too, simply because that machine's processor speeds are slower than the Vectra's.

'. . . I had no difficulties whatsoever when transferring from one version to the other, even though they run on different machines.'

The Word Plus

The NewWord 3 package includes The Word Plus. This is a set of modular utilities, mostly for spelling checking and correction. The Word Plus uses the same dictionary as the spelling checker in NewWord 3 and is really rather redundant, although it does work more quickly on large documents. Various other programs are included which add facilities to count the number of words in a file, look up anagrams, and even help solve crossword puzzles.

The main part of The Word Plus package consists of four programs which find spelling errors, help find corrections, make the corrections and organise these actions; another program automatically hyphenates text so that if it's printed in short columns, it looks neater. A program called Lookup consults the dictionary for a particular word and lists all the words that are similar to it or which could conceivably be misspellings.

Find is a program which can help solve word puzzles. If asked to look-up 'ab??re', it finds only one word to match that pattern — abjure. Anagram is a program which acts in a similar way but finds anagrams instead of word matches; and another utility counts words in a document file.

The final The Word Plus programs allow words to be removed from and added to the main dictionary in order that specialised vocabulary can be added, and so on.

Price

NewWord 3 costs £249.95, and it remains to be seen whether this is good value or not. It seems to be an unusually high price, considering NewStar's previous low-price policy.

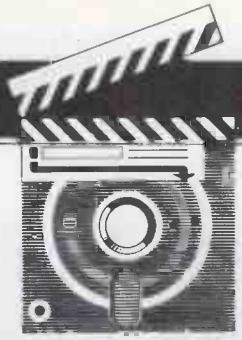
NewWord 2

NewWord was originally written (again, like WordStar) for machines using MS-DOS and CP/M operating systems; therefore, it would be a relatively easy task to convert the program to run on the PCW8256. The only question is: why do it? After all, the 8256's strong selling point is that it's the ultimate word processing machine — cheap, and with everything you would want as standard. Why should anyone need more word processing programs, tools or utilities?

One answer lies in the fact that I am sitting in front of a PCW8256 at this moment, happily typing away but not with LocoScript. I have always used word processors which have more in common with WordStar than any other program, and despite all these programs' failings, I have become used to them. The cost of another program is really a small price to pay in order to feel truly comfortable, and also to be able to get down to work with only 10 minutes spent setting up the program.

Another reason is that NewWord 2 will also work with the Amstrad CPC6128. This is a market which has access to CP/M software, but only when the software is converted to 3in disk format. NewWord gives users a high-powered word processor at a low price, and, of course, compatibility with the PCW range as well as a wide range of other micros.

NewStar provides thorough documentation with the Amstrad version of NewWord 2. The standard, extremely thorough documentation which accompanies MS-DOS or ordinary CP/M versions is included, as well as an extra document which covers setting up the program and using it with the PCW8256. The main NewWord manual is similar in quality to that described in the NewWord 3 part of this review. The documentation provided by NewStar doesn't match up in looks, but the information it contains is extremely impor-



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tant. It shows how to alter various function keys so that non-standard keys can be used for useful functions within NewWord, and also explains how to make the best use of the various programs and files which make up the NewWord package.

The version of NewWord 2 which I was supplied with had already been set up for use with a memory disk. This is effectively a RAM disk controlled by CP/M +, and behaves exactly as if it were a disk drive. The advantage is that this RAM disk reacts much more quickly than a real disk drive, but the disadvantage is that if the machine is turned off, all data on the memory disk is lost. I nearly fell into this trap immediately after typing in the first page of this review: I left NewWord, having saved the file, but fortunately remembered to re-enter NewWord and copy it across to the real disk drive just before I switched off the computer.

Differences

One immediate difference between NewWord 2 on an Amstrad and NewWord 3 on a fast IBM clone is that the former is very much slower — it's like using a slow word processor on a slow machine such as an IBM PC. Another problem is the need to conserve memory space and be careful of which files are kept on the memory disk.

A feature of NewWord 2 which has been removed from NewWord 3 is the gauge at the top-right of the screen which shows how much available memory space is being taken up by the current file; already, after I've completed only two and a half pages, it's a quarter full, because the gauge measures how much of the current memory space is taken up rather than how much space is available. If the space in memory is filled, then the file is saved to disk and the disk is used as virtual memory; only the part of the file which is being dealt with is held in memory — the rest is on disk. With the memory disk, the amount of memory space left and the amount of disk space are equivalent, so only files of under, say, 12 pages can be worked with in the memory disk.

Another problem is the small amount of space available on a 3in disk for the PCW8256. There aren't many disks in the *PCW* office which have spare space on them, and I found myself desperately searching for one that had enough space left to hold what I had typed so far. But I failed, and had to save two separate chunks of the document on separate disks. This illustrates the versatility of powerful word processor programs like NewWord: there's no difficulty in performing complicated operations on sections of the text. The problem of disk space is more to do with the machine and the lack of disks than anything else.

NewWord 2 comes with The Word Plus's predecessor, The Word. This offers much the same facilities as The Word Plus, but not all of the more unusual ones.

Installing NewWord 2 is simple — you just run a program called NWINSTAL. This has a wide-ranging menu which covers all aspects of the program and has various options for each heading. The installation program also lets you change the printer which is being used, and gives innumerable details regarding the way in which the program works. Help is provided on every entry within NWINSTAL.

Lack of facilities

NewWord 2 is similar in many ways to NewWord 3, except where the advanced features are concerned. NewWord 2 can't perform spelling checking from within the program, nor can it create indexes or tables of contents. It doesn't have a calculator or other mathematical functions, and you can't set up shorthand keys. The printer controls are also less comprehensive, but are still so extensive that I can hardly think of uses for them all.

Price

The price of NewWord 2 for the Amstrad PCW8256 and the CPC6128 is £69, which represents good value for anyone who needs more word power than Locoscript can offer. For example, it would be inadvisable to set out to write a novel using Locoscript, but as long as my epic was split up into sections and a good supply of 3in disks was available, I would be happy to use NewWord for such a task.

Conclusion

The most striking aspect of this NewWord 2/NewWord 3 comparison is that I had no difficulties whatsoever when transferring from one version to the other, even though they run on different machines. My only problems were with adjusting to the 8256's rather sub-standard screen and to its rather unusual keyboard. My biggest quibble is with the printer, which was only set up to take single sheets and which I found quite difficult to use.

NewWord 3 for MS-DOS, PC-DOS, TurboDOS, Concurrent DOS and CPM/86 is, however, not quite such an attractive proposition. Although it represents astonishing word processing power while retaining compatibility, the current pricing anomalies and the trend to reduce the cost of software to the end-user may yet prove to be a difficult barrier to cross.

Nevertheless, NewWord 3 is a program which provides every facility a professional writer could want. It's almost ideal for book manuscripts, but rather pricey for those who require rather less power in their processor.

NewWord 2 and NewWord 3 are available from NewStar Software, 200 North Service Road, Brentwood, Essex CM14 4SQ, tel: (0277) 220573.

'He's not that clever — he can only program in Basic.'

Batch magic

DOS batch processing is notoriously slow, but it does have its uses. John DeHaven provides a compendium of tricks, techniques and curiosities for your reference.

What is the world's slowest interpretative language? This dubious honour surely belongs to DOS batch processing, which runs like *granny*. Let's go ahead and stretch a point and call DOS batch processing a language. It is useful to think of the statements of this language as including the traditional batch processing commands, all DOS commands and the names of any executable files (including other batch files) that are available in the default directory or via PATH.

Unfortunately, even if we generously expand the definition in this way, DOS batch processing still isn't a complete language, since it is not interactive and cannot add or even count. Even so,if you hold your jaw a certain way there is plenty of unsuspected power to be found. We'll explore generation and passing of variables, file creation, true calls with return, giant loops under control of 'FOR' and recursion. Batch processing is not really as boring as IBM and Microsoft try to make it seem.

The traditional (IBM/Microsoft) discussion lists only six batch processing commands, and we'll assume you have a working knowledge of these: ECHO, FOR, GOTO, IF, PAUSE, REM and SHIFT. Of these, ECHO is useful outside of batch processing, and FOR can be used outside batch processing to do some non-trivial things. Four other commands, COMMAND, CLS, EXIT and SET — are not usually mentioned as part of batch processing, although they would rarely be used anywhere else. We will use them all here.

Speed

One reason batch processing runs so slowly is that it makes a disk call for each line of code. Evidently then, a given batch file will run faster if you can reduce the number of lines in it. After you have a batch file running, you may be able to reduce the number of lines by combining some of them in a FOR structure. The following rules apply:

1 If statements have no argument, they may be combined;
2 If statements have the same argument, they may be combined; and
3 Statements with the same argument may also be combined with statements with no argument.

Here are some examples to illustrate the above points:

```
FOR %%A IN (CLS VER VOL BREAK
  VERIFY SET) DO %%A
FOR %%A IN (CLS A: ECHO PAUSE
  CLS) DO %%A Insert back-up
  diskette
FOR %%@ IN (CLS C: IF A:) DO
  %%@ EXIST PP. BAT PP
FOR %%@ IN (MD CD) DO %%@
  \ SDIR1
```

These work because certain commands like CLS and PAUSE (and certain other executable files you might have created) do not take any arguments, so when FOR expands them with an argument, the argument is ignored.

Batch files will run much faster if you allocate extra 'buffers' with CONFIG-SYS. Briefly, this specification allocates memory for disk I/O, one buffer per cluster read from diskette. When a disk call is made, these buffers are checked first, and if the record is already here, no physical disk reference will be made. The overhead cost is about 1k per buffer (*not* 512k as IBM states), above the default two buffers. Here is how you can be sure you have those extra buffers activated:

1 The disk from which you boot must contain a file called: 'CONFIG.SYS.'
2 This file must contain the statement:
  BUFFERS=9
  although a larger number will be OK.
3 For good measure, include the following two lines:
  FILES=99
  DEVICE=ANSI.SYS

The first of these will allow a much larger number of file handles to be opened than the default eight, at a cost of only 3783 bytes of memory. Many programs need more handles than eight, and you'll be disappointed in the performance of some of the following examples if you don't allow this extra latitude. As for the assignment of the ANSI.SYS driver, I can't imagine anyone with more than 16k of RAM not wanting this, because it allows control over screen colours and attributes, arbitrary cursor positioning and even keyboard reassignment (16-character keyboard macros at the DOS level without a fancy program!)

If you are echoing many lines to the display, you will find that it is much faster to put in a single line to TYPE a file that contains your multiline display. This will cost some disk space, since you will have to create this extra file. I usually denote such files as .SCR (for 'screen') files.

If you use labels in a batch file, those that are most likely to be called should be put near the beginning, as the batch processor scans the entire file from the beginning every time it looks for a label.

Control

Whether you use ANSI.SYS or not, the display understands the sequence ESC-[-2-J to mean 'clear the screen'. The CLS command in fact sends just this sequence to the screen. This means that you can include this string in any statements you ECHO to the display and in any file that you might TYPE to the display. If you write your batch files with an editor that allows the insertion of the ESC code, you will be able to echo ANSI control sequences from the batch file. Some very nice effects are available. If we let the expression '^[' stand for the ESC code, the sequence

```
CLS
ECHO^[[2JInstall the back-up
   diskette in drive A.^G^[[5m
PAUSE
ECHO ^[[2K^[[0;1m
```

will clear the screen and display the prompt message followed by a beep and a *blinking* pause message. When a key is struck, the blinking pause message is wiped out.

You could output blank lines with ECHO followed by two or more spaces with DOS 2.x, but this no longer works with DOS 3.x. The sequence ESC-space-<255h> will work with DOS 3.x, the idea being to echo the invisible character 255 hex. On

an IBM machine you can get this character if you hold the ALT key and press 2-5-5 on the numeric keypad. On other machines, or with certain editors, the procedure may be different.

You may want to shut up the display at some stage. To do this you set ECHO OFF so that you won't see the batch procedure running, but certain commands still natter at you. The bit bucket 'file' NUL may be used for this. If your file contains the statement

```
DEL *.BAK>NUL
```

then it will attempt to delete all backup files. If there are none, the error message will be redirected into the 97th dimension and will not be seen. You could also get the effect with the statement

```
IF EXIST *.BAK DEL *.BAK
```

but this would require a bit of extra time for the existence test. IF EXIST only works for files in the *current* drive and directory, which is sometimes a bother.

Variables

There are four kinds of variables in batch processing. %0 returns the name of the batch file itself while %1, %2, %3 represent tokens passed in on the command line after the name of the batch file. %%A, where 'A' may be any character, is the form of a variable that takes successive values of the 'IN' portion of a FOR statement.

The usual literature does not make it obvious that a variable in the form %WORD% will return the value of a variable called 'WORD' that has been set into the 'environment'. To install such a variable, you execute a command, in or out of a batch file, of the form

```
SET VAR=SOME STRING
```

where VAR is the variable name, and the value is any string.

To see how SET works, try the following batch program.

```
ECHO OFF
SET X=NOT
ECHO THIS DOES %X% FAIL.
SET X=
ECHO THIS DOES %X% FAIL.
```

These variables set into the environment are made available to all executable programs, and this is how they are accessed by .BAT programs.

Often you may need to control batch file behaviour according to whether a variable *exists* or not (regardless of its value). The IF statement does not directly test for this; you must supply some minimal string on both sides of the '==' operator. I'll use a minimal string of '@' to show the two basic kinds of existence tests.

Executes if the variable %1 *exists*:

```
IF NOT %1@==@ . . .
```

Executes if the variable %1 *does not* exist:

```
IF %1@==@ . . .
```

Later we'll see some other uses for these techniques but, as an example, suppose you have a program that becomes memory-resident when called, and if called again will install another copy of itself, gradually eating up your available memory (some otherwise excellent commercial products have been known to behave like this). The program is not used every day, and is too large to install no matter what with AUTOEXEC.BAT. What you need is a batch program that calls this maverick program if it is needed, but only once per session. Let's suppose our resident-type program is called DBSORT. A batch file fragment that would do the trick might be:

```
IF NOT %SORT%@==
   INS@ DBSORT
IF NOT %SORT%@==
   INS@ SET SORT=INS
```

After DBSORT is installed once, the variable SORT is set to INS in the environment and, therefore, DBSORT will not again be called until the machine is rebooted.

Creating a file with a batch file

The command 'ECHO This is a test message >TEST.TXT' will create a one-line file named TEST.TXT which contains the words 'This is a test message'. One reason to do this would be to set a flag that will last between sessions. Things set in the environment go away with the power, but a temporarily-created file will not, and its existence may be tested by the IF EXIST statement of batch processing. Your AUTOEXEC.BAT might want to set up a large print spooler if you have a dot-matrix printer installed, and omit the spooler if a daisywheel unit is attached. The following statement in AUTOEXEC.BAT would do it, based on the existence or not of a file called DAISY.

```
IF NOT EXIST DAISY BIGSPOOL/128
```

At some point in your configuration procedure you could create the flag file if required with the statement:

```
ECHO Daisywheel printer installed>DAISY
```

You can create a temporary file and then use the temporary file to answer a question. Two commands that are hard to automate are DEL and PRINT, because under certain conditions they ask questions of the user. The following batch sequences will proceed without pause:

```
ECHO Y >YES
DEL *.* <YES
ECHO LPT1 >PSPEC
PRINT %1 <PSPEC
DEL PSPEC
```

In each case, if the procedure asks a question, it finds a file waiting with the answer, and it takes the answer from the file.

A multiple line file may be written a line at a time, by using the '>>' operator, which adds a line to a file. '>>' creates the file if it doesn't yet exist. The following sequence writes a three-line file (try it).

```
DEL TEMP
ECHO This is the first line
  >>TEMP
ECHO This is the second line
  >>TEMP
ECHO This is yet another line
  >>TEMP
TYPE TEMP
```

You could even write another batch file this way and then execute it! Here is how to create a program that keeps an activity log. First create a file that contains only a carriage return and a line feed by the following procedure:

```
COPY CON CRLF.BAT <return>
<return>
<CTRL-Z> <return>
```

We've named this weird little file CRLF.BAT because there is another important use for it that we'll discover below. One use for this will come clear if you try

```
DATE <CRLF.BAT
```

and then

```
DATE <CRLF.BAT >LOG
TYPE LOG
```

This, then, would be your activity log program fragment. It records a date and time in file LOG whenever it runs:

```
DATE <CRLF.BAT >>LOG
TIME <CRLF.BAT >>LOG
```

For maximum speed we compress this to:

```
FOR %%@ IN (DATE TIME) DO
%%@
  <CRLF.BAT >>LOG
```

You could also use this technique to put *data* in a file. Below we will see how a batch file could read such data.

Chaining

As is well-known, if you name another batch file in a batch file, the next batch file begins executing. In this way batch files may be chained. This chaining can be used to cause an abrupt exit from a long batch file that runs slowly. Suppose the batch file has the following structure:

```
:LABEL1
<FIRST PROCEDURE>
GOTO EXIT
:LABEL2
<SECOND PROCEDURE
GOTO EXIT
.
.
.
:LAST LABEL
<LAST PROCEDURE>
:EXIT
```

This is likely to execute slowly because after any given procedure is executed, EXIT is called and the batch processor must read the whole file from the beginning to find the

label in the very last line. If the do-nothing file CRLF.BAT is still available to DOS, the preceding program may be considerably speeded up by writing it in the following form:

```
:LABEL1
<FIRST PROCEDURE>
CRLF
:LABEL2
<SECOND PROCEDURE
CRLF
.
.
.
:LASTLABEL
<LAST PROCEDURE>
```

Now, instead of searching the file for ":EXIT", the program will directly chain to CRLF and abruptly quit.

Using SHIFT

There are two good uses for the SHIFT command: to allow an indefinite number of command line parameters and to count. Suppose you have a print formatter called PRT.COM. You could feed several files to it with a batch file containing the following:

```
FOR %%@ IN(%1 %2 %3 %4 %5
  %6 %7 8% 9%) DO PRT %%@
```

This is fast enough, but is limited to nine arguments. This little program will accept unlimited arguments, using SHIFT:

```
:DO
  IF %1@==@ GOTO ENDDO
  PRT %1
  SHIFT
  GOTO DO
:ENDDO
```

or quicker:

```
:PROC
  IF %1@==@ GOTO ENDPROC
  PRT %1
  FOR %%@ IN(SHIFT GOTO) DO
  %%@ PROC
:ENDPROC
```

This is the most general form that will not execute if there are no arguments. A shorter (and therefore faster) version of this basic loop may be used, but this form will execute at least once, even if there are no arguments. Use it by all means if this does not matter.

```
:LOOP
  PRT %1
  SHIFT
  IF NOT %1@==@ GOTO LOOP
```

or quicker:

```
:LOOP
  PRT %1
  FOR %%@ IN(SHIFT IF) DO %%@
    NOT %1@==@ GOTO LOOP
```

If we can use CRLF.BAT to break out of the program, we can have the best of both worlds.

```
:LOOP
  IF %1@==@CRLF
  PRT %1
  FOR %%@ IN(SHIFT GOTO)
    DO %%@ LOOP
```

Soon we'll see a more advanced application of this principle. You can also use the command-line tokens as items to be counted. Write TEST.BAT:

```
ECHO OFF
CLS
:DO
  ECHO Display for token %1
  SHIFT
  IF NOT %1@==@ GOTO DO
```

Run TEST with several calls to see this work.

```
TEST
TEST 1 2 3
TEST X X X
TEST NOW THREE WORDS
TEST 1 TWO 3 2+2 5 6 7 8 9 TEN 11
```

Batch procedures

You may want to create a complex batch file to automate an obnoxious procedure, but perhaps you don't use it often enough to remember its complex call syntax.

The answer to this is to set the batch file up so it will give you some instructions if called with no arguments. For example, here is the start of my batch program 'DLOAD.BAT' which permits unattended downloading of partitioned datasets from the IBM mainframe, a procedure that could take hours. The actual download procedure is so slow that batch file speed is a negligible factor, so nothing is compressed into FOR loops here.

```
ECHO OFF
CLS
IF NOT %1@==@GOTO START
  ECHO DOWNLOAD PARTITIONED
    DATASETS FROM MAINFRAME
    ECHO
  ECHO SYNTAX: DLOAD DSN DIR
    MEMBER1 MEMBER2
    MEMBER3 . . .
  ECHO Where DSN  is the fully
    qualified dataset name,
  ECHO        DIR  is the
    destination subdirectory.
  ECHO and MEMBERn
    are any number of member
    names.
  CRLF
:START
SET DSN=%1
SHIFT
SET DIR=%1
FOR %%@ IN(MD SHIFT) %%@\%1
MD\%1 >NUL
SHIFT
:DO
  IF %1@==@ CRLF
  <DOWNLOAD PROCEDURE>
  SHIFT
  GOTO DO
```

Several techniques are used in this program. If DLOAD is entered with no arguments, the first IF statement detects this, and the instructions are echoed. When DLOAD is called with arguments, the first variable is set to %DSN% for later use by <download procedure>, then is shifted away. The second variable (now %1) is stored as %DIR% and then creates the desired subdirectory before banishment by shifting. The 'members' are shifted in turn into position %1 by the loop, until they are all used up. Exits from the program are by fast calls to CRLF.BAT, which was created earlier. If the attempt to make the subdirectory fails, perhaps because the subdirectory already exists, the resulting error message will be shunted off to NUL.

Menus

Fig 1 shows a program to control some settings for an Epson/IBM-type printer. It will display a menu if called without argument, but this menu may be bypassed if the user knows what to enter.

Calling batch files

Now we will see how we can call another batch file and return from it, as though it were a subroutine. If you chain to another batch program, that's it — there is no return. The secret of true calls is the 'COMMAND' statement.

'COMMAND' loads another copy of part of COMMAND.COM into memory and gives it control. This does not consume as much memory as IBM would have you believe, since it does not load another copy of the whole 28k or 40k COMMAND.COM — it only loads another copy of the *command processor* which is about 4k. The new command processor runs quite independently of the previous one.

The command 'EXIT' purges the currently executing command processor and puts you back to the previous one. EXIT does nothing if entered into the one and only original command processor.

It is not obvious what the use of this is until you remember file redirection. What happens if the new command processor takes its input from a *file*? Try it by making a file full of commands, ending with EXIT. We'll call it GIZMO. (If you don't end this file with EXIT you'll never return; the computer will hang up for good.)

```
VOL
ECHO This line is from
  the called file.
VER
EXIT
```

Next create DRIVE.BAT and run it:

```
ECHO OFF
CLS
ECHO This line is from
  the main program.
```

```
PP.BAT
ECHO OFF
CLS
IF NOT %1@==@ GOTO %1
ECHO Enter PP E for elite                PP P for pica
ECHO       PP W for wide                 PP C for condensed
ECHO       PP B for BOLD                 PP D for doublestrike
ECHO       PP R to reset printer
CRLF
:E
ECHO ^[M^[1^G >PRN
CRLF
:P
ECHO ^[P >PRN
CRLF
.
.
.
```

Fig 1

```
COMMAND <GIZMO
ECHO This line is again
  from the main program.
```

This illustrates the general principles. We can vastly improve on this, though. The special form:

```
COMMAND/C string
```

says, in effect, to invoke a new command processor, feed it 'string' as an input command, execute the command, then EXIT. If we feed a command processor a batch file name, it executes the batch file. Because of this we can rename GIZMO to GIZMO.BAT and drop the EXIT command from the end, thereby converting it into a plain vanilla batch file. Change DRIVE.BAT as follows:

```
ECHO OFF
CLS
ECHO This line is from
  the main program.
COMMAND/C GIZMO
ECHO This line is again
  from the main program.
```

This is almost the effect we want. We are spared the installation message from the command processor, but the secondary command processor echoes everything. Even if you put ECHO OFF at the beginning of GIZMO.BAT it will still echo the first prompt and the ECHO OFF. If it is *really* important to silence everything, you can use redirection. Change the programs as follows:

GIZMO.BAT:

```
VOL >CON
ECHO This line from the
  called file. >CON
VER >CON
```

DRIVE.BAT:

```
ECHO OFF
CLS
ECHO This line from the
  original batch program
COMMAND/C GIZMO >NUL
ECHO This line again from
  the called program
```

The trick here is to send all output from the secondary command processor into NUL. Then we override this in the called batch file with redirections to CON for everything we really want to see. (More examples on this are given below.)

This call/return procedure can be nested to any depth that your memory allows, and you can play tricks with variables. Try these three batch programs.

MAIN.BAT

```
ECHO OFF
CLS
ECHO MAIN here. Are you watching?
COMMAND/C SUBFILE1 file speak
sub %1 >NUL
ECHO Whew! We made it back to
MAIN again.
```

SUBFILE1.BAT

```
ECHO This is %3%1 1 %2ing. >CON
COMMAND/C %3%12 %1 %2 %3
%4
ECHO Goodbye from %3%1 1.
>CON
```

SUBFILE2.BAT

```
ECHO Now %3%1 2 %2s. >CON
IF NOT %4@==@ ECHO
  What does "%4" mean? >CON
```

Try launching this collection with 'MAIN' and 'MAIN AXOLOTL'.

More practically, suppose I have a lot of programs to download from the mainframe with DLOAD.BAT. What I want are several members from each of several partitioned datasets. This whole procedure might take all night — I plan to submit a huge metabatch file when I go home in the evening. I can create a driver for DLOAD.BAT and off we go:

```
COMMAND/C DLOAD BNW.TE.CLIST
  TECLIST M1 M2 M3 M4 . . .
COMMAND/C DLOAD BNW.TE.SAS
  TESAS M1 M2 M3 M4 . . .
COMMAND/C DLOAD BNW.TE.
  TABLES
  TETABLES M1 M2 M3 M4 . . .
```

If nothing goes horribly wrong, I should return in the morning to find the selected members neatly copied into appropriate subdirectories.

Recursion

By now you may be saying 'All that is very well, but if a batch file can be made to call another file, what would happen if you asked it to call *itself* or maybe call another batch file that called the first one, or maybe . . .'

Being of an inquisitive nature I explored some of these questions. The answer, in general, is that you *can* have any number of recursive chains or calls, so long as memory and file handles are available. If you are careful of counts and end conditions, you won't get in too much trouble. On the other hand, if one of these were to run away . . .

To ease into this subject, we'll consider recursive chaining first. Recursive chaining is an alternative to SET that initialises variables for further use by the program. The difference is that this way the program sets %1 through %9, so an operation like SHIFT might be used against them. Nothing fancy is needed for recursive chaining. Consider a file called CHAIN.BAT:

```
ECHO OFF
CLS
IF %1@==@ CHAIN 1 2 3 4 5 6 7 8 9
:DO
  ECHO <DO SOMETHING WITH
    FILE%1>
  SHIFT
  IF NOT %1@==@ GOTO DO
```

Here is a catalogue printer for your hard disk. Your various subdirectories are 'remembered' in the recursive call statement.

CAT.BAT

```
ECHO OFF
CLS
IF %1@==@ CAT DBASE LOTUS
  ORD WRK C
CD\
DIR | SORT >PRN
:LOOP
  DIR \%1 | SORT >PRN
  FOR %%@ IN(SHIFT IF) DO %%@
    NOT %1@==@ GOTO LOOP
```

CAT.BAT will print catalogues for any arbitrary selection of directories if called like this:

```
CAT DIR1 DIR2 DIR3 . . .
```

Suppose you have a file card ACTION.DATA which expects to find data in the form of tokens in a file called DATA.BAT. Possibly DATA.BAT was generated by another program which could be another — or even this — batch file. DATA.BAT contains a statement as follows:

```
ACTION DATA1 DATA2 DATA3 . . .
```

ACTION.BAT starts as follows:

```
IF %1@==@ DATA
```

As we can see, if ACTION.BAT is called with no arguments, it will immediately chain to DATA.BAT which calls ACTION right back, passing DATA1, DATA2, DATA3 . . . to it as %1, %2, %3 . . .

So far I haven't been able to think of something I needed to do with batch processing that couldn't be done more easily some other way. No doubt the Lisp-wallahs out there will immediately think of several important applications. On the other hand, this may be one of those case which vividly illustrates the difference between what you get away with and what's useful. END

BIBLIOFILE

Pascal programming on the Mac is the order of the day, with a sprinkling of IBM PC graphics to follow. David Taylor reviews this month's book selection.

Pascal fruits

Title: Pascal for the Macintosh
Authors: Henry Ledgard & Andrew Singer
Publisher: Addison-Wesley
Price: £18.95 (paperback)

The Mac's too matey to program, I find. With a well-stocked hard disk itching to demonstrate this or have a go at that (or swapping the disks if you must), MacOperatives soon find that with Microsoft's Word and Chart, good-old MacPaint and perhaps Think Tank, and certainly Jazz, there's not so much you can't tackle without, so to speak, having the bonnet up.

The Mac's mousey environment is, moreover, ill at ease with programming's gobbledygook. It takes all sorts, I know, but personally I'd sooner point the mouse and go than key in lines such as:

```
if NewArrival. IDNum < Start. IDNum
then
  begin
    NewArrival. Next:=Start;
    Start:= NewArrival;
    Down:= True
  end
```

Besides, Pascalling has never struck me as nearly so much fun as Niklaus Wirth made out. Anyone who names their computer language after an obscure French mathematician (Blaise Pascal) and has their sights set on the educational market should be treated with caution, I'd maintain.

Pascal has always been quite easy to master, I'll give you that: code written in blocks, full of procedures. But until now you had to sit down and plan ahead, scribble things down to compile before you could run. The release of Mac's Pascal finally brings an interactive interpreter to hand (you can see more of what goes on and interfere as programs run), but even so, Pascal scarcely has the kind of bash-on-regardless mentality which a fancy-free Mac tends to encourage.

Still, Messrs Ledgard and Singer seem smitten, and have come up with a very jolly book which aims to prod you towards Pascal problem-solving without boring you to tears learning syntax, parrot-fashion. It's jolly because the lads are Sherlock Holmes fanatics and (as in their pre-Mac tome, *Elementary Pascal*) have devised little mysteries for the Great Detective and Doctor Watson to solve with the aid of an Analytical Engine (copyright Charles Babbage).

The idea is that you coo along with Watson at the force of precise, logic-

al **thinking** exhibited by Holmes, not to **mention** the Engine. Then you think — Aha! I could do that, using MacPascal. Quite so. Elementary. It's all very silly, but at any rate differently jolly, unlike the usual run of narcoleptic Pascal primers.

In the end, you can use Pascal to draw squares or a bar chart. You can run a program which, given the properties of cigar ash, identifies the brand of cigar (very Holmesian is that) or one which will keep your golf score (which isn't). Not quite *The Speckled Band*, perhaps, but you will soon find that you've grasped the principles of the algorithm, say, or have got the hang of arrays and strings and mugged up on Pascallian syntax without hardly noticing — all very useful if you're to persist with this urge to program on a Mac.

The book is very handsomely produced, which for nearly £20 it better had be.

Chartist's materials

Title: Presentation Graphics on the IBM PC
Author: Steve Lambert
Publisher: Microsoft Press
Price: £16.95 (paperback)

They're a very nice series, these glossy paperbacks from Microsoft, expanding on MS-DOS or Word or what have you. Funnily enough, Microsoft Chart is what we have here for one-time Washington locksmith Steve Lambert to fiddle with and thus reveal columns, bars, lines, pies, scatters, and so forth, the way impact-mad boardrooms like 'em.

I'm sorry to bring on the wet blanket again, but if gee-whiz presentational graphics are what you need, the otherwise inestimable IBM PC just isn't the first machine to spring to mind, as arty-smarty it's not.

If you'd stop fiddling about with Pascal on that Mac, you'd find that machine does a nifty job at drawing what you will. IBMs can do better if you're talking AT with an enhanced colour card and the new sooperdoop monitor, and so on, but the bog-standard PC is no Leonardo, or Hercules wouldn't be in business.

Still, Chart is nothing if not a triumph of ingenuity, and while I'd hesitate to endorse Mr Lambert's promise of 'dazzling' presentational graphics, they'll do. Precisely what they'll do, of course, depends on what you want to put across. 'A graph is an editorialised comment,' asserts Mr Lambert, as corporate Americans tend to do. 'It is weighted heavily by your opinion or point of view. The first step towards creating an effective graph is deciding precisely what point you would like to prove or which elusive fact you would like to force out . . .'

Quite so and elementary again. With this book you are taught how Chart does charts *ad nauseam*, rather as you were when reading Chart's in-box documentation, and then you're tempted half-crazy by a series of demonstrations of how much better it's done using pricey peripherals like Laserwriters.

Chart is now hugely popular in the US and will, I dare say, be giving Dataplot a run for its money in the UK. I'm impressed, even though I don't have much use for it.

The latest Microsoft product I'm bursting to try is Word Version 3.0, which apparently does everything any author could ask, except make the tea, and is, I gather (and fervently hope) at last rid of the original protection system which was such a bind if you wanted to reinstate Word after doing reckless tasks such as reformatting an overcrowded hard disk. I trust Mr Lambert will provide another glossy add-on handbook in due course.

Time's up!

Title: Work Out Computer Studies 'O' Level and GCSE
Author: G Taylor
Publisher: Macmillan
Price: £4.95 (paperback)

In the nick of time, perhaps, comes this thorough-going crib — sorry, useful adjunct to proper teaching and fully structured homework — which aims to nudge up your Computer Studies exam grade. Swot it conscientiously and there's an odds-on chance it will.

Graham Taylor is a teacher (boo!) or actually he's Head of the Division of Computer Studies at Ealing College of Higher Education, and so knows how to mix instruction and worked examples. It is not, perhaps, an exhilarating read, but then neither are most O Level questions, and this book sticks to its purpose of holding hands through the syllabus.

It's *very* comprehensive. It's a while since I did O Levels, perhaps, but there's enough information here to get you a Doctorate at the very least. Besides the lessons, worked examples and sample questions, you get more general guidance on revision techniques and psyching yourself up for the big day, plus a chapter on project work, with hints on what kind of thing is likely to merit a good assessment.

If you read this book from cover to cover and still flunk it, come the day, I should switch to Latin or Needlework if I were you. It shouldn't be any sweat to pass any Computer Studies exam if you've mastered everything here. Nothing to it, really, provided you've done the work! Some things never change.

In short, well worth a fiver of any panic-stricken student's money.

We've seen it all before

Title: The Super-User's BBC Micro Book
Author: Brian James and Graham Keeler
Publisher: Addison-Wesley
Price: £10.95

I can't be 100 per cent certain, but I've a nagging suspicion that I've read something along these lines before. The aim of this book, says its blurb, is to introduce us to the treasure-house of possibilities arising from using the wide range of facilities built into the BBC Micro with its own version of Basic. Now, I could have sworn I've come across a book rather like that. Possibly two or three. A thousand?

Exercises in mid-chapter are a feature here, more's the pity — I've done enough homework. Then there are ever so many sentences which get you down. Here's one: 'The ideal way to use this book is with a BBC Microcomputer to hand.' Geroff! And here's another: 'In order to send output from the computer to the printer, it is necessary to give the computer a series of commands.' Hands up anyone who guessed that!

Between such bits of garbage writing, the facts are there, but, oh dear, it's a job to stay awake. Far too many dreadfully dull computer books continue to be published on subjects which have already been done to death.

This is one of them.

Easy as CPC

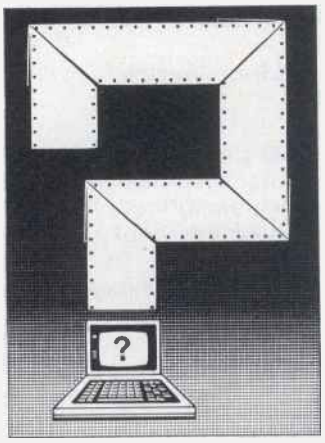
Title: Advanced Amstrad CPC6128 Computing
Author: Ian Sinclair
Publisher: Collins
Price: £9.95 (paperback)

Rather unfortunate, really, to be doing a book on the Amstrad if your name's Sinclair. Never mind; *PCW* readers know Our Ian is the right stuff, and he's done a conscientious job itemising what's what for advanced users of the CPC6128 (*née* CPC464) which frankly is not the machine with which I'd most care to grapple, but there we are.

As Sinclair says, you do get a lot for your money from Amstrad, whose cheap and cheerful smaller fry are currently sweeping away all-comers. This book is heavy-weight stuff, and you'll need CP/M as well as Basic and AMSDOS know-how to take part. If you have a CPC6128, I shouldn't hesitate. But scarcely unput-downable if you haven't. END

COMPUTER ANSWERS

Simon Goodwin takes his toolkit to your problems. The address to write to is Computer Answers, PCW, 32-34 Broadwick Street, London W1A 2HG.



Computer Answers is PCW's help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.

Floating-point pitfalls

Could you please explain why my computer considers 37.49 to be different from 37.49?

My office IBM PC/AT runs a Basic program which accepts three figures and checks that the sum of the first two numbers equals the third. All was well until I entered 33.35, 4.14 and 37.49. Even my 'free gift' calculator agreed with my arithmetic, but the computer disagreed, saying that the difference between 33.35+4.14 (that is, 37.49) and 37.49 is 0.00000000000000003814697!

I have since found other 'rogue' figures. Double-precision variables do not solve the problem — they just produce a different difference. I know how to stop the error — that is, multiply by 1000, take the integer part and divide by 1000 — but I would like to know why it happened in the first place. (Incidentally, my father's Epson computer produces the same results.)
Simon James-Morse, Streatham, London

This is a common problem. Your suggested solution — scaling the number up, losing a few digits and scaling it back down — will generally work, but it is slow, potentially unreliable and restricts the range of numbers you can use, because there is a risk that a large number may be scaled beyond the number of digits which can be stored precisely.

To understand the problem and the best solution, you need to think about fractions, numbers and the way in which a computer works. In the interests of clarity, I'll explain from first principles.

In the 'decimal' arithmetic system which we use today, unlike with Roman numerals, the value of a given digit depends upon its position. By convention, a digit in a certain position represents 10 times the value it would in the position to the right, and a tenth of the value of the same digit written to the left.

If you want to write the whole number (a number with no fractional part) you can always represent it exactly using this scheme: you just write down the number of units — tens, hundreds, and so on — up until the answer is complete.

We put a decimal point after the digit representing a certain number of units. Thereafter, each digit represents a certain number of tenths, hundredths, and so on.

Some fractions cannot be written precisely in decimal, however many digits you use.

One obvious example is a third, where you need an infinite number of 'three' digits after the point in order to represent the fraction precisely. Another example is the fraction one-seventh, where you must repeat the digits 142857 over and over again after the decimal point. The more digits you use, the more accurate the result; but you can never represent either of these fractions exactly using the decimal scheme.

So far, this may seem obvious and irrelevant. But we have established that decimal arithmetic cannot represent some fractions precisely.

Now imagine a numbering scheme where the value of each successive digit is three times that of the same digit written to its left. The columns then go (for example) nines, threes, ones, thirds, ninths, and so on. In this way thirty would be written 1010.

If we use this numbering system, the fraction one-third *can* be written exactly, as 0.1 (the one after the point represents one third). Similarly, one-ninth can be written exactly as 0.01, and one-ninth is another number that could not be written precisely with any number of decimal digits.

This system is called 'base three' because the ratio of each digit position to its successor is three; only three possible values are needed for each digit position. Counting goes 0, 1, 2, 10 (one, three and no units), 11, 12, 20, 21, and so on.

If we make the 'base', or ratio of position values, seven, we must allow each position in a number to represent up to seven values (digits from 0 to 6). Then we can write a seventh (.142857 and so on, in decimal) exactly as 0.1. We still need an infinite number of digits to write a third in base seven, but this time the sequence consists of '2' digits. A third, in base seven, is .2222222 recurring! Check this by adding two sevenths, two 49ths, two 443rds (443=7*7*7) and so on.

Modern digital computers work with 'binary' or base two arithmetic. This is because it's easy to make electronic circuits work with two states – on and off, or 0 and 1 — rather than three, seven or 10. It follows that halves, quarters, eighths, and so on, can be stored exactly in a few bits (0.1, 0.01, and 0.001 respectively).

Fractions which can be made up from reciprocals of powers of two (1/2), 1/(2*2), 1/(2*2*2), 1/(2*2*2*2), and so on) can be stored exactly — three-quarters is .11 in binary (a half plus a quarter); other fractions cannot. A third in binary is written 0.01010101, and so on. Again, this can be easily checked.

Humans tend to frequently use fractions such as tenths and hundredths because we're used to decimal maths. But a tenth, when written in binary, is an infinite sequence: 0.0001100110011 . . . Not surprisingly, a hundredth is also an infinite sequence if written in binary.

'Double-precision' maths just gives you some extra binary digits to play with, but as the 'exact' number goes on for ever, this won't help you. Fractions of 10 cannot be represented accurately in any number of binary digits — that's the problem.

Unfortunately, it isn't practical to make computers with 10 levels from 'off' to 'on' and process decimal digits directly — there's too much risk of confusion between similar levels.

Of course, you can use groups of binary digits, or bits, to represent each decimal digit. This scheme is called binary coded decimal, or BCD.

Four bits are used to store every decimal digit. This format allows exact decimal fractions to be stored, but BCD processing is slower and more complicated than binary. BCD values also need more space than binary for a given degree of accuracy.

In the days long before micros, IBM made a computer which was designed to work entirely with BCD values, but the idea didn't catch on.

Today, Atari's 8-bit micros use BCD maths, and so does Zilog's obscure MCZ range; all these machines are mathematical sluggards as a result. Pocket calculators don't have to be fast, or store lots of numbers, but they do need to appear precise so they often use BCD to achieve this.

You can avoid all problems with binary arithmetic if you follow one simple rule — always work in *whole units.* It is only fractions which cause problems, so if you make sure that you work in pence, or cents, or whatever your basic unit is, you'll never get the wrong answer as long as you stay within the number of digits the machine can hold accurately. Try to avoid division except by factors or fractional multiplication — these will always give approximate

results. Be sure to round numbers consistently thereafter.

You must use string input statements to read numbers, so that floating-point approximations never have a chance to creep in. Check that the decimal point is in the right place in the input, then remove it to get a whole number which you can process without problems. Insert the decimal point — using string operations, once again — before you print results.

So far, I've only suggested a solution for accountants and other professional pedants. Scientific users, and others who need fractions to model the real world, should not be upset by this discussion. When you're working with arbitrary fractions, binary arithmetic is no less accurate than decimal. Indeed, it packs more accuracy into a given amount of memory than other schemes such as BCD.

Spectrum bus connections

I own a Spectrum 48k micro and intend to add a couple of components interfaced directly to the connector at the back of the machine. I understand that the Z80 CPU can directly address 256 input/output addresses using address lines A0 to A7, but I don't know which output enables I/O instead of RAM addresses. Also, there are a few other outputs which I am not sure about: these are IORQE, BUSRQ, ROMCS, BUSACK, MREQ and IORQ.
S Brown, Dover, Kent

The Z80 can actually address 65536 ports, rather than the 'official' 256. As you must know, the OUT (N),A instruction puts the value N on the lower eight bits of the address bus, and the value in the accumulator, A, onto the data bus.

The instruction OUT (C),A similarly puts the value of the C register on the low half of the address bus, and the data in A on the data bus — but it also puts the value of register B on the other eight address lines, so the instruction really works like OUT (BC),A. IN A,(C) works in the same way, so you can access 256 times as many ports as normal if you use the (C) instructions, set BC rather than C, and decode the required address lines. The Spectrum uses this trick when reading the keyboard, as you can guess if you read chapter 23 of the original, much lamented, *Spectrum Manual*.

That said, the decoding of signals inside the Spectrum has been kept extremely simple — some would say crude — so that many port addresses are denied to you. In particular, all port addresses which leave A0 zero select the ZX82 ULA, which controls the video, the keyboard and the cassette ports. If A1 is zero, the ZX printer is selected; A3 and A4 select the ZX Interface 1. I've no idea what happened to A2, but Sinclair reserves it anyway. You don't want your hardware to interfere with Sinclair's, so you must use port addresses from 31 upwards — 31 is the lowest number, with bits 0 to 4 all set to one.

With regard to signals, IORQ is low when I/O devices are being addressed (the fact that the signal is active low is often signified by a horizontal line above the name). In contrast, MREQ is low when memory is being addressed or refreshed.

External devices should pull BUSRQ low when they want access to the bus, without interference from the processor. They should not try to write to the bus until the processor signals its acceptance by pulling BUSACK low. If ROMCS is pulled high, the built-in 16k ROM disappears from the memory map so that Interface 1 or some other device can substitute a different ROM. This is how the Spectrum allows extra, 'shadow' ROMs to fit into its 64k address space.

Assuming that, as is normal, your electronics is turned on by a logic 'low', you can use a three-input OR gate to combine IORQ, A5 and either RD or WR (depending on whether you want to ReaD or WRite). When the Spectrum performs an OUT instruction to port 31, WR, A5 and IORQ all become 'low' at the same time. IN from port 31 sets RD, A5 and IORQ low. It is up to your electronics to snatch or present a data value on the data bus at the appropriate moment — an 8-bit tri-state latch will do the trick.

This explanation should be enough to enable you to connect simple gadgets to the Spectrum. If you need to know more, I suggest you buy a copy of the *Spectrum Hardware Manual* by Adrian Dickens, published by Melbourne House.

Disk compatibility

Are the 3.5in disk drives of the Atari ST and Commodore Amiga computers Sony-type or Shugart-compatible?

In its original announcement, Enterprise stated that its disk controller was fully compatible with CP/M, but I have recently read that the system is able to read MS-DOS files.

This is very good if the Enterprise system has not lost compatibility with CP/M. Could you check this?

Is it possible to transform an 80-track disk into an 80/40-track one?
Dominique Centeno, Lausanne, Switzerland

Sony 3.5in drives expect the same signals as Shugart 400 series drives. They can be connected to the same controllers, and you can even mix Sony drives and the 5.25in Shugart variety on a single system. However, the software needed to read each format differs because each format uses different rules when allocating space for files.

The Atari ST uses a 'standard' CP/M-68k format, which means that Atari disks can be read by popular MS-DOS computers. The Amiga goes its own way and uses a special format in which each track (a concentric ring of data) on the disk is used as a whole, rather than divided into slices or 'sectors'. This allows data to be stored densely, but it means that special software is needed to read the disk.

Amazingly enough, the Enterprise can read CP/M disks as well as the MS-DOS variety. Its 'main' disk operating system, EX-DOS, held in ROM, uses the MS-DOS 1.0 format so it can read disks generated on an IBM PC, an Apricot, a Nimbus or an Atari ST, for example. Enterprise also supplies another system, IS-DOS, at no extra charge; this system is held in RAM, like CP/M, and is capable of reading and writing CP/M-80 disks. Both systems support 5.25in drives and the 3.5in variety, as explained above.

IS-DOS is designed to be compatible with CP/M version 2.2; it expects programs to be on MS-DOS disks. IS-DOS gives a 56k transient program area, which is large enough for virtually all CP/M 2.2 programs, and all the CP/M system calls are supported. Of course, IS-DOS is not exactly the same as CP/M, so 'badly behaved' programs may run into problems — the reserved fields in the file control blocks have special meanings in IS-DOS, and the CP/M BIOS jump table is not in the usual place. In practice this shouldn't affect properly written programs, but I'd advise you to 'try before you buy' if you really need to run a specific CP/M package. Enterprise can be contacted on (01) 739 4282.

The exact hardware change required to convert an 80-track drive into a switchable model will depend upon the brand of drive. It is worth comparing an 80-track-only drive with a switchable unit from the same manufacturer: often the circuitry will be identical and the only difference will be the switch, which you can add yourself if you're feeling confident.

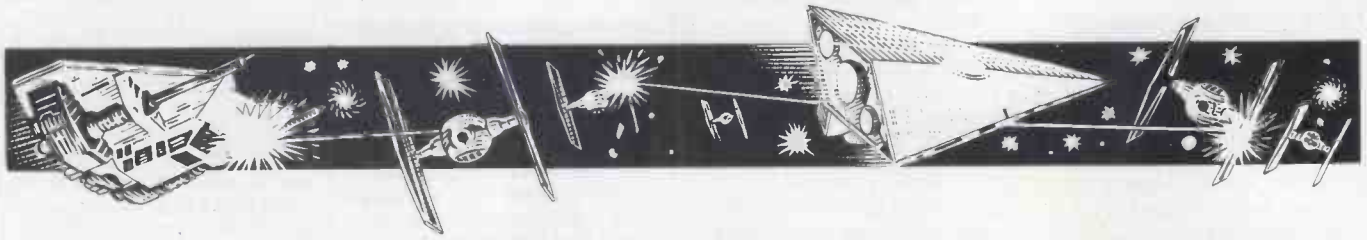
You can generally read a 40-track disk on an 80-track drive without the need to make any hardware changes; all you have to do is tell your disk software to step twice from one track to the next. Most popular disk operating systems can be patched or configured to do this.

Writing to a 40-track disk with an 80-track drive is not so easy. It can be done, but the different mechanical dimensions of an 80-track drive mean that the resultant recording may be less reliable than if it were produced by a 'proper' 40-track drive. The same applies, of course, to switchable 40/80-track drives, which are really designed to be used in the 80-track mode. Everything should be fine if you always use the same type of 40-track drive when formatting and writing data to a specific disk.

Atomic fusion

With regard to the letter headed 'Atomic Decay' in 'Computer Answers', *PCW* March, Keith Maton may be able to find help in the 'Atom Forum' of the February 1986 issue of *Acorn User*. Acorn Atom users are also supported by the Atom Users' Club, run by Andy Nicholls of 4 Tavistock Road, Carshalton, Surrey SM5 1QR tel: (01) 644 9953. He should also try contacting Mike Barwise at 68 Harmondsworth Lane, Harmondsworth, Middlesex UB7 0AA — Mike may be able to help as he runs a small mail order company which supports the Atom.
Stephen Read, Basingstoke, Hants

END



With cries of 'Fore!' and 'Good shot, sir!' Stephen Applebaum tees off for this month's games selection. He also tries his hand (or fist) at boxing, and meets a psychic pig. Games for the Atari ST, the Macintosh and the Commodore 64/128 are featured.

The tartan trousers brigade

Title: Golf Construction Set
Computer: Commodore 64/128
Supplier: Ariolasoft
Format: Disk, cassette
Price: £14.95, £12.95

When Ariolasoft announced that it would be launching a golf simulation, I was unimpressed. With other golf games, if you take away the walk around the course, the fresh air and the nice scenery, there's little else left to enjoy. There's the golf, but the less said about that, the better.

Before I offend too many golfing readers, I must come clean and admit that for all my prejudices against golf and one of the last bastions of Englishness, the course clubhouse, Golf Construction Set is a skilful paradigm of one aspect of the sport simulation genre.

Golf Construction Set is as close as you'll get to the real thing, on a home computer, at the present time. The disk version comes on one floppy, complete with four pre-programmed courses: the Belfry, Sunningdale, Wentworth Old course and Royal St George's; all of which have been lovingly reproduced, right down to the smallest undulations of the various greens.

Such fidelity means that playing a round in Golf Construction Set is no pitch 'n putt, but a full-blown, full club tour of four of the UK's grandest professional courses.

Initially, novices will find the formidable layout of these circuits too hazardous to allow them to make any appreciable difference to their default handicap of 28. As a result, Ariolasoft has deferentially included a practice mode which, although it doesn't allow a handicap to be decremented indefinitely, does give novices a chance to input a lower handicap to simulate the standard of play encountered at a professional level, and play the various courses, without having to enter a competition.

Two forms of competition have been incorporated into Golf Construction Set, the difference between them being the way in which the winner is decided. In Tournament mode, the winner is the player who has taken the least amount of shots over 18 holes.

The victor in Match mode, on the other hand, is the one who has amassed the greater number of winning holes — that is, the competitor who's put the ball in the hole before his opponent, the greater number of times.

The final scores in both modes differ quite dramatically, depending on the course and the weather conditions. Of the four courses, the most accessible when you're just starting out is the Belfry.

After loading Golf Construction Set and before 'walking' to the first tee, players are asked to satisfy several conditions. These include choosing a course and either pre-set or customised weather conditions. On Royal St George's it's advisable to alter the weather conditions to suit your experience, as the course is dogged by inclement weather, characterised by capricious winds.

Before teeing off, players are requested to select three clubs which they must leave behind in the clubhouse for the game's duration. A full bag contains five woods, nine irons, a pitching wedge, a sand wedge and a putter. Experience told me to forsake the two and four woods, plus the two iron, which proved to be a reasonably shrewd choice.

Most selections made in Golf Construction Set can be negated via a whimsically-named Oops function. However, this has not yet been implemented at the club selection phase, so you are stuck with your first choice of rejected clubs. Golfers who accidentally leave the one wood, or driver, will find themselves at a distinct disadvantage on most of the holes, as it's necessary to achieve good distance from the majority of tee shots.

At the first tee, the display divides into three windows. The top-left window is a golfer's-eye-view down the fairway; while below is a box containing the contents of the player's bag, and information on the prevailing weather conditions. Other useful snippets of data are the number of the hole, its par, stroke index and length.

The largest window contains an annotated plan view of the current hole, and takes up much of the right-hand side of the display. This window contains the characters representing trees, lakes, bunkers, and so on, as well as special symbols down the sides of the window showing the drastic changes in gradient of the fairway and the green.

When you've selected a club from your bag, you must tell Golf Construction Set the general direction in which you wish to hit the ball, by moving a cursor on the aforementioned plan view — this also affects the view in the top-left window, which changes to display the new

view. Only the ball's flight path is affected by this option; factors such as distance and duration can be influenced by adding or decreasing the amount of loft on the ball.

'Loft' implies the angle of attack at the point of contact between the club-head and the ball. Although you can't alter the angle at impact exactly, you can select whether you hit the ball above or below its centre. Striking it above its centre gives the ball a low trajectory, while a low hit pitches it high.

If used properly, loft can successfully help you overcome strong headwinds or send the ball scudding along on a good tailwind. The effects of a cross-wind, however, can only be mitigated by applying the correct amount of fade to a ball.

'Fade' means that the ball will veer to the left or the right towards the end of its flight. A small pair of feet, displayed on screen, are moved to indicate the severity and direction of fade that you wish to use.

Finally, you're ready to take your shot. For this, the bottom of the screen displays a silhouette of a golfer who can be made to swing his club by pressing the fire button on the joystick. He continues to idly swing his club until you press the button again. The power of the shot depends on how far you let him swing back the club before you press the button a second time.

The flight of the ball is indicated by a dot moving across the plan view, and there is a 3D version of the same thing, as seen by the golfer.

On the green, the golfer's-eye-view changes to show an aerial shot of the pin. A cross-cursor appears, which you move to indicate where you want the ball to go when putted. Small symbols at the sides of the window indicate the lie of the green. Quite often, it's necessary to overcompensate on the power of a putt to overcome the gradient of some greens.

When you successfully put the ball down the hole, the program asks if you want to save the round for continuation at a later date. You're not obliged to, and can simply move on to the next hole.

When all 18 holes have been completed, a scorecard is displayed and your new handicap is calculated. Improvements in handicap can be saved onto disk.

Even were it only to contain the four pre-programmed courses, Golf Construction Set would be worth its asking price. But, in addition to these courses, Ariolasoft has provided a utility which allows you to design and save your own customised courses. This utility is easy to use, and allows everything featured in the game's four courses to be included in your own designs.

Golf Construction Set is one of the best games to appear from Ariolasoft, and shows that the company doesn't have to rely solely on Electronic Arts for top-notch material. That said, it's paradoxical that Electronic Arts is to market the game in the US, and is set to provide extra courses for UK players.

An ordinary tale of country folk

Title: The Black Cauldron
Computer: Atari ST
Supplier: Sierra On-Line
Format: Disk
Price: N/a

The Walt Disney studio has been responsible for some of the greatest moments in cinema history. Its *métier* has always been the full-length animated feature, but in recent years these films have become a rare occurrence, due mainly to the phenomenal sums of money required to finance such a venture.

Disney's last attempt to recapture the magic of its golden years was the cartoon extravaganza, *The Black Cauldron*. Although this tale of good and evil contains much of the charisma and prodigious technical pazazz of its forebears, it lacks the winsome naivity which endeared earlier productions to their audiences.

For all *The Black Cauldron's* faults, Sierra On-Line has deemed it worthy of being turned into a game based around the film's flimsy plot. Whether the company thought the film strong enough to warrant a game, or used it because of the expedient of having the Walt Disney name on the packaging, is difficult to assess. Nonetheless, Sierra On-Line has produced a surprisingly good game, considering the film's chaste scenario and insipid characters.

Sierra's The Black Cauldron can be viewed as a follow-up to the company's King's Quest II, an earlier excursion into animated adventure territory. Both games are examples of a relatively new breed of adventure which relies on the player's ability to manipulate a joystick or a mouse, rather than typing accuracy.

In the game you play the part of Taran, a country boy under the patronage of an old savant called Dallben. At the beginning of the game you are happily going about the daily ritual of feeding Dallben's prize pig, Hen Wen, when the animal suddenly has what can only be described as an epileptic fit. Realising the significance of the affliction, Dallben produces a bowl of water into which he presses the animal's snout.

The result is an ethereal vision, importing to Taran and Dallben the Horned King's plan to kidnap Hen Wen and use her psychic powers to find the whereabouts of the Black Cauldron. Far from helping the Horned King fulfil any culinary aspirations, the Black Cauldron would provide him with no less than unspeakable power.

Thus informed, Taran follows Dallben's advice and takes Hen Wen to the demesne of the Fair Folk. Unfortunately, Taran's expeditious departure from the farm didn't give the doting Dallben enough time to tell him the whereabouts of the Fair Folk's cottage, leaving Taran and Hen Wen to run the gauntlet of the Horned King's Gwythaints (dragons).

After securing Hen Wen in the protection of the Fair Folk, safe in the knowledge that they won't have turned her into sandwich filling by the time he returns, Taran sets off to defeat the Horned King.

That, then, is the basic story of The Black Cauldron, and the ritual you must go through before really getting into the game.

Like its forerunner, King's Quest II, The Black Cauldron is composed of a plethora of lavishly colourful pictures which can be navigated freely by the game's principal character, Taran. As you'd expect, Taran is under player control; he can be motivated with a joystick or the Atari mouse. Of the two, the joystick is much the better option, as the mouse tends to send our hero off-course.

As I have stated, Sierra has designed its graphic adventures so that they can be played without recourse to the computer's keyboard. Four basic commands cover almost every action in the game, and can be accessed by moving a cross-cursor over the Taran character and clicking once on the mouse's right-hand but-

ton. This produces a small window containing the words DO, USE, LOOK and RETURN.

If you were to press the right-hand mouse button twice, instead of once, you would open a full-screen window giving Taran's inventory. The objects presented here are the ones referred to by the command USE.

The Black Cauldron's outstanding feature is its graphics. There are too many screens to store in the ST's memory, so Sierra has employed the old method of accessing individual screens when they are required. In the past this has made Sierra's adventures painfully slow, especially on the Commodore 64. Luckily the ST isn't dogged by slow access speeds, so the time which must be spent loading a screen is negligible.

Dallben's farm is depicted as a quaint, thatched cottage exuding smoke from its stone chimney. Inside is a flaming log fire over which is hanging a cauldron of hot, bubbling gruel — Hen Wen's dinner. Outside, next to a little straw-thatched barn, is a small pen and Hen Wen's abode. By taking the cauldron out to the pen, you can coax Hen Wen out of her 'hut' to eat the gruel.

Over the past year, we've seen companies constantly breaking new ground in the way adventure games are presented. Along with Mindscape, producer of the highly original Deja Vu, Sierra On-Line is part of a small group of companies which have seen the light early, and have taken full advantage of the immense possibilities offered by 16-bit technology. Even though it's streets ahead of similar programs, The Black Cauldron is still only a harbinger of things to come.

Machines such as the ST, the Amiga and the Macintosh have given us something to smile about, just when the home games market was in peril of stagnation.

Below the belt

Title: Championship Boxing
Computer: Macintosh
Supplier: Mirrorsoft
Format: Disk
Price: £26.95

After languishing under a welter of indifferent track and field games for the past couple of summers, it's a pleasure to be able to review sports programs of the calibre of championship Boxing and Golf Construction Set. Together, these programs provide a badly needed fillip to what is fast becoming a very bland area of the computer games market.

There have been several boxing games already, but none which I've seen have the depth and complexity of Sierra's Championship Boxing.

Sierra, realising that people don't necessarily want a game in which two boxers slug it out onscreen while the players wrestle with a joystick or demolish their keyboard, have reconciled the situation by fusing arcade action with strategy-based sequences which put the player in the roles of both manager and trainer.

Your first task as manager is to hire a boxer. This part of the program takes the form of a roster which features a host of famous, and not so famous, names.

Every boxer in the roster has been re-created using characteristics recorded at the apogee of his career. If you want to see how a particular boxer might have faired with less punching power, say, or even a glass jaw, you can change his various characteristics in the gym.

You are by no means confined to Sierra's selection of boxers, and can add contenders of your own while in the gym. Unfortunately, Championship Boxing has no facility for saving boxers onto a disk separate from the original program disk, so when the roster is full, you have to remove a number of pugilists before being able to store new ones.

Included in Championship Boxing is a special Create utility which allows you to define the characteristics of your ideal boxer. This section consists of screens subdivided into windows containing different characteristics. Within each box are a number of options which allow you to select the degree to which a boxer will be affected by a specific strength or foible: these are such things as accuracy, speed, aggression, whether he's prone to cuts and injury, and killer instinct.

Championship Boxing contains various fight modes, and you must select the appropriate one before entering the ring. The number of rounds is variable between one and 15, while rounds can last from one to three minutes. Scoring can take one of two forms: the ten-point must; or the round system.

With the ten-point must, boxers are awarded from seven to 10 points at the end of each round. The 'must' comes into the system's name because each judge is obliged to give one of the boxers 10 points. Points are awarded for hits, aggression, knock-downs, and so on.

In the round system, each judge awards one point to the boxer he or she considers to have won the round.

Whatever the fight option selected, the rules which apply to a fight remain the same: that is, when a boxer is knocked down, he receives a count of 10 from the referee. If he rises to his feet before the final count, the fight resumes.

Fights can be won by a straight knock-out or a technical knock-out. A technical knock-out is achieved by inflicting an injury serious enough to prevent an opponent from continuing a bout. If there is no knock-out, the winner is determined by the judges, using either the ten-point must or the round scoring system.

Finally, you are ready to enter the ring. There are three modes in which Championship Boxing can be played: strategy mode, arcade mode, and simulation mode.

In arcade mode, you have full control over your boxer's movements. Seven keys cover all his movements, including a head punch, a body punch and an uppercut.

Simulation mode leaves everything to the computer, giving you a chance to sit back and enjoy the action.

Graphically, Championship Boxing leaves little to the imagination. The animation of the various boxers is excellent, while a little humour has been injected by the inclusion of a cartoon boxer, whose trunks fall down when he's near to collapse, and animal characters including a gorilla, a shrimp and a kangaroo.

To accompany the animation, Sierra has designed some nice backgrounds, including a good ringside, a special judges screen, and separate views of the boxers' corners when the game is being played in strategy mode. END

At your service

If you're an IBM PC or PC-compatible user, it could be worth joining the Compulink User Group. Or how about taking advantage of a commercial BBS's services? Peter Tootill has the details.

Compulink is a user group for users of IBM PCs and compatible machines (including Apricots). Apart from the standard user group activities such as newsletters, a software library (which apparently amounts to over 800 disks of public domain software) and occasional meetings, Compulink is heavily concerned with bulletin boards. Compulink runs a multi-user BBS on a networked system of three PC compatibles using Fido BBS software (see 'Networks', *PCW*, October 1985, for more information on Fido). Frank Thornley, the chairman (or 'chief hacker', as he calls himself) of Compulink is also the UK co-ordinator for Fido.

An IBM PC/AT-compatible is at the heart of the Fido BBS, and has a hard disk which contains the message files and the download areas. Four of the phone lines accept V21 and V23 (300/300 and 1200/75 bit/sec) calls; the other two lines take V22 and V23bis (1200 and 2400 bits/sec, full duplex).

Parts of the Compulink BBS are open to all callers, but non-members are asked to make a £10 contribution. Compulink members have privileged access to the system, including several megabytes of software from the library. A CD-ROM will be implemented so that all 800 of the disks can be online at the same time. A new software tool, Compufind, is being written to enable users to cope with the not inconsiderable problem of locating programs on the CD-ROM.

A further feature which is currently being tested is conferencing, using software called Common Ground. Conferencing systems are very popular in the US, and are similar to BBS systems except that the messages are arranged around a topic, introduced by one of the users.

The Compulink BBS is claimed to be the first multi-user BBS in the UK and the largest BBS outside the US. The group organisers have ambitious plans for the system which include PSS access to cut down phone bills, and regional BBSs. The first of these should be running in Liverpool (based on the old Fido Fastnet system, but on a new telephone number) by the time you read this. Others will depend on support and finances. Another, more ambitious, plan is to link the regional BBSs to the main system by dedicated data lines.

Compulink is interested in selling computer time to other user groups which want to provide some kind of electronic messaging system for their members.

The Compulink User Group is located at 67 Woodbridge Road, Guildford, Surrey GU1 4RD, tel: (0483) 65895. The BBS numbers are (0483) 573337 (four lines, V21 & V23) and (0483) 573338 (two lines, V22 and V22bis).

Commercial systems

There are now a range of what can be termed 'commercial' BBSs operating in the UK. These range from those run by commercial organisations which make them freely available to the public (mainly to publicise the company and its products), to those which fulfil a commercial end in their own right and are available only on payment of a subscription. One of the earliest examples of the former is Distel which is run by Display Electronics, and which specialises in surplus computer and electronics equipment. Distel allows callers to browse through details of available products, check for special offers, and even to place credit card orders while connected to the system.

Another organisation which uses a BBS as an adjunct to its business is Budget Typesetting. Typenet has been set up to receive copy from authors for typesetting by telephone, thus avoiding the problems of different disk formats that usually plague such an operation. Articles can be uploaded in the early hours of the morning, which is when authors traditionally finish their work(!), and are available to the typesetter immediately — or as soon as he gets to his office the next day. There are no postal delays and no danger of typescript being lost in the mail.

BBSs are also being used as part of a general electronic message and telex bureau service by organisations such as Telnet and Lasermail; for example, customers without access to their own telex terminals can send and receive telexes via the BBS.

A very different kind of commercial BBS is one which charges users a subscription for access to some, or indeed all, of the system's facilities; the idea being to cover the costs of the system from the subscriptions. This is a relatively new idea in this country, but as you can imagine, this type of system is quite common in the US. However, I understand that even in the US, it is difficult to make a BBS cover its costs in this way, let alone make a profit.

A number of UK BBSs are starting to make a small charge for access to some or all of their features. TBBS London now asks for a £1 registration fee — this was chiefly to discourage undesirable callers; the former MOBBS has become Matrix and is only available to subscribers. (Incidentally, Matrix has recently moved to Liverpool from Manchester.)

Persuading people to pay a subscription on top of the cost of the phone call does mean offering something more than the average BBS — many BBSs are still free, so why should people pay to use one? One reason is that the system is less likely to be engaged when it is called, which could be a significant advantage, judging by the number of complaints I have received from people who have been unable to get through to my BBS (Liverpool Mailbox).

Here are the relevant telephone numbers for the general systems and organisations mentioned above:
Distel: (01) 679 1888 (V21) and (01) 679 6183 (V23)
Budget Typesetting: (01) 658 8754 (voice)
Typenet: (01) 658 6942 (V21)
Telnet: (01) 891 6171 (voice)
Lasermail: (0903) 212552 (data, V21)
Matrix: (051) 737 1882 (new number)

The regular listing of UK bulletin boards is being revised, and will next appear in the August issue. END

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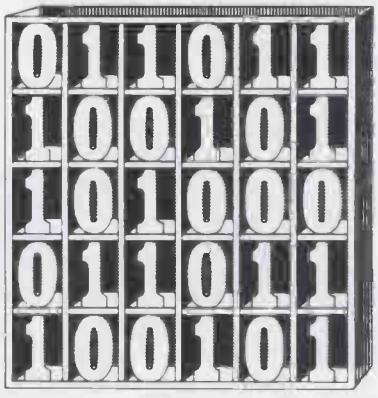


David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, 32-34 Broadwick Street, London W1A 2HG.

Z80 32-BIT POWERS

The first datasheet this month is a Z80 routine to calculate positive integer powers, from T Sullivan of Sheffield.

POWX is the final routine of the highly structured, 32-bit arithmetic suite published last month. It makes extensive use of other routines in the suite for transferring the arguments and results between working registers and memory-held variables, and also for the necessary squaring, multiplication, shifting, clearing and exchanging.

DATASHEET 1

```
;=============================================================
;= POWX   - 32-bit signed Nth power.
;=============================================================
;JOB        32-bit (sign bit + 31-bit magnitude) power.
;ACTION     ON result overflow
;           [ Set overflow flag and exit. ]
;           IF power index negative
;           THEN [ set negative index flag and exit. ]
;           ELSE [ Result sign = root sign AND power index lsb.
;                  Set result = 1.
;                  IF power index > 0 THEN
;                  [ FOR power index bits (msb to bit 0)
;                    [ Square result.
;                      IF current power index bit = 1 THEN
;                      [ Result = result * root. ] ] ] ]
;-------------------------------------------------------------
;CPU        Z80
;HARDWARE   Variables in RAM.
;SOFTWARE   XENTRY, XEXIT, LWSLAX, EXDH, SQSUB, CLRH, MULSUB.
;-------------------------------------------------------------
;INPUT      Three variables at (HL), (DE) & (BC).
;OUTPUT     Cy=1: Error, (HL), (DE) & (BC) unchanged.
;                 S=0: magnitude overflow.
;                 S=1: negative power index input.
;           Cy=0: (HL) = (DE)^(BC).
;                 S, Z return sign & zero status.
;ERRORS     None.
;REG USE    F BC DE HL
;STACK USE  28
;RAM USE    None.
;LENGTH     75
;CYCLES     Not given.
;-------------------------------------------------------------
;CLASS 2     *discreet      -interruptable     *promable
;*-**-*      *reentrant     -relocatable       *robust
;=============================================================
;
POWX    CALL XENTRY     ;Save regs. & get arguments.      CD lo hi
        RLCA            ;Move power index sign to sign    07
        RLC  A          ;bit of A, root sign to 0,A,      CB 07
        SCF             ;set Cy for if error, and exit    37
        JP   M,XEXIT    ;S=1 if power is negative.        FA lo hi
;
        EXX             ;Access alternate regs.           D9
        AND  C          ;Get result sign and return       A1
        RRCA            ;it to bit 7,A.                   0F
        INC  L          ;Initialise part result to 1.     2C
        PUSH BC         ;Move power index lo-word         C5
        POP  IY         ;from BC' to IY.                  FD E1
        PUSH DE         ;Move root lo-word from DE' to    D5
        POP  BC         ;BC' as multiplicand.             C1
        EXX             ;Access normal regs.              D9
        PUSH BC         ;Move power index hi-word         C5
        POP  IX         ;from BC to IX. Now in IXIY.      DD E1
        PUSH DE         ;Move root hi-word from DE to'    D5
        POP  BC         ;BC. BCBC' now multiplicand.      C1
;
        PUSH AF         ;Save result sign in normal A.    F5
        LD   A,32       ;Set power index bit count.       3E 20
;
PXSIGL  CALL LWSLAX     ;Shift index higher until msb     CD lo hi
        JR   C,PXSIGF   ;found then jump into power loop. 38 13
        DEC  A          ;Repeat until a significant bit   3D
        JR   NZ,PXSIGL  ;is found or index = 0. If 0      20 F8
        JR   PXPLE      ;then result = 1, so exit.        18 1D
;
;...Power loop. Square part result and if index bit set then
;...multiply by root (actually, result := root * result).
;
PXPLP   CALL EXDH       ;Move part result to DEDE'        CD lo hi
        CALL SQSUB      ;and square (square in HLHL').    CD lo hi
        JP   M,PXPLE    ;Exit if result 31-bit overflow.  FA lo hi
        CALL LWSLAX     ;Get next power index bit and     CD lo hi
        JR   NC,PXPLT   ;skip if not set.                 30 0C
;
;...Entry point to power loop, 1st squaring unnecessary.
;
PXSIGF  CALL EXDH       ;Move result to DEDE' as m'plier. CD lo hi
        CALL CLRH       ;Clear product accumulator and    CD lo hi
        CALL MULSUB     ;mul by root. (DEDE' is cleared). CD lo hi
        JP   M,PXPLE    ;Exit if result 31-bit overflow.  FA lo hi
;
PXPLT   DEC  A          ;Repeat for remaining power       3D
        JR   NZ,PXPLP   ;index bits.                      20 E3
;
;...Exit ensuring bit 7,H cleared and Cy set only if overflow.
;
PXPLE   POP  AF         ;Restore result sign (7,A).       F1
        RLC  H          ;Bit 7,H set if overflow, so      CB 04
        SRL  H          ;convert to Cy & clear 7,H.       CB 3C
        JMP  XEXIT      ;Exit, store result if Cy=0.      C3 lo hi
;=============================================================
```

MC/LCASE FILE SIZE

Russell Greene of Chelsea College has sent improvements to his CP/M MAC.PRN comments case conversion routine (*PCW*, March).

Although the original code is suitable for small conversion files (less than 16k on Russell's SuperBrain but dependent on system disk parameters), it crashes out by underestimating the size of medium-to-large files.

There are three short alterations which add 11 bytes to the program; these are shown in Fig 1. The first change involves a BDOS call to store one data word equal to the file sector size into FCB (file control block) locations 34 and 35, after the file read but before conversion; the second change picks up the two-byte file size for use as a write counter; and the third change is needed for the two-byte decrement and check for zero.

```
;=============================================================
;...MC/LCASE improvements (larger file handling).
;
;...1st change.
;...INSERT at location 01DB (March routine).
;
CONVERT MVI  C,35       ;Compute file sector size and     0E 23
        LXI  D,FCB1     ;store in FCB1+33,34              11 5C 00
        CALL BDOS       ;(FCB locations 34,35)            CD 05 00
;
;...2nd change.
;...REPLACE 4-byte, 2-instructions "LDA FCB1+32" and "MOV B,A"
;...at location 0225 (March routine) by 5-byte, 3-instructions:-
;
        LHLD FCB1+33    ;Get sector count for write.      2A 7D 00
        MOV  C,L        ;Move into BC for count.          4D
        MOV  B,H        ;                                 44
;
;...3rd change.
;...REPLACE 1-byte, 1-instruction "DCR B" at location 0247
;...(March routine) by 3-byte, 3-instructions:-
;
        DCX  B          ;16-bit decrement write count.    0B
        MOV  A,C        ;check 16-bit count for zero.     79
        ORA  B          ;                                 B0
;=============================================================
```

Fig 1

6502 LARGE DIVISION

DINVAR (datasheet two), from Adrian Taylor of Brighton, performs unsigned division on dividends up to 256 bytes long. The divisor, however, is limited to a mere four bytes.

Adrian wrote the routine while experimenting with hashing procedures, and needed a fast remainder-only division (MOD) that would leave the dividend intact. The ASCII strings corresponding to long variable or file names can be divided by a suitable prime to give a two- or four-byte hash reference number

for quicker table searches.

As written, DINVAR also returns the quotient. The original remainder-only version can be recovered by omitting the instructions 'ADC #0', which sets the result bit in the current byte; and 'STA (QTPNT),Y', which writes the completed byte to quotient space in memory. An alternative version could overwrite the dividend by the quotient.

Adrian has tested the routine with a 6522 VIA timer on 100,000 pseudo-random divisions to produce sample timings for divisors of from one to four bytes. Interestingly, larger divisors perform better — presumably because less comparison is required, on average, than with shorter divisors. The 256-byte by one-bit division time is presumed to be the maximum operating time of the routine.

DATASHEET 2

```
;═══════════════════════════════════════════════════════════════
;= DINVAR - 1-byte to 256-byte by 4-byte division.
;═══════════════════════════════════════════════════════════════
;JOB         To divide an unsigned binary integer, from 1 to 256
;           bytes in length and stored least-significant-byte in
;           lowest address, by an unsigned divisor of up to
;           32-bit precision, returning a 4-byte remainder and
;           a quotient of equal length to the dividend.
;ACTION      ON remainder overflow [ Set fail flag and exit ]
;           IF divisor = 0
;           THEN [ Set fail flag and exit. ]
;           ELSE [ Clear 32-bit remainder.
;                  FOR dividend & quotient ms to ls bytes
;                  [ Read next dividend byte.
;                    FOR dividend byte 8-bit count
;                    [ Shift dividend byte bit into remainder,
;                      clearing next quotient result bit.
;                      IF remainder >= divisor THEN
;                      [ Remainder = remainder - divisor.
;                        Set quotient result bit. ] ]
;                    Write quotient byte. ]
;                  Clear fail flag and exit. ]
;═══════════════════════════════════════════════════════════════
;CPU         6502
;HARDWARE    Equal length dividend and quotient RAM.
;SOFTWARE    None.
;═══════════════════════════════════════════════════════════════
;INPUT       M4,5 = pointer to dividend in memory.
;           MF   = dividend byte length ($01 to $00=256).
;           M6,7 = pointer to quotient in memory.
;           M8-B = 32-bit divisor.
;           Quotient space must equal dividend space.
;           Dividend must be stored with most significant byte
;           in highest address.
;OUTPUT      All registers changed, M0-3 changed,
;           other page zero locations unchanged.
;           C=0: Division completed.
;                Quotient in quotient space (ms-byte in hi-mem).
;                M0-3 = 32-bit remainder.
;           C=1: Division failed (zero divisor, overflow).
;                M0-3 and quotient space = ?
;ERRORS      No check for quotient overwrite of dividend.
;REG USE     P A X Y
;STACK USE   1
;RAM USE     M0-MB, MF.
;LENGTH      115
;CYCLES      Average timing (by VIA) for 100,000 pseudo-random
;           value DINVAR divisions. 4-byte dividend by
;                      4-byte   3-byte  2-byte  1-byte  divisor
;           cycles:      1645     2140    2639    3090
;           Maximum (256-byte / 1-bit):  240,671 cycles.
;═══════════════════════════════════════════════════════════════
;CLASS 2     -discreet      *interruptable      *promable
;-****-      *reentrant     *relocatable        -robust
;═══════════════════════════════════════════════════════════════
;
REMA    =   M0          ;M0-M3, 4-byte remainder accumulator.
DDPNT   =   M4          ;M4,M5, 2-byte pointer to dividend.
QTPNT   =   M6          ;M6,M7, 2-byte pointer to quotient.
DSOR    =   M8          ;M8-MB, 4-byte divisor.
DDLEN   =   MF          ;MF,    1-byte dividend byte length.
;
DINVAR LDA  DSOR+0      ;Test divisor for zero.                 A5 M8
       ORA  DSOR+1      ;                                       05 M9
       ORA  DSOR+2      ;                                       05 MA
       ORA  DSOR+3      ;If zero then                           05 MB
       BEQ  FAIL        ;exit, C set, division by zero.         F0 68
;
       LDA  #0          ;Using A,                               A9 00
       STA  REMA+0      ;Clear 4-byte remainder                 85 M0
       STA  REMA+1      ;accumulator.                           85 M1
       STA  REMA+2      ;                                       85 M2
       STA  REMA+3      ;                                       85 M3
;
       LDY  DDLEN       ;Get dividend byte length (00 = 256)    A4 MF
       DEY              ;and convert to index (0 to 255).       88
;
DIV1   LDA  (DDPNT),Y   ;Get next dividend byte to A.           B1 M4
       LDX  #8          ;8-bit count in X.                      A2 08
;
DIV2   ASL  A           ;Shift next dividend bit out of A       0A
       ROL  REMA+0      ;and into remainder, shifting           26 M0
       ROL  REMA+1      ;remainder up to accommodate.           26 M1
       ROL  REMA+2      ;                                       26 M2
       ROL  REMA+3      ;If C=1 then remainder overflow         26 M3
       BCS  FAIL        ;so exit, C set.                        B0 4C
;
       PHA              ;Save dividend--quotient byte.          48
;
TRY3   LDA  REMA+3      ;Begin at ms-byte, compare              A5 M3
       CMP  DSOR+3      ;divisor with current remainder,        C5 MB
       BCC  DIV4        ;skip subtraction if d'sor too big,     90 36
       BEQ  TRY2        ;compare next bytes if same,            F0 02
       BCS  DIV3        ;subtract if divisor smaller.           B0 1A
;
TRY2   LDA  REMA+2      ;Repeat with next significant           A5 M2
       CMP  DSOR+2      ;byte if necessary.                     C5 MA
                        ;                                       90 2C
       BCC  DIV4        ;                                       F0 02
       BEQ  TRY1        ;
       BCS  DIV3        ;                                       B0 10
;
TRY1   LDA  REMA+1      ;Repeat with next significant           A5 M1
       CMP  DSOR+1      ;byte if necessary.                     C5 M9
       BCC  DIV4        ;                                       90 22
       BEQ  TRY0        ;                                       F0 02
       BCS  DIV3        ;                                       B0 06
;
TRY0   LDA  REMA+0      ;Repeat with least significant          A5 M0
       CMP  DSOR+0      ;byte if necessary.                     C5 M8
       BCC  DIV4        ;                                       90 18
;
DIV3   LDA  REMA+0      ;With C=1 from comparison, subtract     A5 M0
       SBC  DSOR+0      ;divisor least significant byte         E5 M8
       STA  REMA+0      ;from remainder.                        85 M0
;
       LDA  REMA+1      ;Continue for 4-byte subtraction...     A5 M1
       SBC  DSOR+1      ;                                       E5 M9
       STA  REMA+1      ;                                       85 M1
;
       LDA  REMA+2      ;                                       A5 M2
       SBC  DSOR+2      ;                                       E5 MA
       STA  REMA+2      ;                                       85 M2
;
       LDA  REMA+3      ;                                       A5 M3
       SBC  DSOR+3      ;... leaving C=1 to show                E5 MB
       STA  REMA+3      ;subtraction gone okay.                 85 M3
;
DIV4   PLA              ;restore dividend--quotient byte        68
       ADC  #0          ;& add in quotient result bit.          69 00
       DEX              ;Repeat for 8 bits of d'dend to         CA
       BNE  DIV2        ;give 8-bit partial quotient.           D0 B2
;
       STA  (QTPNT),Y   ;Store quotient byte to correct         91 M6
       DEY              ;place. count off one byte done         88
       CPY  #$FF        ;and test for all dividend done         C0 FF
       BNE  DIV1        ;repeating until quotient found.        D0 A7
;
       CLC              ;C=0 to show division done              18
       RTS              ;and exit.                              60
;
FAIL   SEC              ;C=1 to show division failed            38
       RTS              ;and exit.                              60
;═══════════════════════════════════════════════════════════════
```

68000 MATRIX TRANSPOSITION

TRN68K (datasheet three) has been submitted by Paul Cowper of Manchester as a matrix rotation. However, instead of merely turning the 8-bit square matrix around by 90 degrees, the routine performs a 'flip' about one of the diagonals.

Matrix rotations are useful in graphics applications, but small transpositions such as TRN68K seem only to have use in arranging character bit patterns for Epson-standard printers in bit image mode.

All that is needed to convert the routine to a rotation is to shift bits out from the low-order end of the source bytes rather than the high-order end. Perhaps this is not so easy in 68000 code, which seems to get bogged down when manipulating single bytes in memory.

DATASHEET 3

```
;═══════════════════════════════════════════════════════════════
;= ROT68K -    Transpose an 8-bit by 8-bit character matrix.
;═══════════════════════════════════════════════════════════════
;JOB          To transpose an 8-bit by 8-bit matrix, stored as
;            eight contiguous bytes.
;ACTION       FOR each bit (7 to 0)
;            [ FOR each byte (0 to 7)
;              [ Shift left 64-bit accumulator...byte. ] ]
;            Write accumulator to source.
;═══════════════════════════════════════════════════════════════
;CPU          68000 series.
;HARDWARE     8 bytes matrix RAM.
;SOFTWARE     None.
;═══════════════════════════════════════════════════════════════
;INPUT        A0 addresses source matrix (lowest address).
;OUTPUT       Matrix transposed.
;            CCR changed. All other registers unchanged.
;ERRORS       None.
;REG USE      A0 CCR
;STACK USE    (A7): 24
;RAM USE      None.
;LENGTH       38
;CYCLES       3288
;═══════════════════════════════════════════════════════════════
;CLASS 2      -discreet      *interruptable      *promable
;-*****       *reentrant     *relocatable        *robust
;═══════════════════════════════════════════════════════════════
;
TRN68K MOVEM.L D0-D4/A1,-(A7) ;Save working regs.              48E7
                              ;                               F840
       MOVEA.L A0,A1          ;Save source point to A1.       2248
       MOVEQ   #7,D0          ;Source bits/byte count.        7007
;
T68K1  MOVEQ   #7,D1          ;Source byte count.             7207
;
T68K2  MOVE.B  (A0),D2        ;Add copy of source byte to     1410
       ADD.B   D2,(A0)+       ;effect a byte left shift.      D518
       ADDX.L  D4,D4          ;Rotate bit through 64-bit      D984
       ADDX.L  D3,D3          ;temp dest, D3D4.               D783
       DBF     D1,T68K2       ;Repeat for 1 bit from each     51C9
                              ;of 8 source bytes.             FFF6
;
       MOVEA.L A1,A0          ;Reset source point to start.   2049
       DBF     D0,T68K1       ;Repeat for 8 bits from         51C8
                              ;every byte.                    FFEE
;
       MOVEM.L D3/D4,(A0)     ;Then store turned matrix       48D0
                              ;from D3D4 to source memory.    0018
       MOVEM.L (A7)+,D0-D4/A1 ;Restore working regs.          4CDF
                              ;                               021F
       RTS                    ;Exit, matrix transposed.       4E75
;═══════════════════════════════════════════════════════════════
```

Smooth operator

Christopher Korycinski explains how to structure and simplify your programming with the use of logical operators in Basic, and illustrates their usefulness with some simple routines.

Problems in computer programming often lie in inadequate or badly documented manuals. One of the areas in which there seems to be maximum murkiness is that of bit-wise logic operations. These may not be mentioned at all, or just skimmed over. If you're very lucky, you may come across some 'truth tables', but overall very little attention is given to these very useful (and often time and space-saving) operators which can be used to reduce a spaghetti-like heap of IF . . . THEN statements to one line of Basic. The purpose of this article is to cast at least a little light on this area.

True or false?

As is well-known, all computer operations finally resolve to manipulation of two logic states:
0 = zero voltage level or FALSE in logic terms
1 (or −1) = a negative voltage level, or TRUE in logic terms

You could see this for yourself by loading Basic into your computer and typing:
PRINT TRUE

If TRUE is a reserved word, then the chances are that you will find the number −1 (minus one) on your screen. If you find that this evaluates to 1, then you will need to change some of the routines discussed below to take account of this.

In a similar way you could type
PRINT NOT(TRUE)
to find that 0 (zero) is printed. You have to type NOT(TRUE), or perhaps NOT TRUE, as the word FALSE is not part of the reserved word list(the words which act as instructions) for all computers. Obviously, if it is present, use it. However, this omission is not a problem as it is obvious that if something is NOT TRUE, then it must be false; in other words, the two are identical.

One other problem may arise if you don't have either TRUE or FALSE as a reserved word, as, for example, in Microsoft Basic. When you type PRINT TRUE you will find '0' printed, as the variable TRUE has been given the value 0. So, if you type PRINT NOT(TRUE) you will find that −1 appears. More confusing still, is that Microsoft Basic will work by evaluating a TRUE statement to −1 and a FALSE one to 0 just as normal. The problem is not in the values assigned to TRUE or FALSE, but in the absence of the reserved word, so it is merely a slight inconvenience rather than a major problem.

What practical use is this? Well, it allows the setting up of a number of flags in your program which can be tested at any point to see how the program should branch. Type the following in and see:

```
10 A=-1
20 IF A THEN GOTO 40
30 PRINT "YOU SHOULDN'T BE HERE"
40 PRINT "YOU SHOULD BE HERE"
50 END
```

Now RUN it and see what happens. If everything has gone well, only 'YOU SHOULD BE HERE' should have been printed, and the computer should have skipped over line 30. It tested A in line 20 to see if A was 'true' because IF A . . . means the same as IF A = TRUE THEN . . . Finding that it was true (that is, it was −1), it went straight to line 40. (Note that some Basics will evaluate any non-zero value of A as TRUE when used in this way.) If you want to be absolutely sure that only −1 will evaluate to TRUE, then it is safest to rewrite line 20 as:

```
20 IF A = -1 THEN GOTO 40
```

but I have never found it necessary to do so.

You could go back to the program and change line 10 to

```
10 A=0
```

then RUN it again.

You should see that both lines have been printed because the test in line 20 failed (A was set to 'false'), so both the PRINT statements were used.

Setting a number of such flags in your program can make it far neater than testing for a variable. For example, you may have inserted a default printing subroutine in your program, but may wish to change it if required. Normally you would just type 'P' to print, but if changes are necessary, you could go to a printer menu by typing 'C'. Your program would trap the 'C' and set a flag — why not call it C? This would mean that if you selected the 'change printer' menu, then the flag would be set, otherwise it would not. So your program could run:

```
1000 K$=INKEY$
1010 IF K$= "C" THEN C=-1 (or
   C=TRUE)
        .
        .
        .
2000 IF C THEN GOTO (user-defined
   printing)
   .
   (default printing)
```

(You might be able to change line 1010 to

```
1010 IF K$ = "C" THEN C
```

This implies that if the test is true, then C is also to be set to TRUE (−1). Try it and see: it tests the flag at line 2000 and branches according to whether or not it is set.

Similar concepts could be used to refresh part of a screen display; for example, to test whether an 'INSERT ON' display should or should not be on the screen of a word processor. But in this case it is useful to have a key acting as a toggle rather than having to remember two separate keys for the same operation — one to switch it on, and another to switch if off. Let's say that you are using a routine involving INKEY$, INKEY, INPUT$(1) or something similar to obtain the value of a key pressed by the user without having to type an ENTER. So we could have:

```
100 K$=INKEY$:IF K$="" THEN 100
110 IF K$="I" THEN GOSUB 1000
:REM TOGGLE INSERT MODE
   .
   .
1000 IF J THEN J=0: GOTO1020
:REM IF INSERTION TOGGLE IS ON,
   SWITCH IT OFF
1010 J=-1 : REM SWITCH
   INSERTION TOGGLE ON
1020 . . . . change screen display, etc,
   to reflect new status
1030 .
```

Whether or NOT?

This works, but it is far from neat.

Note how you have to test the status of the insertion toggle in line 1000 before you can decide whether it should go to 'off' or to 'on'. How do we get around this?

The solution is easy. Type in the following and see what happens.

```
10 CLS: REM CLEAR SCREEN
20 A=-1
30 IF A THEN PRINT "ON": GOTO
   50: REM IF TRUE PRINT "ON"
40 PRINT "OFF": REM OTHERWISE
   PRINT "OFF"
50 A = NOT(A)
60 GOTO 30
```

Now RUN it. You should find that ON and OFF are printed alternately down your screen. Why? Because NOT TRUE = FALSE, so NOT(−1) = 0. In a similar way NOT FALSE = TRUE, so NOT(0) = −1.

So as the program runs, line 50 will toggle A between 0 and −1 at every pass. What is more important is that this enables us to change the logic state of any TRUE/FALSE value without having to test it first.

So lines 1000 and 1010 (above) could be rewritten as one:

```
1000 J = NOT(J)
1010 . . . not needed
1020 . . . refresh screen display in
     accordance with value of I.
```

A word of warning about the use of NOT. In terms of logic this should reverse the bits of a number in the sense of 0 being changed to 1 and 1 being changed to 0. So if we had 10101111 (= 175), then NOT(10101111) should evaluate to 01010000 (= 80). It doesn't. It will give you −176. This is because logical NOT evaluates to one's complement of the number. This is why NOT(0) = −1 and NOT(−1) = 0. So take care.

Versatility

Another property of the TRUE/FALSE logic is that these flags are used with all of the *relational operators* both singular and in all their combinations, *viz* <, >, =, <>, <=, =>. So if we have a statement

```
IF A > B THEN . . .
```

the TRUE flag is set to −1 if the relationship is true, and to 0 if it is false. The program will now branch depending on the value of the flag. But this is not the only way in which we can use these flags, because we can assign the flag to a variable.

```
V = (A > B)
```

In this case the numerical variable V will hold 0 if the relationship is false and −1 if it is true. So far so good, but this in itself has rather limited application unless we can extend it in some way. Needless to say this can be done.

If you look at the following line you will see that the variable V is set to 34 if A is greater than B, otherwise it is set to 0.

```
10 IF A > B THEN V = 34:GOTO 30
20 V = 0
30 . . . rest of program
```

This can be simplified a little by rewriting it like this:

```
10 V =ABS((A > B)*34)
20 (not needed)
30 . . . rest of program
```

First of all the relationship A>B is evaluated and given a value of −1 if it is true. This −1 is now manipulated by 34 to give −34. We then use ABS to give us a positive value (obviously not needed if logic TRUE = 1 in your computer) which is assigned to V. If the relationship is false, then we have 0*34 = 0 and V is assigned to this value.

With a little ingenuity a number of IF . . . THEN statements could be telescoped into one line, but it is a good idea to make sure that you have a REM statement as a reminder of what you are trying to do. Logic statements can be far from clear when you return to them after some time.

As an example, take a look at the following:

```
10 IF A > 34 THEN V = 4: GOTO 50
20 IF A = 34 THEN V = 3: GOTO 50
30 IF A < 20 THEN V = 2: GOTO 50
40 V=1 : REM V=1 if A=>20 and >34
50 . . . rest of program
```

Here the value of the variable V is set to either 1, 2, 3 or 4 depending on the value of A. Using TRUE/FALSE logic this could be rewritten to:

```
10 V = ABS((A > 34)*4 + (A = 34)*3
   + (A < 20)*2 + ((A =>20) AND (A
   <34)))
20 . . . not needed
30 . . . not needed
40 . . . not needed
50 . . . rest of program
```

You can see that each term involving A (compare them to the IF . . statements above) would be evaluated as either TRUE (−1) or FALSE (0) and is then multiplied by the value we wish to assign to V. Unless a mistake has been made, only one of these terms will be true and after the multiplication give us the negative number corresponding to the value of V we want. All the rest will evaluate to 0. By obtaining the positive value of the number we get the value we want for V.

This is still rather untidy, though we have saved a number of lines. We can simplify it still further by changing line 10:

```
10 V = 1 + ABS((A>34)*3
+ (A=34)*2 + (A<20))
20 . . . not needed
30 . . . not needed
40 . . . not needed
50 . . . not needed
```

As using logical operations in this way is a real space and time-saver, let's see exactly what happens using two values for A in the above simplified form of line 10. Read the following first.

Let's say that A = 56. The first test (A >34) is true, so the flag is set to −1. This is then multiplied by three to give us −3. The second test (A = 34) fails, so the flag is given a value of 0. 0 * 2 is still 0. The third test (A<20) also fails, so the flag is evaluated to 0 in the same way. So we have −3 + 0 + 0 = −3. This is then changed to a positive number and 1 is added to give us 4 as the final result, which is correct for the value of V.

Now let's run through it again using A = 25. The first test (A>34) fails, so the flag is given the value of 0. 0*3 = 0. The second test (A=34)*2 fails, so the flag is given the value of 0. Again 0*2 = 0. The third test (A<20) fails, so the flag is given the value of 0. The whole expression inside the brackets evaluates to 0+0+0=0. The ABS of this is still 0. Finally, we add the 1. 1+0=1, and this is the value we assign to V, which is correct.

If you compare the space taken up by the original IF . . . THEN and the final one-liner, you can see that the effort required to rethink the problem in terms of logic values is certainly worth making. It might be faster, and it is definitely more elegant.

AND/OR operators

There are two other common logic operators, AND and OR. Both of these work in a bit-wise fashion. This means that they work on single bits of a number, and not on the number itself — just as 'NOT' does. In order to discuss them, let's examine how numbers are represented in bit-wise form. Life is short, so let's just consider positive numbers in the range 0-255, which will include the control codes (0-31), all the ASCII set (32-127), and the 'high bit' set of characters — often graphics or foreign letters — in the range 128-255.

All the numbers in the above range can be defined in eight binary bits. The highest number, 255, is represented by:

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	1	1	1	1	1	1	1	= 255

and

0	0	0	0	0	0	0	0	= 32

Note that the eighth bit (high bit) is bit 7 because the first bit is bit 0.

It is fairly straightforward to work out the decimal value of a binary number — though rather tedious. All you have to do is remember that 2^7 = 128; 2^6 = 64; 2^5 = 32; 2^4 = 16; 2^3 = 8; 2^2 = 4; 2^1 = 2; 2^0 = 1 and then patiently add up all the powers of 2 which have their bits set.

As it is more common to do things the other way around to get the bit representation of a number, the following program will do it for you.

```
10 CLS: REM CLEAR SCREEN
20 INPUT "NUMBER? ",A
30 B = A — INT(A/2) * 2
40 A = INT(A/2)
50 B$ = STR$(B) + B$
60 IF A = 0 THEN PRINT B$: END
70 GOTO 30
```

If you now type a number, its bit

representation will be produced for you.

The program works in the same way as a person would work it out with pencil and paper — dividing the number by two, and writing down the remainder, which may be either 1 or 0. Reading the digits of the remainder gives you the bit representation.

Using the program, take a look at the bit representation of the following numbers: 65, 66, 67, 68, 69, 70. These represent ASCII values for A, B, C, D, E, F. If you examine them carefully, you will see that bit 5 is not set on any of these numbers. This is the case until you get to 96. Now try getting the bit representation of 97, 98, 99, 100, 101, 102. These represent the ASCII values of a, b, c, d, e, f. Compare the bits of A and a, B and b, and so on. You will find that with the exception of bit 5 they are identical. The only bit difference between upper and lower-case letters is that bit 5 is set in the lower-case ones and is 0 in the lower case.

It is not hard to see that by manipulating bit 5, we can change between upper and lower-case letters. To see how this can be done it will be necessary to look at 'Truth Tables'.

This is a truth table for the logical operator AND

	0	1
0	0	0
1	0	1

Unless your chief amusement is reading books on symbolic logic, the above may look rather daunting. But it is easy to see that if you AND two zeros, then you get zero. In a similar way, if you AND a zero and a one, the answer is zero. The only time ANDing gives a 1 is if the bits of *both* numbers are set. The usefulness of this may not be apparent at first, so let's put it another way: if you AND a bit with zero, the answer will always be zero. If you AND a bit with 1, then the number will not be changed as 0 AND 1 = 0; 1 AND 1 = 1. Remember that these are *logical* operators, so don't confuse ANDing with adding! AND means that the result is TRUE (−1) if both propositions are TRUE. If just one of the propositions is FALSE (0), then the result must also be FALSE.

So if all we need to do is to zero bit 5 and leave the rest the same, then it is only necessary to AND with 01011111. The bits ANDed with the 1s will be unchanged, while bit 5 *must* be changed to 0. Now this is rather nice, because we now have a simple way to change all keyboard input to upper case — but remember that it will also affect other ASCII characters which have bit 5 set. In particular, characters below 63 will have their values changed to lie in the range of 1-31 (that is, control characters). This can be rather inconvenient. The other snag is that only numbers can be ANDed. If you can access ASCII values directly from the keyboard using an operator like INKEY, then there is no difficulty. If you can only get characters, then you will have to change them to numbers before ANDing them. This is not hard.

Try:

```
10 CLS: REM CLEAR SCREEN
20 A$=INKEY$:IF A$ = "" THEN 20
30 A$=CHR$(ASC(A$) AND 95)
40 PRINT A$;
50 GOTO 20
```

RUN this and then play around with the keyboard pressing keys which are both SHIFTed and unSHIFTed. Everything should come out in upper case.

If you look back to the 'toggles' paragraph, you will recall that an insertion toggle can be controlled by typing an 'I', but I skated over what would happen if you typed an 'i'. All that is necessary is to AND the input with 95 and the problem disappears.

If you have a character string, for example, from an INPUT statement, then the above method is not possible. But all you need to do is step through the string ANDing each character.

```
110 FOR N = 1 TO LEN(TX$): REM
    TX$ = TEXT STRING
120 MID$(TX$,N,1) =
    CHR$(ASC(MID$(TX$,N)) AND 95)
130 NEXT N
```

The above might do the job, though some computers will not accept line 120 unless MID$(TX$,N,1) on the left is replaced by a variable, giving:

```
110 FOR N = 1 to LEN(TX$)
120 TM$ = TM$ +
    CHR$(ASC(MID$(TX$,N)) AND 95)
130 NEXT N : REM TM$ = A
    TEMPORARY HOLDER FOR THE
    CONVERTED STRING
140 TX$ = TM$: TM$ = ""
```

It is clear now that any bit, or bits, can be unset by ANDing them with 0, while those which are to be unchanged are ANDed with 1. Another example of how useful this can be is if you have some text in which the high bit is set. A number of word processors do this to indicate 'soft' carriage returns or where spaces can be inserted for justification. Other computers use a high bit to select inverse video or bright/dim test. Whatever the purpose of setting bit 7, the result is a shambles if you try to display it on your screen as ordinary text. The obvious way out of this is to unset the bit by ANDing each character with 01111111 (= 127). This leaves everything alone except the high bit, which is ANDed with 0 making it a 0 no matter whether it is a 0 or a 1. Note that in these logic functions there is no need to test the bit. ANDing automatically leaves correct ones alone.

All you have to do is read in the text, then step through it using the MID$ function described above to change any high bits. It's that easy.

You may have noticed that the example of changing to upper case by ANDing with 95 will also set the high bit to zero because 95 = 01011111. This is usually an advantage on computers where you can produce characters in the ASCII range 128-255 by pressing a GRAPHICS key with one of the ordinary keys, because it now doesn't matter whether the user types a, A, graphics+a or graphics+A, the result will always be A. If you want to have the option of using some graphics symbols, then instead of ANDing with 95 you could AND with 11011111 (= 223). But remember that this will also zero bit 5 on all of your graphic characters as well.

Before looking at the last example of ANDing numbers, it might be worthwhile typing in a program which will show you the numerical result of ANDing. Otherwise it can all get rather confusing.

```
10 CLS: REM CLEAR SCREEN —
   'AND' PROGRAM
20 INPUT "FIRST NUMBER",A
30 INPUT "SECOND NUMBER",B
40 PRINT: PRINT A;" and";B;" =";A
   AND B
50 PRINT "AGAIN? (Y/N)";
60 AN$ = INKEY$: IF AN$ = ""
   THEN 60
70 IF (ASC(AN$)AND 95) = 89 THEN
   10
80 END
```

If you want to see the effect of ANDing characters, then try this:

```
10 CLS
20 INPUT "WHICH CHARACTER . . .
   ",A$
30 INPUT "ANDed WITH ? . . . ",A
40 PRINT A$;" when ANDed
   with";A;" = ";CHR$(ASC(A$) AND
   A)
50 PRINT "AGAIN? (Y/N) ";
60 AN$ = INKEY$:IF AN$ = "" THEN
   60
70 IF (ASC(AN$) AND 95) = THEN 10
80 END
```

Note the brackets round the IF statement in line 70, which ensure correct evaluation of the IF statement as logic operations such as AND OR NOT have a very low priority. Missing out brackets can lead to some *very* mysterious bugs as the statement looks fine but is evaluated in a rather unexpected, and incorrect, way.

Suppose we have a fairly large menu to choose from — say 20

items. It is convenient to both the programmer and the user to be able to choose the menu option without having to type an ENTER after the input. The snag is that there appears to be no easy way of doing this. If we use the usual INKEY$ or INKEY operator, this will only pick out one keypress. The obvious solution is not to have each menu item numbered, but have it lettered (A, B, C . . . .) instead. This allows up to 26 items to be selected with only one keypress. So far so good. But what do we do with the input? If we used INKEY$, it is a letter which makes it rather clumsy to use a list of computed GOSUBS or GOTOS after the menu.

If we used INKEY, then it could be either one of two numbers for each letter, depending on whether an upper or lower-case letter was input. So we could get either 65 or 97 for an A. Awkward.

If we look at the bit pattern of A, we see that it is 01000001; a is 01100001. B is 01000010; b is 01100010 . . . and so on. If we ignore the three high bits, the rest of the number is (in binary) 1, 10, 11, and so on, as we work our way up the alphabet. Notice that it doesn't matter whether we input a lower or an upper-case character — the result is the same if we ignore the three top bits. This is fine, because if we remove bits 6 and 7, we are left with numbers which go up from 1 to 26 in exact correlation to the order of letters in the alphabet. So if we type in an A or an a, then we end up with 1. If we type in a B or a b, then we have a 2. C or c will give 3, and so on. Just right for our computed GOSUBS. It should be obvious how to achieve this marvel — you just AND the input with 00011111 (= 31). The two top bits are 0, so the result must have the three top bits set to 0 as well, irrespective of what they were before. So we could have:

```
.
.
. (menu items — up to 26)
300 C$ = INKEY$: IF C$ = "" THEN
    300
310 C = ASC(C$) AND 31
320 ON C GOSUB 1000, 2000, 3000,
    4000 . . . . . .
```

Very simple and tidy.

Alternatives

Here is a much better way to do the same job which I came across in *Open # Stream* Issue 2 (NewBrain owner's group) which I have adapted for use with Microsoft Basic. It only handles numbers up to 255, but this is easy to change.

```
3000 INPUT "WHICH NUMBER? ";A
3010 IF A>255 THEN 300
3020 FOR B = 7 TO 0 STEP -1
3030 IF A AND 2^B THEN PRINT 1;
: GOTO 3060
3040 REM You are ANDing with 2
'to the power of' B
3050 PRINT 0;
3060 NEXT B
```

The key line is 3030. It steps through the powers of 2 (that is, the value of bits in a number) ANDing them with the number itself. If the number has got the appropriate bit set, then the result of ANDing will be true, so you print a '1'. If ANDing produces a 0, then the test in line 3030 fails and the bit must be 0, so you print a '0'. You then repeat the procedure until you have stepped through all the bits down to 0.

So far, lower-case letters have been changed to upper-case by ANDing them with 95 to change bit 5 to 0. But suppose that you want to do the opposite and change upper-case to lower-case? ANDing won't work, because this will either leave bits as they are, or unset them. What we want is something to set bit 5 to 1 irrespective of whether it is a 0 or a 1.

'. . . the programs and routines given here are just starting points for some not-so-common exploration of the possibilities of Basic . . . once you look at problems in text or number-handling, their solution becomes easier . . .'

There is, of course, a logical operator to enable us to do just that. Look at the truth table below for the logical operator OR:

	0	1
0	0	1
1	1	1

Here you can see that if either bit of the two digits being ORed is set, then the result will be set.

```
0 OR 0 = 0
0 OR 1 = 1
1 OR 0 = 1
1 OR 1 = 1
```

Look again at the last one in the table. Even if both bits are set, then the result of ORing is TRUE. This is not immediately obvious if you look at it from the 'intuitive' point of view, because you immediately think of it in 'either/or' terms — either one or the other must be set, but not both. This is wrong, so be careful.

We can see from the table that ORing a digit with 0 leaves it unchanged, and ORing it with 1 will set it irrespective of whether it was a 0 or a 1 originally. Now this is just what we want. If we have a number of which bit 5 is to be set and the rest left unaltered, then all we need to do is OR the number with 00100000 (= 32).

The best way to see how this works is to use the AND program (above) but change all the ANDs for ORs. RUNning this will take the mystery out of ORing.

Using this information, our change-to-lower-case routine would look like:

```
500 K$ = INKEY$: = IF K$ "" THEN
    500
510 K$ = CHR$(ASC(K$) OR 32))
```

Let me emphasise that this, like ANDing with 95, will not only affect letters, but also any other character which has bit 5 set to 0. So check that this does not cause any problems with your expected input.

Truth tables

So far I have only discussed AND, NOT and OR. These are, I believe, found in all computers. Other Basics will also give you XOR, IMP, EQV. Although I don't propose to discuss them here, I will give their truth tables in order that those of you who have the patience can work through them and devise other useful routines. Basic is far from dead!

	0	1
0	0	1
1	1	0

Truth Table for XOR (exclusive OR)

X \ Y	0	1
0	1	1
1	0	1

(Note that if X is 1 and Y is 0 then X IMP Y is false, but if X is 0 and Y is 1 then X IMP Y is true.)

Truth Table for IMP (implication)

	0	1
0	1	0
1	0	1

Truth Table for EQV (equivalence)

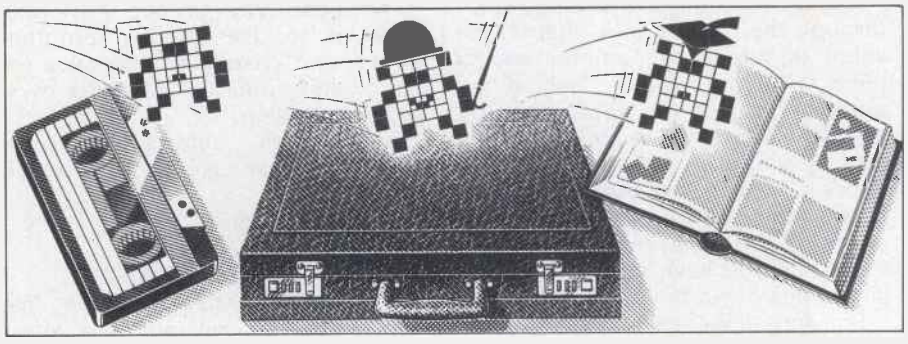
Conclusion

All the routines given in this article have been run using Microsoft Basic, but I have tried to make them generally applicable across a wide range of computers by not using any IF . . . THEN . . . ELSE statements and keeping things simple.

Obviously they can be improved on by using the power of your version of Basic. For example, the BBC can use INKEY and not INKEY$, thereby picking up the ASCII value of the keypress straight away. The NewBrain can use device 5 for this purpose. Both of these would avoid having to use ASC(I$).

Finally, the programs and routines given here are just starting points for some not-so-common exploration of the possibilities of Basic. You may well find that once you look at problems in text or number-handling as logic problems, their solution becomes easier and more elegant. END

PROGRAM FILE



Games

Scientific/mathematic

Business

Toolkit/utilities

Educational/Computer Aided Learning

Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the end of this section.

My opening theme will be familiar to regular readers — the quality of program submissions and their originality has to be very much improved. Despite previous rantings and ravings on this subject, I am still receiving silly programs which do no more than plot graphs or play hangman. Even if these programs have been written for new machines such as the Amstrad PCW8256 or the Atari ST range, the usual principles apply, and there is no novelty for anyone. *Please* — if you intend to send a program to Program File, make sure it's original, interesting and high-quality!

Despite the fact that the box opposite states clearly that stamped, addressed envelopes must accompany submissions, many people continue to ignore this. It is standard practice in all forms of publishing to dispose of unwanted submissions if they don't have an SAE with them, and this practice is now in effect at *PCW*.

Occasionally, I have had to spend almost half a day dealing with the administration of the programs which arrived the previous day. Consequently, I have little time to devote to evaulating submissions, and so I can't always give them the attention they deserve.

Programs should be as easy to convert to other machines as possible. The exception to this is when a program makes use of a micro's special facilities or introduces new facilities, such as a new command. Otherwise, there is no excuse for the lack of common commands and clearly labelled machine-dependent parts of code — I/O commands, graphics and string handling are especially applicable here. There is no reason why easy conversion shouldn't apply to machine code programs, too. As long as BIOS or ROM calls are explained with a comment to show what they do, another programmer can make a stab at converting a program, even for an entirely different processor.

It should be noted that the Spectrum, the QL, the Dragon and the Enterprise machines differ widely from the standard computer Basic. Further details about precise language differences can be found in the *PCW* Basic Converter Chart which last appeared with the November 1985 issue. There are some commands which operate in a radically different fashion from machine to machine: these deal with disk files (and cassette files); getting a character from the keyboard and storing it in a string; printing; error trapping; and a few of the more obscure string-handling commands.

If you want to convert a program to run on another machine or write a program which can be easily converted, the above-mentioned areas are the ones to watch out for. The programs should be very carefully documented.

Another major problem with graphics programs is screen size. Practically no micro offers similar screen height and width to another micro, so all plotted output has to be transformed by a function which makes the output run correctly on a different-sized screen. Conversion from a large screen to a smaller screen is simple, as all plotted points will be mapped onto one or more new points to be plotted. If the screen size to be converted from is oldxsize × oldysize, and the screen to be converted to is newxsize × newysize, then a point (x,y) will be mapped to a point x*newxsize/oldxsize,y*newysize/oldysize). Problems only arise if the screen being mapped to is larger than the original screen; then, an image created by separately plotting a number of points will be spread out and will contain gaps. This problem can be avoided by using the machines's built-in plotting and filling routines, which will fill in all intermediate points. This only leaves the problem of graphics which only use single-dot plotting commands, but these are rarely used to produce anything but discrete images such as plotted graphs.

An apology is due to Enterprise owners who typed in the Typing Tutor from 'Program File', *PCW* April. Unfortunately, I omitted the keyboard layout diagram for the program — however, this will not affect the running of the program.

By now, all regular *PCW* readers should have read about PCW Online; and 'Newsprint' readers should know by now that the monthly fee has been reduced and the number of facilities on offer has been increased. The most exciting parts of the Online service will be: the noticeboard/special interest groups section; the *PCW* database of reviews and information, which will cover even more ground than the magazine; and the programs section, which will contain the best of Program File as well as a large collection of public domain software.

For reasons of space, there are some programs which can't be published in *PCW*, even though they are of a high quality. But there is no reason why these programs shouldn't be made available on PCW Online — anyone who is interested should contact me. Details about the uploading and downloading of PCW Online programs appear on page 130, *PCW* June.

Although the Online service will be on Telecom Gold, the noticeboard will bear no resemblance to the one on Gold, and will be a combined special interest group electronic mail system. At present, our plans are to begin with noticeboards for the following items: Amstrad, Apple, Atari, BBC, MS-DOS/PC-DOS, Programming, Graphics, AI and General. Please let me know of any comments you may have on this list.

Amstrad is a notoriously mean company. It has loaned *PCW* a

PROGRAM FILE

PCW8256 on which to conduct software reviews, look at programs, and so on. Unlike other computer manufacturers, however, Amstrad is only willing to let us have the machine for a couple of months, so don't be too surprised if mention of Amstrad machines in *PCW* stops very soon.

To make the most of the 8256's time in the office, I would like to include a few good programs for the machine in Program File before the deadline. Partly due to this, the Program of the Month is for the 8256; the other reason is that this month's programs are rather uniform in quality — nothing too bad, but nothing outstanding. The Program of the Month shows how to access point-plotting graphics from the Amstrad's Basic. This is a program which doesn't apply to other machines in any way, but it is important because it adds a much-needed feature to the new Amstrad.

One of the problems with PCW8256 Basic is that it provides no way of producing graphics on screen. PLOT RSX provides exactly what is needed — a simple way of plotting points. The program produces assembly code for an RSX command (a machine code routine which can be called from within Basic as if it were an ordinary command). This RSX sets a single bit of the screen memory on or off. When this routine is available, others can be written, in Basic or machine code, to provide other plotting facilities.

The second program is a rather strange one, written in Turbo Pascal and intended for MS-DOS machines. It's a 6502 emulator and works so well that the author, after writing a few routines to imitate BBC ROM calls, was able to dump the code for Acornsoft Lisp to a disk and run it. Amazingly, the program works completely, albeit slowly. It should be possible to convert Pascal 6502 Emulator to run on other machines without too much difficulty, but running it on a BBC, with that machine's limited memory, would be awful.

For the Spectrum there's a program called Harmonograph, which emulates a piece of machinery of the same name. The author of the program has submitted some excellent design details with the program, and also an account of how he came across it — he discovered the idea at school.

A harmonograph consists of a flat plate which can swing in two dimensions as if it were hanging by its corners from a hook. Above the plate is a pen on some kind of suspension, so that the nib can keep even pressure on the surface of a piece of paper attached to the plate. When the plate is swung, interesting repetitive patterns are drawn on the paper.

For the BBC Micro there's an interesting program called Slowdown, which does exactly that. When Slowdown is called, it's possible to slow down the BBC by degrees or speed it up again to full speed. This can be useful for debugging programs which use graphics, where standard debugging would interfere with the display.

One type of program which I don't normally consider is a tape directory program, purely because it always seems sensible to me to put one program on one side of a cassette, and write the program names on a label and keep them filed manually. However, one program this month enables you to keep a cassette filing system. It's for the Epson HX20 which uses microcassettes — these are expensive, so it makes sense to keep several programs on one side of a cassette. The program is equivalent to a disk directory, but will also automatically position the tape at the start of a selected file.

For IBM or compatible computers, or any machine which runs MBasic, there's a program which makes daisywheel printers provide graphical output (the daisywheel should be able to do microjustification).

The program allows anyone with only a daisywheel printer for text output to add graphics printing. There's one problem, however — it's very slow!

For the Oric, there's a tip to access the FUNCTion key and use it for other purposes, in this case as a Home key.

Remember: all submissions to Program File should be accompanied by a stamped, addressed envelope.

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications.

Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work.

We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but please keep a copy of everything.

Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month. Send your contributions to Owen Linderholm, Program File, PCW, 32-34 Broadwick Street, London W1A 2HG.

Program of the Month
Amstrad PCW8256 PLOT RSX

by Ron Yorston

This CP/M RSX allows you to plot to the screen from Locomotive Basic, one of the major omissions from the language as it's supplied. The assembly code for the RSX is given in the first listing, and should be typed in and saved as the file plot.asm. It can be assembled to the file plot.com with the following sequence of commands:

rmac plot
link plot[op]
ren plot.rsx=plot.prl
gencom plot[null]

The second listing should be entered as the Basic program plot.bas and saved. The following set of commands will then set up Basic to use the plot commands (the programs plot.bas and plot.com should both be on the same disk as the Basic):

plot
basic
load "plot"
run
new

The plotting RSX will now be installed in memory. Basic programs which use the plot utility should have the line 'plot=HIMEM+1:set%=0:clear%=1:toggle%=2' near the beginning, and *definitely* before any Memory command.

The function is called by a line of the form 'CALL plot(x%,y%,action%)', where x% is the x coordinate of the point to be plotted, y% is the y coordinate, and action% is the plotting action to be performed. The coordinates run from (0,0) to (719,247). It's up to the user to ensure that a point plotted is on-screen, although some error checking is provided.

The action variable can take a value of 0, 1 or 2. If it's 0, the point is turned on; if it's 1, the point is turned off; and if it's 2, the point is reversed. The third listing gives an example of how to use the plotting routine. Hard copy of the onscreen graphics can be provided if the Extra and PTR keys are pressed together.

```
;
; RSX to set bit in screen memory
;  H contains action byte:  0  set bit
;                           1  clear bit
;                           2  toggle bit
;  L contains y coordinate (0 <=  L <= 247 )
; DE contains x coordinate (0 <= DE <= 719 )
;
;
wboot:  equ     1
scrrun: equ     000e9h
;
        cseg
        db      0,0,0,0,0,0
        jmp     start
next:   db      0c3h
        dw      0
prev:   dw      0
remov:  db      0ffh
nbank:  db      0
        db      'SCRSETXY'
loader: db      0
        db      0,0
start:
        mov     a,c
        cpi     76
        jz      begin
        jmp     next
begin:
        push    h
        lhld    wboot   ;form firmware exec address
        lxi     b,87
        dad     b
        shld    cjfirm
        pop     h
        lxi     b,code
        call    entfw
        dw      scrrun
        ret
;
code:                   ;perform operation in screen memory
        mvi     a,3     ;restrict range of x to 0..1023
        ana     d
        mov     d,a
        push    h       ;save action byte
        mvi     h,0     ;restrict range of y to 0..255
        dad     h       ;fetch roll table pointer
        lxi     b,0b600h
        dad     b
        mov     c,m     ;get address from table
        inx     h
        mov     b,m     ;BC contains pixel row pointer

        mov     a,e     ;mask off low order bits of pointer
        ani     0f8h
        mov     l,a
        mov     h,b     ;put it in HL
        dad     h       ;shift masked pointer left
        dad     d       ;add x to masked pointer

        mov     a,l     ;mask off low order bits from x
        ani     0f8h
        mov     l,a
;
        mov     a,c     ;get low order bits of pixel row pointer
        ani     7
        ora     l       ;add low order bits into HL
        mov     l,a     ;HL now contains memory address of bit
;
        mov     a,e     ;get low order bits of x
        ani     7
        inr     a
        mov     b,a     ;B contains rotate count
;
        xra     a       ;clear A
        stc             ;set carry bit
loop:   rar             ;form mask by shifting carry
        db      010h    ;djnz loop
        db      0fdh    ;(not available in this assembler)
                        ;mask in A, address in HL
        pop     b       ;fetch action byte
        mov     c,a     ;save mask in C
        mov     a,b
        cpi     0       ;check action byte
        jnz     not0
        mov     a,c     ;action byte = 0
        ora     m       ;set bit in memory
        mov     m,a
        ret
;
not0:
        cpi     1
        jnz     not1
        mov     a,c     ;action byte = 1
        cma             ;clear bit in memory
        ana     m
        mov     m,a
        ret
;
not1:
        cpi     2
        rnz             ;unknown action, return
        mov     a,c     ;action byte = 2
        xra     m       ;toggle bit in memory
        mov     m,a
        ret
;
entfw:  db      0c3h
cjfirm: dw      0
        end
```

```
 10 REM load machine code for plotting function at top of memory
 20 memtop=HIMEM-16
 30 MEMORY memtop
 40 FOR i=memtop+1 TO memtop+14
 50       READ x
 60       POKE i,x
 70 NEXT i
 80 DATA &hd5,&h5e,&h23,&h56,&h0a,&he1,&h6e,&h67
 90 DATA &h0e,&h4c,&hcd,&h05,&h00,&hc9


100 REM demo program to plot a graph
110 REM set up plotting
120 plot=HIMEM+1 : set%=0 : clear%=1 : toggle%=2
130 :
140 REM clear screen
150 PRINT CHR$(27);"E"
160 :
170 REM draw axes
180 :
190 x%=100
200 FOR y%=20 TO 200
210    CALL plot(x%,y%,set%)
220 NEXT y%
230 :
240 y%=110
250 FOR x%=100 TO 600
260    CALL plot(x%,y%,set%)
270 NEXT x%
280 :
290 REM plot a graph
300 :
310 FOR z%=0 TO 500
320     x%=z%+100
330     y%=110-SIN(z%*0.0174533)*90
340     CALL plot(x%,y%,set%)
350 NEXT z%
360 :
370 REM label axes
380 :
```

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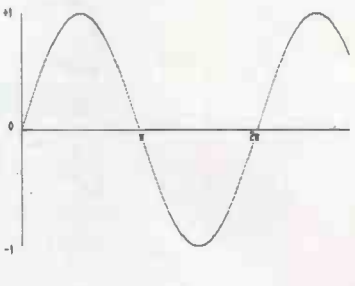
PROGRAM FILE

```
390 PRINT CHR$(27);"Y";CHR$(32+14);CHR$(32+35);CHR$(27);CHR$(24)
400 PRINT CHR$(27);"Y";CHR$(32+14);CHR$(32+56);"2";CHR$(27);CHR$(24)
410 PRINT CHR$(27);"Y";CHR$(32+13);CHR$(32+10);"0"
420 PRINT CHR$(27);"Y";CHR$(32+2);CHR$(32+9);"+1"
430 PRINT CHR$(27);"Y";CHR$(32+25);CHR$(32+9);"-1"
```



Pascal 6502 Emulator

by Mark Needham

This program has been written in Turbo Pascal for the IBM PC. It should be possible to convert it to run on other machines with other 'flavours' of Pascal. It emulates every instruction and addressing mode of a standard 6502, including the bug for indirect jumps over a page boundary.

The Emulator has a full disassembler and assembler, so 6502 code can be typed in directly to the memory locations. The bottom 32k of the 64k addressable by the 6502 can be used; the top 32k cannot. The Emulator detects JSRs and JMPs to this area, which it assumes holds ROM routines, and calls a special routine called DOSPECIAL to emulate them. An Include file is given which emulates some of the BBC Micro's OS calls.

To run a normal 6502 program, enter the code using the byte editor or the assembler, move the program counter to the first location, and enter 6 to run the program. The program can be stopped by a BRK instruction or by pressing ESC. S will single-step through the program.

The emulator consists of two programs and two include files. CRAT6502.PAS creates a file of 6502 mnemonics and address modes for each of the 256 opcodes; this file is loaded by EMUL6502.PAS, which is the main code which emulates the 6502 microprocessor. COMMON.INC is an include file required by both files.

The 6502 emulator only processes the bottom 32k of memory, so the Pascal code must handle all accesses above 8000 hex. An include file must be used to emulate calls to the top 32k. The include file, SPECIAL.INC, holds the example BBC Micro OS calls which are all that are needed to run the Acornsoft Lisp interpreter on the emulator.

A list of commands accepted by the emulator is given before the program listings.

```
case a of          { EXAMPLE SPECIAL.INC WHICH EMULATES BBC MICRO }
-12 : begin
        writeln('OSBYTE Call: A = ',Areg);                { FFF4 }
        case Areg of
        131 : begin Xreg := 0; Yreg := $19 end;     { get PAGE  }
        132 : begin Xreg := 0; Yreg := $7c end;     { get HIMEM }
        end;
      end;
-15 : begin                { FFF1 }
        case Areg of
        0 : begin          { KEYBOARD INPUT }
              readln(s); s := s + chr(13); Param := Xreg + (Yreg shl 8);
              buffer := M[Param] + (M[succ(Param)] shl 8);
              for loop := 0 to length(s)-1 do
                M[buffer+loop]:=ord(s[loop+1]);
              ClrCarry; Yreg := length(s)
            end;
        3 : begin          { RETURN INTERVAL TIMER}
              buffer := Xreg + (Yreg shl 8);  M[buffer] := 1;
              for loop := 1 to 4 do M[buffer+loop] := $ff
            end;
        else writeln('OSWORD : A = ',Areg,' X = ',Xreg,' Y = ',Yreg);
        end
      end;
-18,-29
    : begin      { FFEE }  { WRITE CHARACTER TO SCREEN }
        if Areg = 13 then writeln
        else if Areg = 12 then clrscr
          else if Areg = 127 then write(chr(8))
            else if (Areg > 31) and (Areg < 128) then write(chr(Areg))
      end;
-41 : writeln('OSBGET Call')
else writeln('Unknown Call - ',D2H(a,4))
```

PROGRAM FILE

```
    end;
    DoCommand(RTS,Implied)    { END OF SPECIAL.INC FILE }




{ Included in CRAT6502.PAS and EMUL6502.PAS (ADN is AND as AND is reserved) }

type Instructions = (ADC,ADN,ASL,BCC,BCS,BEQ,BIT,BMI,BNE,BPL,BRK,BVC,BVS,
                     CLC,CLD,CLI,CLV,CMP,CPX,CPY,DEC,DEX,DEY,EOR,INC,INX,
                     INY,JMP,JSR,LDA,LDX,LDY,LSR,NOP,ORA,PHA,PHP,PLA,PLP,
                     ROL,ROR,RTI,RTS,SBC,SEC,SED,SEI,STA,STX,STY,TAX,TAY,
                     TSX,TXA,TXS,TYA,UND);
     modeType = (Immed,Abs,Page0,Accum,Implied,IndX,
                 Indy,ZeroX,ZeroY,AbsX,AbsY,Relat,Indir,Unknown);
     strfield = string[80];
     DescStr = string[3];
     FileDef = record
                 inst  : Instructions;
                 mode  : ModeType;
                 Desc  : DescStr
               end;
{ End of COMMON.INC file }




program CreateData;   { THIS PROGRAM CREATES THE DATA FILE FOR EMUL6502 }

{$i Common.inc }

var File6502 : file of FileDef; Rec6502  : FileDef; r,check  : integer;

procedure s(a : integer; b : Instructions; c : ModeType; d : DescStr);
begin
  with Rec6502 do begin inst := b; mode := c; desc := d; end;
  check := check + a; seek(File6502,a); write(File6502,Rec6502)
end;
          {  INITIALISE 256 UNKNOWN COMMANDS }
begin
  writeln('IBM Turbo PASCAL 6502 Emulator Table Creation Procedure.');
  assign(File6502,'data6502.rel');
  rewrite(File6502); seek(File6502,0);
  Rec6502.inst := UND;  Rec6502.mode := Unknown; Rec6502.Desc := 'BYT';
  check := 0;       { ADDS UP ALL OPCODES TO CHECK YOUR TYPING }
  for r := 0 to 255 do write(File6502,Rec6502);

  s($6d,ADC,Abs, 'ADC');    s($7d,ADC,AbsX,'ADC');   s($79,ADC,AbsY,'ADC');
  s($65,ADC,Page0,'ADC');   s($61,ADC,IndX,'ADC');   s($71,ADC,IndY,'ADC');
  s($75,ADC,Zerox,'ADC');   s($69,ADC,Immed,'ADC');
  s($2d,ADN,Abs,'AND');     s($3d,ADN,AbsX,'AND');   s($39,ADN,AbsY,'AND');
  s($25,ADN,Page0,'AND');   s($35,ADN,ZeroX,'AND');  s($31,ADN,IndY,'AND');
  s($29,ADN,Immed,'AND');   s($21,ADN,IndX,'AND');
  s($0e,ASL,Abs,'ASL');     s($1e,ASL,AbsX,'ASL');   s($06,ASL,Page0,'ASL');
  s($16,ASL,ZeroX,'ASL');   s($0a,ASL,Accum,'ASL');

  s($90,BCC,Relat,'BCC');   s($b0,BCS,Relat,'BCS');  s($f0,BEQ,Relat,'BEQ');
  s($30,BMI,Relat,'BMI');   s($2c,BIT,Abs,'BIT');    s($24,BIT,Page0,'BIT');
  s($d0,BNE,Relat,'BNE');   s($10,BPL,Relat,'BPL');  s($00,BRK,Implied,'BRK');
  s($50,BVC,Relat,'BVC');   s($70,BVS,Relat,'BVS');

  s($18,CLC,Implied,'CLC'); s($d8,CLD,Implied,'CLD');
  s($58,CLI,Implied,'CLI'); s($b8,CLV,Implied,'CLV');
  s($cd,CMP,Abs,'CMP');     s($dd,CMP,AbsX,'CMP');   s($d9,CMP,AbsY,'CMP');
  s($c5,CMP,Page0,'CMP');   s($d5,CMP,ZeroX,'CMP');  s($d1,CMP,IndY,'CMP');
  s($c9,CMP,Immed,'CMP');   s($c1,CMP,IndX,'CMP');
  s($ec,CPX,Abs,'CPX');     s($e4,CPX,Page0,'CPX');  s($e0,CPX,Immed,'CPX');
  s($cc,CPY,Abs,'CPY');     s($c4,CPY,Page0,'CPY');  s($c0,CPY,Immed,'CPY');

  s($ce,DEC,Abs,'DEC');     s($de,DEC,AbsX,'DEC');   s($c6,DEC,Page0,'DEC');
  s($d6,DEC,ZeroX,'DEC');   s($ca,DEX,Implied,'DEX');s($88,DEY,Implied,'DEY');

  s($4d,EOR,Abs,'EOR');     s($5d,EOR,AbsX,'EOR');   s($51,EOR,IndY,'EOR');
  s($59,EOR,AbsY,'EOR');    s($45,EOR,Page0,'EOR');  s($41,EOR,IndX,'EOR');
  s($55,EOR,ZeroX,'EOR');   s($49,EOR,Immed,'EOR');

  s($ee,INC,Abs,'INC');     s($fe,INC,AbsX,'INC');   s($c8,INY,Implied,'INY');
  s($e6,INC,Page0,'INC');   s($f6,INC,ZeroX,'INC');  s($e8,INX,Implied,'INX');

  s($4c,JMP,Abs,'JMP');     s($6c,JMP,Indir,'JMP');  s($20,JSR,Abs,'JSR');

  s($ad,LDA,Abs,'LDA');     s($bd,LDA,AbsX,'LDA');   s($b1,LDA,IndY,'LDA');
  s($b9,LDA,AbsY,'LDA');    s($a5,LDA,Page0,'LDA');  s($a1,LDA,IndX,'LDA');
  s($b5,LDA,ZeroX,'LDA');   s($a9,LDA,Immed,'LDA');
  s($ae,LDX,Abs,'LDX');     s($be,LDX,AbsY,'LDX');   s($b6,LDX,ZeroY,'LDX');
  s($a2,LDX,Immed,'LDX');   s($a6,LDX,Page0,'LDX');
  s($ac,LDY,Abs,'LDY');     s($bc,LDY,AbsX,'LDY');   s($a4,LDY,Page0,'LDY');
  s($b4,LDY,ZeroX,'LDY');   s($a0,LDY,Immed,'LDY');
  s($4e,LSR,Abs,'LSR');     s($5e,LSR,Absx,'LSR');   s($46,LSR,Page0,'LSR');
  s($56,LSR,ZeroX,'LSR');   s($4a,LSR,Accum,'LSR');
  s($ea,NOP,Implied,'NOP');

  s($0d,ORA,Abs,'ORA');     s($1d,ORA,AbsX,'ORA');   s($19,ORA,AbsY,'ORA');
  s($05,ORA,Page0,'ORA');   s($15,ORA,ZeroX,'ORA');  s($11,ORA,IndY,'ORA');
  s($09,ORA,Immed,'ORA');   s($01,ORA,IndX,'ORA');

  s($48,PHA,Implied,'PHA'); s($08,PHP,Implied,'PHP');
  s($68,PLA,Implied,'PLA'); s($28,PLP,Implied,'PLP');

  s($2e,ROL,Abs,'ROL');     s($3e,ROL,AbsX,'ROL');   s($26,ROL,Page0,'ROL');
  s($36,ROL,ZeroX,'ROL');   s($2a,ROL,Accum,'ROL');
  s($6e,ROR,Abs,'ROR');     s($7e,ROR,AbsX,'ROR');   s($66,ROR,Page0,'ROR');
  s($76,ROR,ZeroX,'ROR');   s($6a,ROR,Accum,'ROR');
  s($40,RTI,Implied,'RTI'); s($60,RTS,Implied,'RTS');

  s($ed,SBC,Abs,'SBC');     s($fd,SBC,AbsX,'SBC');   s($f9,SBC,AbsY,'SBC');
  s($e5,SBC,Page0,'SBC');   s($f5,SBC,ZeroX,'SBC');  s($f1,SBC,IndY,'SBC');
  s($e9,SBC,Immed,'SBC');   s($e1,SBC,IndX,'SBC');
  s($38,SEC,Implied,'SEC'); s($f8,SED,Implied,'SED');
  s($78,SEI,Implied,'SEI');
  s($8d,STA,Abs,'STA');     s($9d,STA,AbsX,'STA');   s($99,STA,AbsY,'STA');
  s($85,STA,Page0,'STA');   s($95,STA,ZeroX,'STA');  s($81,STA,IndX,'STA');
  s($91,STA,IndY,'STA');
  s($8e,STX,Abs,'STX');     s($86,STX,Page0,'STX');  s($96,STX,ZeroY,'STX');
  s($8c,STY,Abs,'STY');     s($84,STY,Page0,'STY');  s($94,STY,ZeroX,'STY');

  s($aa,TAX,Implied,'TAX'); s($a8,TAY,Implied,'TAY');
  s($ba,TSX,Implied,'TSX'); s($8a,TXA,Implied,'TXA');
  s($9a,TXS,Implied,'TXS'); s($98,TYA,Implied,'TYA');

  close(File6502); writeln; write('CHECKSUM ');
  if check <> 19563 then writeln('ERROR') else writeln('OK')
end.

{ End of CRAT6502.PAS }
```

PROGRAM FILE

```
program EMUL6502;       { 6502 EMULATOR PROGRAM WRITTEN IN TURBO PASCAL }

{$i Common.inc }   { Include file COMMON.INC }

   MemDef = record bvalue : byte end;

const Page1 = 256; CLE = #13; ret = #13; del = #8;

var
 disp      : boolean;                    M        : array[0..32767] of byte;
 File6502  : file of FileDef;            Data6502 : array[0..255] of FileDef;
 MemDump   : file of MemDef;             MemRec   : MemDef;
 Areg,Xreg,Yreg,PSR,SP,opcode                     : byte;
 s,t,spaces,HexCodes,Mnems,FileName               : strfield;
 PC,Branch,loop,temp,start,startAddr,EndAddr      : integer;

procedure SetNegative;  begin PSR := PSR or  128 end;
procedure ClrNegative;  begin PSR := PSR and 127 end;
procedure SetOverFlow;  begin PSR := PSR or   64 end;
procedure ClrOverFlow;  begin PSR := PSR and 191 end;
procedure SetBreak;     begin PSR := PSR or   16 end;
procedure ClrBreak;     begin PSR := PSR and 239 end;
procedure SetDecimal;   begin PSR := PSR or    8 end;
procedure ClrDecimal;   begin PSR := PSR and 247 end;
procedure SetInterrupt; begin PSR := PSR or    4 end;
procedure ClrInterrupt; begin PSR := PSR and 251 end;
procedure SetZero;      begin PSR := PSR or    2 end;
procedure ClrZero;      begin PSR := PSR and 253 end;
procedure SetCarry;     begin PSR := PSR or    1 end;
procedure ClrCarry;     begin PSR := PSR and 254 end;

function CarryClr     : boolean; begin CarryClr     := (PSR and 1)   =   0 end;
function CarrySet     : boolean; begin CarrySet     := (PSR and 1)   =   1 end;
function ZeroClr      : boolean; begin ZeroClr      := (PSR and 2)   =   0 end;
function ZeroSet      : boolean; begin ZeroSet      := (PSR and 2)   =   2 end;
function OverFlowClr  : boolean; begin OverFlowClr  := (PSR and 64)  =   0 end;
function OverFlowSet  : boolean; begin OverFlowSet  := (PSR and 64)  =  64 end;
function NegativeClr  : boolean; begin NegativeClr  := (PSR and 128) =   0 end;
function NegativeSet  : boolean; begin NegativeSet  := (PSR and 128) = 128 end;
function DecimalSet   : boolean; begin DecimalSet   := (PSR and 8)   =   8 end;

function CheckHex(a : char) : boolean;
begin CheckHex := ((a>='0') and (a<='9')) or ((a>='A') and (a<='F')) end;

function D2H(a,b : integer) : strfield;  { CONVERT TO HEX FOR DISPLAY }
begin
  s := '';
  for loop := 1 to b do
  begin s := copy('0123456789ABCDEF',(a and 15)+1,1)+s; a := a shr 4 end;
  D2H := s
end;

function Tab(a : integer) : strfield; begin Tab := copy(spaces,1,a) end;

function WrapAddr(a : integer) : integer;
begin if a = $7fff then WrapAddr := 0 else WrapAddr := succ(a) end;

function BITS(a : byte) : strfield;  { SETS BITS FOR STATUS REGISTER }
var mask : byte;
begin
  s := ''; mask := 128;
  for loop := 0 to 7 do
  begin
    if (a and mask)=mask then s:=s+'1' else s:=s+'0'; mask := mask shr 1
  end; BITS := s
end;

function FetchByte : byte;  { GET A BYTE FROM PC AND INC PC (WRAP AT $8000) }
begin
  if disp then HexCodes := HexCodes + D2H(M[PC],2)+' ';
  FetchByte := M[PC]; PC := WrapAddr(PC)
end;

procedure tomnem(s : strfield); begin if disp then Mnems := Mnems + s end;

procedure UpdateNandZ(ArithUnit : byte);  { SETS N AND Z FLAGS ON BYTE VALUE }
begin
  if (ArithUnit and 128)=128 then SetNegative else ClrNegative;
  if ArithUnit = 0 then SetZero else ClrZero
end;

function incbyte(b : byte) : byte; { WRAP BYTE (this probably not necessary) }
begin if b = 255 then incbyte := 0 else incbyte := succ(b) end;

function decbyte(b : byte) : byte; { (Nor this thinking about it) }
begin if b = 0 then decbyte := 255 else dectyte := pred(b) end;

procedure Push(p : byte);  { PUSH BYTE ON STACK THE DEC POINTER }
begin M[Page1 + SP] := p; SP := decbyte(SP) end;

function Pull : byte;       { INC STACK POINTER THEN PULL BYTE }
begin SP := incbyte(SP); Pull := M[Page1 + SP] end;

function WrapByte(b : integer) : byte; begin WrapByte := b mod 256 end;

function GetEA(AddressMode : ModeType) : integer; { MAIN ROUTINE }
var temp : byte; addr : integer;                  { TO GET ADDRESS OR BYTE }
begin
  case AddressMode of
  Abs   : begin
            addr:=FetchByte+(FetchByte shl 8); GetEA:=addr;
            tomnem('$'+D2H(addr,4))
          end;
  Indir : begin
            addr:=FetchByte+(FetchByte shl 8); tomnem('($'+D2H(addr,4)+')');
            if (addr mod 256)<>255 then GetEa := M[addr]+(M[succ(addr)] shl 8)
            else      { TO HANDLE JMP BUG. GOT TO THINK OF EVERYTHING ! }
            begin GetEA := M[addr]+(M[addr-255] shl 8); tomnem(' BUG !!') end
          end;
  Page0 : begin temp:=FetchByte; tomnem('$'+D2H(temp,2)); GetEa:=temp end;
  AbsX  : begin
            addr:=FetchByte+(FetchByte shl 8); GetEa:=addr+Xreg;
            tomnem('$'+D2H(addr,4)+',X')
          end;
  AbsY  : begin
            addr:=FetchByte+(FetchByte shl 8); GetEA:=addr+Yreg;
            tomnem('$'+D2H(addr,4)+',Y')
          end;
  ZeroX : begin
            addr:=FetchByte; GetEA:=WrapByte(addr+Xreg);
            tomnem('$'+D2H(addr,2)+',X')
          end;
  ZeroY : begin
            addr:=FetchByte; GetEA:=WrapByte(addr+Yreg);
            tomnem('$'+D2H(addr,2)+',Y')
          end;
  IndY  : begin
            temp := FetchByte; GetEA := M[temp]+(M[incbyte(temp)] shl 8)+Yreg;
            tomnem('($'+D2H(temp,2)+'),Y')
          end;
```

PROGRAM FILE

```
    IndX  : begin
              temp:=FetchByte; tomnem('($'+D2H(temp,2)+',X)');
              temp:=wrapbyte(temp+Xreg); GetEA:=M[temp]+(M[incbyte(temp)] shl 8)
            end;
    Relat : begin
              temp := FetchByte;
              if temp>127 then addr := PC+(temp-256) else addr := PC + temp;
              tomnem('$'+D2H(addr,4)+' '); GetEA := addr
            end;
    Accum : begin GetEa := Areg; tomnem('A') end;
    Immed : begin temp:=Fetchbyte; GetEA:=temp; tomnem('#$'+D2H(temp,2)) end
    end
  end;

  procedure DoCommand(Instr : Instructions; mode : modeType);
  var CarryToAdd,temp     : byte;
      EA,offset,sum1,sum2,temp1,temp2,Ans1,Ans2 : integer;
      OldCarry            : boolean;

    procedure DoSpecial(a : integer);
    var Inkey : char; Param,x,y,buffer : integer;
    begin
    {$i special.inc }
    end;

    procedure Compare;    { COMPARE TO BYTES AND SET FLAGS }
    begin
      if sum1 >= sum2 then SetCarry else ClrCarry;
      if sum1 = sum2 then SetZero else ClrZero;
      sum1 := sum1 - sum2;
      if (sum1 and 128)=128 then SetNegative else ClrNegative
    end;

    procedure BCDAddition;
    begin
      ClrZero; ClrNegative; ClrOverFlow; ClrCarry;
      temp1 := Areg mod 16; temp2 := temp mod 16;
      if (temp1<8) and (temp2<8) and (temp1+temp2+carrytoadd>7)
        then SetOverflow;
      ans1 := temp1+temp2+carrytoadd;
      if (ans1 mod 16) =0 then SetZero else ClrZero;
      CarryToAdd := 0; ClrCarry;
      if ans1 >9 then begin CarryToAdd:=1; SetCarry; Ans1:=Ans1-10 end;
      temp1 := Areg div 16; temp2 := temp div 16;
      if (temp1 < 8) and (temp2 <8) and (temp1+temp2+carrytoadd>7)
        then SetOverflow;
      Ans2 := temp1+temp2+carrytoadd;
      if (Ans2 mod 16)<>0 then ClrZero;
      if (Ans2 and 8)=8 then SetNegative;
      CarryToAdd := 0; ClrCarry;
      if Ans2 >9 then begin SetCarry; Ans2 := Ans2 - 10 end;
      Areg := (Ans2 shl 4) + Ans1
    end;

  begin              { ALL 6502 COMMANDS ARE CODED HERE EXCEPT RTI AND BRK }
    case Instr of
    ADC : begin
            if mode = Immed then temp := GetEA(mode)
            else temp := M[GetEA(mode)];
            if CarrySet then CarryToAdd := 1 else CarryToAdd := 0;
            if DecimalSet then BCDAddition
            else
            begin
              if Areg > 127 then Sum1 := Areg - 256 else Sum1 := Areg;
              if temp > 127 then Sum2 := temp - 256 else Sum2 := temp;
              Sum1 := Sum1 + Sum2 + CarryToAdd;
            if (Sum1 <-128) or (Sum1 > 127) then SetOverFlow else ClrOverFlow;
            if Areg+temp+CarryToAdd > 255 then SetCarry else ClrCarry;
            Areg := wrapByte(Areg+temp+CarryToAdd); UpdateNandZ(Areg)
          end
        end;
  ADN : begin  { THIS IS 'AND'. PASCAL USES 'AND' SO I CAN'T }
          if mode=Immed then temp := GetEA(mode) else temp := M[GetEA(mode)];
          Areg := (Areg AND temp); UpdateNandZ(Areg)
        end;
  ASL : begin
          if mode = Accum then temp := GetEA(mode)
          else begin EA := GetEA(mode); temp := M[EA] end;
          if (temp and 128)=128 then SetCarry else ClrCarry;
          temp := temp shl 1;
          if mode = Accum then Areg := temp else M[EA] := temp;
          UpdateNandZ(temp)
        end;
  BCC : begin Branch := GetEA(mode); if CarryClr then PC := Branch end;
  BCS : begin Branch := GetEa(mode); if CarrySet then PC := Branch end;
  BEQ : begin Branch := GetEA(mode); if ZeroSet  then PC := Branch end;
  BIT : begin
          temp := M[GetEA(mode)];
          if (temp and 128) =128 then SetNegative else ClrNegative;
          if (temp and 64)  = 64 then SetOverFlow else ClrOverFlow;
          if (temp and Areg)=  0 then SetZero else ClrZero
        end;
  BNE : begin Branch := GetEA(mode); if ZeroClr  then PC := Branch end;
  BMI : begin Branch := GetEA(mode); if NegativeSet then PC := Branch end;
  BPL : begin Branch := GetEA(mode); if NegativeClr then PC := Branch end;
  BVC : begin Branch := GetEA(mode); if OverFlowClr then PC := Branch end;
  BVS : begin Branch := GetEA(mode); if OverFlowSet then PC := Branch end;
  CLC : ClrCarry;
  CLD : ClrDecimal;
  CLI : ClrInterrupt;
  CLV : ClrOverFlow;
  CMP : begin
          sum1 := Areg;
          if mode=Immed then sum2 := GetEA(mode) else sum2 := M[GetEA(mode)];
          compare
        end;
  CPX : begin
          sum1 := Xreg;
          if mode=Immed then sum2 := GetEA(mode) else sum2 := M[GetEA(mode)];
          compare
        end;
  CPY : begin
          sum1 := Yreg;
          if mode=Immed then sum2 := GetEA(mode) else sum2 := M[GetEA(mode)];
          compare
        end;
  DEC : begin EA:=GetEA(mode); M[EA]:=decbyte(M[EA]); UpdateNandZ(M[EA]) end;
  DEX : begin Xreg := decbyte(Xreg); UpdateNandZ(Xreg) end;
  DEY : begin Yreg := decbyte(Yreg); UpdateNandZ(Yreg) end;
  EOR : begin
          if mode = Immed then temp := GetEA(mode) else temp := M[GetEa(mode)];
          Areg := (Areg XOR temp); UpdateNandZ(Areg)
        end;
  INC : begin EA:=GetEA(mode); M[EA]:=incbyte(M[EA]); UpdateNandZ(M[EA]) end;
  INX : begin Xreg := incbyte(Xreg); UpdateNandZ(Xreg) end;
  INY : begin Yreg := incbyte(Yreg); UpdateNandZ(Yreg) end;
  JMP : begin PC := getEA(mode); if PC < 0 then DoSpecial(PC) end;
  JSR : begin
          EA := WrapAddr(PC); Push(EA div 256); Push(EA mod 256);
          PC := GetEA(mode);  if PC < 0 then DoSpecial(PC)
```

MICROMART

PROGRAM FILE

```
        end;
    LDA : begin
            if mode=Immed then Areg := GetEA(mode) else Areg := M[GetEA(mode)];
            UpdateNandZ(Areg)
          end;
    LDX : begin
            if mode=Immed then Xreg := GetEA(mode) else Xreg := M[GetEA(mode)];
            UpdateNandZ(Xreg)
          end;
    LDY : begin
            if mode=Immed then Yreg := GetEA(mode) else Yreg := M[GetEA(mode)];
            UpdateNandZ(Yreg)
          end;
    LSR : begin
            if mode = Accum then temp := GetEA(mode)
            else begin EA := GetEA(mode); temp := M[EA] end;
            if (temp and 1) = 1 then SetCarry else ClrCarry;
            temp := temp shr 1;
            if mode = Accum then Areg := temp else M[EA] := temp;
            UpdateNandZ(temp)
          end;
    NOP : begin end; { DO NOTHING WHAT SO EVER }
    ORA : begin
            if mode=Immed then temp := GetEA(mode) else temp := M[GetEA(mode)];
            Areg := (Areg OR temp); UpdateNandZ(Areg)
          end;
    PHA : Push(Areg);
    PHP : Push(PSR);
    PLA : begin Areg := Pull; UpdateNandZ(Areg) end;
    PLP : PSR := Pull;
    ROL : begin
            if mode = Accum then temp := GetEA(mode)
            else begin EA := GetEA(mode); temp := M[EA] end;
            OldCarry := CarrySet;
            if (temp and 128)=128 then setcarry else ClrCarry;
            temp := temp shl 1;
            if OldCarry then temp := temp or 1;
            if mode = Accum then Areg := temp else M[EA] := temp;
            UpdateNandZ(temp)
          end;
    ROR : begin
            if mode = Accum then temp := GetEA(mode)
            else begin EA := GetEA(mode); temp := M[EA] end;
            OldCarry := CarrySet;
            if (temp and 1)=1 then setcarry else ClrCarry;
            temp := temp shr 1;
            if OldCarry then temp := temp or 128;
            if mode = Accum then Areg := temp else M[EA] := temp;
            UpdateNandZ(temp)
          end;
    RTI : begin PSR := Pull; PC := Pull + (Pull shl 8) end;
    RTS : PC := WrapAddr(Pull + (Pull shl 8));
    SBC : begin
            if mode = Immed then temp := GetEA(mode)
            else temp := M[GetEA(mode)];
            if CarrySet then CarryToAdd := 1 else CarryToAdd := 0;
            if DecimalSet then
            begin
              temp := 99-((temp div 16)*10+(temp mod 16));
              temp := ((temp div 10) shl 4) + (temp mod 10); BCDAddition
            end
            else
            begin
              if Areg > 127 then Sum1 := Areg - 256 else Sum1 := Areg;
              if temp > 127 then Sum2 := temp - 256 else Sum2 := temp;
              Sum1 := Sum1 - Sum2 + CarryToAdd - 1;
              if (Sum1 <-128) or (Sum1 > 127) then SetOverFlow else ClrOverFlow;
              if Areg-temp+CarryToAdd-1 < 0 then ClrCarry else SetCarry;

               Areg := wrapByte(Areg-temp+CarryToAdd-1); UpdateNandZ(Areg)
             end
          end;
     SEC : SetCarry;
     SED : SetDecimal;
     SEI : SetInterrupt;
     STA : M[GetEA(mode)] := Areg;
     STX : M[GetEA(mode)] := Xreg;
     STY : M[GetEA(mode)] := Yreg;
     TAX : begin Xreg := Areg; UpdateNandZ(Areg) end;
     TAY : begin Yreg := Areg; UpdateNandZ(Areg) end;
     TSX : begin Xreg := Sp;   UpdateNandZ(Xreg) end;
     TXA : begin Areg := Xreg; UpdateNandZ(Areg) end;
     TXS : SP := Xreg;
     TYA : begin Areg := Yreg; UpdateNandZ(Areg) end
     end
end;

procedure ReadData;  { THIS LOADS THE 6502 CODES CREATED BY CRAT6502.PAS }
begin
  assign(file6502,'data6502.rel'); reset(file6502); seek(file6502,0);
  for loop := 0 to 255 do read(File6502,Data6502[loop]);
  close(file6502)
end;

procedure InitRegisters;   { INITIALISE ALL REGISTERS AND CLEAR MEMORY }
begin
  for loop:=0 to 32767 do M[loop]:=0;
  Areg:=0; Xreg:=0; Yreg:=0; PC:=0; SP:=$ff; PSR:=0
end;

procedure DisplayRegisters;  { DISPLAY REGISTERS }
begin
  writeln; writeln('PC   SR NV-BDIZC AC XR YR SP');
  writeln(D2H(PC,4),'   ',BITS(PSR),' ',D2H(Areg,2),' ',
          D2H(Xreg,2),' ',D2H(Yreg,2),' ',D2H(SP,2));  writeln
end;

procedure SaveRec(a:byte); begin MemRec.Bvalue:=a; write(MemDump,MemRec) end;

function LoadRec : integer;
begin read(MemDump,MemRec); LoadRec := MemRec.Bvalue end;

procedure SaveMemory;  { SAVE ENDADDR BYTES OF MEMORY FROM STARTADDR }
begin
  writeln('Writing ',D2H(EndAddr,4),' Bytes.');
  assign(MemDump,FileName); rewrite(MemDump); seek(MemDump,0);
  SaveRec(StartAddr mod 256); SaveRec(StartAddr div 256);
  SaveRec(EndAddr   mod 256); SaveRec(EndAddr   div 256);
  SaveRec(PC        mod 256); SaveRec(PC        div 256);
  for loop := StartAddr to StartAddr + EndAddr do SaveRec(M[loop]);
  close(MemDump)
end;

procedure LoadMemory(a : integer);  { LOAD ENDADDR BYTES }
begin
  assign(MemDump,FileName); reset(MemDump); seek(MemDump,0);
  StartAddr := LoadRec+(LoadRec shl 8); EndAddr:=LoadRec+(LoadRec shl 8);
  PC        := LoadRec+(LoadRec shl 8); if a <> -1 then StartAddr := a;
  writeln('Loading ',D2H(EndAddr,4),' Bytes at ',D2H(StartAddr,4));
  for loop := StartAddr to StartAddr + EndAddr do M[loop] := LoadRec;
```

PROGRAM FILE

```
    close(MemDump)
  end;

  procedure SingleStep;   { SINGLE STEP COMMAND AT PC }
  begin
    disp := true;
    write(D2H(PC,4),' '); HexCodes := ''; opcode := fetchbyte;
    Mnems := Data6502[opcode].Desc+' ';
    if Data6502[Opcode].Mode = Unknown then tomnem('$'+D2H(Opcode,2))
    else with Data6502[opcode] do DoCommand(inst,mode);
    writeln(copy(HexCodes+spaces,1,10),Mnems); DisplayRegisters
  end;

  procedure UnAssemble;  { DISASSEMBLE CODE BETWEEN TWO LOCATIONS }
  var temppc,addr,temp : integer;
  begin
    disp := true; tempPC := PC; PC := StartAddr;  { DON'T LOSE PC }
    repeat
      write(D2H(PC,4),' '); HexCodes := ''; opcode := fetchbyte;
      Mnems := Data6502[opcode].Desc+' ';
      if Data6502[Opcode].mode = Unknown then tomnem('$'+D2H(Opcode,2))
      else temp := GetEA(Data6502[opcode].mode);
      writeln(copy(HexCodes+spaces,1,10),Mnems);
    until (PC > EndAddr) or (PC < StartAddr);
    PC := tempPC
  end;

  procedure Run6502; { THIS RUNS THE CODE AT PC. PRESS ESC TO ABORT (IN THEORY)}
  var c : char;
  begin
    disp := false; write('Running..'); opcode := fetchbyte;
    while opcode <> 0 do
    begin
      with Data6502[opcode] do DoCommand(inst,mode);
      if KeyPressed then
      begin
        read(Kbd,c); if c=#27 then begin opcode:=0; writeln('** ABORT **') end
      end;
      if opcode <> 0 then opcode := fetchbyte
    end;
    writeln; DisplayRegisters
  end;

  procedure DisplayMemory;     { DISPLAY MEMORY BETWEEN 2 POINTS }
  var i,j,k : integer;
  begin
    writeln; StartAddr := (StartAddr div 16) shl 4;
    repeat
      s := D2H(StartAddr,4)+'  '; t := '';
      for j := 0 to 15 do
      begin
        k:=M[StartAddr+j]; s:=s+D2H(k,2)+' '; if j=7 then s:=s+'- ';
        if (k > 31) and (k<127) then t:=t+chr(k) else t:=t+'.'
      end; writeln(s+'  '+t); StartAddr:=StartAddr+16
    until (StartAddr > EndAddr)
  end;

  procedure interface;  { MAIN ROUTINE TO PROCESS USER COMMANDS }
  var ProgExit         : boolean;
      CLine,Com,Value : strfield;
      Command,Inkey    : char;
      Error            : array[1..10] of strfield;
      ComMode          : ModeType;
      loop,Er,cptr,Address,whoops,ByteValue,ComCount : integer;

    function ToUpper(s : strfield) : strfield;
    begin
      if s<>'' then for loop := 1 to length(s) do s[loop]:=Upcase(s[loop]);
      ToUpper := s
    end;
  procedure SkipSpaces; begin while CLine[cptr]=' ' do cptr := succ(cptr) end;.

  procedure GetEquals;
  begin
    Cptr:=succ(Cptr); SkipSpaces;
    if CLine[Cptr]<>'=' then Er:=2 else Cptr:=succ(Cptr)
  end;

  procedure GetAddress(x : integer);
  var s : string[4]; c : char;
  begin
    if x = 1 then Cptr := succ(Cptr);
    SkipSpaces; s := '';
    repeat
      c := CLine[Cptr];
      if c = chr(13) then Er := 1
      else
      begin
        if CheckHex(c) then begin s:=s+c; Cptr:=succ(Cptr) end else Er := 3
      end
    until (length(s) = 4) or (Er <> 0);
    if s[1] > '7' then Er := 8;
    if Er=0 then val('$'+s,Address,whoops)
  end;

  procedure GetFileName;
  var c : char;
  begin
    cptr := succ(cptr); SkipSpaces; FileName := '';
    if CLine[Cptr] <> '"' then Er := 9
    else
    begin
      Cptr := succ(Cptr);
      while (CLine[cptr] <> '"') and (CLine[cptr] <> CLE) do
      begin FileName:=FileName+CLine[Cptr]; Cptr := succ(Cptr) end;
      if CLine[cptr] = CLE then Er := 9
    end
  end;

  procedure GetRange(x : byte);
  begin
    GetAddress(1);
    if (Er = 0) then
    begin
      StartAddr := Address; skipSpaces;
      if CLine[Cptr] <> ',' then Er := 5
      else begin GetAddress(1); if (Er = 0) then EndAddr := Address end
    end;
    if (Er = 0) and (x = 1) and (StartAddr > EndAddr) then Er := 6
  end;

  procedure GetByte;
  var s : string[2]; c : char;
  begin
    SkipSpaces; s := '';
    repeat
      c := CLine[Cptr];
      if c = chr(13) then Er := 1
      else
```

PROGRAM FILE

```
      begin
        if CheckHex(c) then begin s:=s+c; Cptr:=succ(Cptr) end else Er := 3
      end
    until (length(s) = 2) or (Er <> 0);
    if (Er = 0) then val('$'+s,ByteValue,whoops)
  end;

  procedure Get8Bits;
  var s : string[8]; v : byte; c : char;
  begin
    SkipSpaces; s := '';
    repeat
      c := CLine[Cptr];
      if c = chr(13) then Er := 1
      else
      begin
        if (c = '0') or (c = '1') then
        begin s := s + c; Cptr := succ(Cptr) end else Er := 3
      end
    until (length(s) = 8) or (Er <> 0);
    if Er=0 then begin
                   temp := 128; v := 0;
                   for loop:=1 to 8 do
                   begin if s[loop]='1' then v:=v+temp; temp:=temp shr 1 end;
                   ByteValue := v
                 end
  end;

  procedure FillArea(a : byte);  { FILL MEMORY WITH ZEROS }
  begin for loop := StartAddr to EndAddr do M[loop] := a end;

  function KeyByte : byte;
  begin
    KeyByte:=0; GetEquals;
    if Er=0 then begin GetByte; if Er=0 then KeyByte := ByteValue end
  end;

  procedure Editor;
  var KeyExit,EditExit,Minusd : boolean;
      Inkey                   : char;
      c                       : string[2];
      whoops,t                : integer;
  begin
    StartAddr:=Address; writeln; write(D2H(StartAddr,4),'  ');
    EditExit:=false;
    repeat
      KeyExit:=false; c:=''; Minusd:=false; write(D2H(M[StartAddr],2),'.');
      repeat
        read(kbd,InKey); Inkey := UpCase(Inkey);
        case Inkey of
        '-'       : begin
                      KeyExit := true; Minusd := true;
                      if StartAddr = 0 then StartAddr := 32767
                      else StartAddr := pred(StartAddr);
                      writeln; write(D2H(StartAddr,4),'  ')
                    end;
        ret       : begin
                      EditExit := true; KeyExit := true;
                      if c <> '' then
                      begin
                        if length(c)=1 then c := '0'+c;
                        val('$'+c,t,whoops); M[StartAddr] := t
                      end
                    end;
                  : begin
                      KeyExit := true;
                      if c <> '' then
                      begin
                        if length(c)=1 then begin c := '0'+c; write('  ') end;
                        val('$'+c,t,whoops); M[StartAddr] := t
                      end else write('  ');
                      StartAddr := WrapAddr(StartAddr)
                    end;
        '0'..'9',
        'A'..'F' : if length(c)<2 then begin c:=c+Inkey; write(Inkey) end;
        del       : if length(c)<>0 then
                    begin
                      write(chr(8),' ',chr(8)); if length(c)=1 then c := ''
                      else c := c[1]
                    end
        end
      until KeyExit;
      if not(EditExit) and not(Minusd) then
      begin
        if StartAddr mod 8 = 0 then
          begin writeln; write(D2H(StartAddr,4),'  ') end else write('  ')
      end
    until EditExit; writeln
  end;

  procedure GetCom;  { GET 3 COMMAND CHARS AND VALIDATE }
  var ComOK : boolean;
  begin
    if length(CLine)<3 then Er := 1
    else
    begin
      Com := copy(CLine,1,3); ComCount := 0; ComOk := false;
      repeat
        if Data6502[ComCount].Desc=Com then ComOk:=true
        else ComCount := succ(ComCount)
      until ComOK or (ComCount = 256); if not(ComOK) then Er := 1
    end
  end;

  procedure GetMode;  { GET ADDRESS MODE AND VALIDATE }
  var mask : strfield;  c : char;
  begin
    ComMode := Unknown;
    if length(CLine)=4 then ComMode := Implied
    else
    begin
      delete(CLine,1,3); mask := ''; value := '';
      while CLine[1] <> CLE do
      begin
        c:=CLine[1];
        if CheckHex(c) then begin mask:=mask+'n'; value:=value+c end
        else mask := mask + c;
        delete(CLine,1,1)
      end;
      if mask = '#$nn'    then ComMode := Immed;
      if mask = '$nnnn'   then ComMode := Abs;       { Or Relative }
      if mask = '$nnnn,X' then ComMode := AbsX;
      if mask = '$nnnn,Y' then ComMode := AbsY;
      if mask = '($nn,X)' then ComMode := IndX;
      if mask = '($nn),Y' then ComMode := IndY;
      if mask = '($nnnn)' then ComMode := Indir;
      if mask = '$nn'     then ComMode := Page0;
      if mask = '$nn,X'   then ComMode := ZeroX;
      if mask = '$nn,Y'   then ComMode := ZeroY;
      if (mask = 'n') and (Value = 'A') then ComMode := Accum
```

PROGRAM FILE

```
      end
    end;

    procedure DoEr(a : integer; b : strfield);
    begin writeln(Tab(a),'^'); writeln(Tab(a),'Error ',b) end;

    procedure DropCode;
    var ComFound : boolean; Operand,OperandLo,OperandHi,Offset : integer;
    begin
       ComFound := false; ComCount := 0;
       val('$'+Value,Operand,whoops); val('$'+copy(Value,1,2),OperandLo,whoops);
       if length(Value)>2 then val('$'+copy(Value,3,2),OperandHi,Whoops);
       repeat
         with Data6502[ComCount] do
           if ((Desc = Com) and (Mode = ComMode)) or
              ((Desc = Com) and (Mode = Relat) and (ComMode = Abs))
           then ComFound := true else ComCount := succ(ComCount)
       until ComFound or (ComCount = 256);
       if ComFound then
       begin
         M[Address] := ComCount; Address := WrapAddr(Address);
         case Data6502[ComCount].Mode of
         Immed,IndX,IndY,Page0,ZeroX,ZeroY
           : begin M[Address]:=OperandLo; Address:=WrapAddr(Address) end;
         Indir,Abs,AbsX,AbsY
           : begin
               M[Address]:=OperandHi; Address := WrapAddr(Address);
               M[Address]:=OperandLo; Address := WrapAddr(Address)
             end;
          Relat
           : begin
               Offset := Operand - address -1;
               if (Offset < -128) or (Offset > 127) then
               begin DoEr(9,'Branch Too Far'); Address := pred(Address) end
               else begin M[Address] := Offset; Address := WrapAddr(Address) end
             end
         end
       end else DoEr(9,'Illegal Address Mode')
    end;

    procedure Assemble;
    var AssExit : boolean;
    begin
      AssExit:= false;
      repeat
        write(D2H(address,4),' '); readln(CLine); CLine:=ToUpper(CLine)+chr(13);
        while (CLine<>'') and (pos(' ',CLine)<>0) do
          delete(CLine,pos(' ',CLine),1);
        if CLine = chr(13) then AssExit := true
        else
        begin
          Er := 0; GetCom;
          if Er = 0 then
          begin
            GetMode;
            if ComMode<>Unknown then DropCode else DoEr(9,'Unknown Addr Mode')
          end else DoEr(5,'Unknown Opcode')
        end
      until AssExit; Er := 0
    end;

  begin
    Error[1] := 'Unexpected End of Line';       Error[2] := '= Expected';
    Error[3] := 'Illegal Character';            Error[4] := 'Unknown Command';
    Error[5] := 'Comma Expected';               Error[6] := 'Illegal Range';
    Error[7] := 'Bad Command. Type ? for help'; Error[8] := 'Range 0000..7FFF';
    Error[9] := '" Expected';
    ProgExit := false;
    repeat
      write('-'); readln(CLine);
      if length(CLine) <> 0 then
      begin
        CLine := ToUpper(CLine)+chr(13);
        Cptr := 1; SkipSpaces; Command := CLine[Cptr]; Er := 0;
        case Command of
  'A' : begin
          Cptr := succ(Cptr);
          case CLine[Cptr] of
          'C' : Areg := KeyByte;
          'S' : begin GetAddress(1); if Er=0 then Assemble end
          else Er := 4
          end
        end;
  'E' : begin GetAddress(1); if Er=0 then Editor end;
  'F' : begin
          GetRange(1);
          if (Er = 0) then
          begin
            SkipSpaces; if CLine[Cptr] <> ',' then Er := 5
            else begin
                   Cptr := succ(Cptr);
                   GetByte; if Er=0 then FillArea(ByteValue)
                 end
          end
        end;
  'G' : Run6502;    { RUN CODE FROM CURRENT PROGRAM COUNTER }
  'L' : begin
          GetFileName;
          if Er=0 then
          begin
            Cptr := succ(Cptr); SkipSpaces;
            if CLine[Cptr] = ',' then
              begin GetAddress(1); if Er=0 then LoadMemory(Address) end
            else LoadMemory(-1)
          end
        end;
  'M' : begin GetRange(1); if Er=0 then DisplayMemory end;
  'P' : begin
          Cptr := succ(Cptr);
          if CLine[Cptr] = 'C' then
          begin
            GetEquals;
            if Er=0 then begin GetAddress(0); if Er=0 then PC:=Address end
          end else Er := 4
        end;
  'Q' : begin
          write('Quit - Are You Sure (Y)es or (N)o ? ');
          repeat read(Kbd,Inkey); Inkey := Upcase(Inkey)
          until (Inkey = 'N') or (Inkey = 'Y');
          if Inkey = 'Y' then ProgExit := true else writeln
        end;
  'R' : DisplayRegisters;
  'S' : begin
          Cptr := succ(Cptr);
          case CLine[Cptr] of
          CLE : SingleStep;
          'P' : SP := KeyByte;
          'R' : begin
                  GetEquals;
                  if Er=0 then
```

PROGRAM FILE

```
                    begin Get8Bits; if Er=0 then PSR := ByteValue end
                  end;
              else Er := 4
              end
            end;
        'U' : begin GetRange(1); if Er=0 then UnAssemble end;
        'W' : begin
              GetFileName;
              if Er=0 then
              begin
                Cptr := succ(cptr); SkipSpaces;

                if CLine[Cptr] <> ',' then Er := 5
                else begin GetRange(0); if Er=0 then SaveMemory end
              end
            end;
        'X' : begin
              Cptr := succ(Cptr);
              if CLine[Cptr] = 'R' then Xreg := KeyByte else Er := 4
            end;
        'Y' : begin
              Cptr := succ(Cptr);
              if CLine[Cptr] = 'R' then  Yreg := KeyByte else Er := 4
            end;
        '?' : begin
              writeln(' IBM Turbo PASCAL 6502 Emulator Commands'); writeln;
              writeln(' AC = nn ............ Set Accumulator');
              writeln(' AS ssss ............ Assemble starting at ssss');
              writeln(' E ssss ............. Edit bytes from ssss');
              writeln(' F ssss,eeee,nn ..... Fill Memory ssss..eeee with nn');
              writeln(' G .................. Start Program from current PC');
              writeln(' L "name",ssss ...... Load memory (ssss optional)');
              writeln(' M ssss,eeee ........ Display Memory, ssss..eeee');
              writeln(' PC = nnnn .......... Set Program Counter');
              writeln(' Q .................. Quit 6502 Emulator');
              writeln(' R .................. Display Register contents');
              writeln(' S .................. Single Step from current PC');
              writeln(' SR = bbbbbbbb ...... Set Status Register');
              writeln(' SP = nn ............ Set Stack Pointer');
              writeln(' U ssss,eeee ........ UnAssemble Code ssss..eeee');
              writeln(' W "name",ssss,llll . Write llll bytes from ssss');
              writeln(' XR = nn ............ Set X register');
              writeln(' YR = nn ............ Set Y register'); writeln
            end
        else Er := 7
        end;
        if Er <> 0 then
        begin writeln(Tab(cptr),'^'); writeln(Tab(cptr),'Error ',Error[Er]) end
      end
    until ProgExit
  end;

  begin
    writeln('IBM Turbo PASCAL 6502 Emulator.  By Mark Needham (April 1986).');
    spaces := '                                                              ';
    ReadData; InitRegisters; DisplayRegisters; Interface
  end.                                                    ( end of EMUL6502.PAS)
```

Spectrum Pascal Harmonograph

by Phil Tipping

The amount of background detail, history and documentation which accompanies this program is phenomenal: nine pages of a carefully-written and elaborate description of the harmonograph, plus the listing. This is followed by five pages of diagrams of two different types of harmonograph, and two pages and three photographs of harmonograph output. There just isn't room in Program File for all this documentation, and since the program is, essentially, concerned with program listings, I decided to concentrate on these.

Just to *précis* the documentation a little, a harmonograph is a mechanical device for producing abstract drawings. It consists of a large, flat board which can easily be swung in two dimensions. Over this is suspended a pen in such a way that it stays still, relative to the board, but remains in contact. If a sheet of paper is attached to the board and the board is set in motion, the harmonograph draws pleasing patterns made up of elliptical curves. The basic mechanism can be enhanced to produce more complex swinging and so more complex patterns.

The first three procedures in the program are support routines which interface to the Spectrum ROM for plotting points and drawing lines. They have been taken from the Hisoft *Pascal Manual*. The program produces points along the curve which the harmonograph produces, and joins these by straight lines. The program terminates when dimension or angle limits are reached, unlike the harmonograph itself which stops when friction finally gets the better of it.

It should be pointed out that friction is an important part of the harmonograph and helps to make the drawings more interesting.

The program is based upon the formulae for two swinging pendulums: one describing a rotating, diminishing ellipse; the other a diminishing circle.

PROGRAM FILE

```
C4A2   20    {$L+}
C4A2   30
C4A2   40    PROGRAM HARMONOGRAPH;
C4A2   50    {Version 19}
C4A2   60
C4A2   70    {
C4A2   80    Aim - To draw a diminishing circle superimposed on a
C4A2   90          rotating diminishing ellipse.
C4A2  100
C4A2  110    Variable name terminology:-
C4A2  120
C4A2  130       ellip, circ = ellipse, circle.
C4A2  140       len, wid    = ellipse length & width.
C4A2  150       rad = circle radius.
C4A2  160       ang = angle.
C4A2  170       axisang = axis angle for rotation.
C4A2  180       incr = increment (-ve = decrement).
C4A2  190       start = starting value.
C4A2  200
C4A2  210       e.g  elliplenincr = increment for ellipse length
C4A2  220       to be added at each calculation/plot.
C4A2  230
C4A2  240
C4A2  250
C4A2  260
C4A2  270
C4A2  280    {Switch off run time checks for speed}
C4A2  290    {$0-,S-,A-}
C4A2  300
C4A2  310
C4A2  320
C4A2  330    {-------------------------------------------------------}
C4A2  340    {Constants}
C4A2  350    {-------------------------------------------------------}
C4A2  360    CONST
C4A2  370       {Offset from origin}
C4A2  380       xoffset = 128;
C4A2  390       yoffset = 87;
C4A2  400
C4A2  410
C4A2  420       {Dimension start values}
C4A2  430       elliplenstart = 120;
C4A2  440       ellipwidstart = 20;
C4A2  450       circradstart  = 5;
C4A2  460
C4A2  470
C4A2  480       {Angle start values}
C4A2  490       ellipangstart = 1.5;
C4A2  500       circangstart  = 1.5;
C4A2  510       axisangstart  = 0;
C4A2  520
C4A2  530
C4A2  540       {Dimension increments}
C4A2  550       elliplenincr  = -0.08;
C4A2  560       ellipwidincr  = -0.01;
C4A2  570       circradincr   = -0.001;
C4A2  580
C4A2  590
C4A2  600       {Angle increments}
C4A2  610       ellipangincr  = -0.3;
C4A2  620       circangincr   = 0.32;
C4A2  630       axisangincr   = -0.003;
C4A2  640
C4A2  650
C4A2  660       {Dimension limits}
C4A2  670       elliplenlimit = 20;
C4A2  680       ellipwidlimit = 5;
C4A2  690       circradlimit  = 1;
C4A2  700
C4A2  710       {Angle limits (if reqd)
C4A2  720       axisanglimit  = -3; (radians)
C4A2  730
C4A2  740
C4A2  750    {-------------------------------------------------------}
C4A2  760    {Variables}
C4A2  770    {-------------------------------------------------------}
C4A2  780    VAR
C4AB  790       {Dimensions}
C4AB  800       elliplen,
C4AB  810       ellipwid,
C4AB  820       circrad   : REAL;
C4AB  830
C4AB  840       {Angles}
C4AB  850       ellipang,
C4AB  860       circang,
C4AB  870       axisang   : REAL;
C4AB  880
C4AB  890       {Coordinates}
C4AB  900       xold,
C4AB  910       xnew,
C4AB  920       yold,
C4AB  930       ynew      : INTEGER;
C4AB  940
C4AB  950
C4AB  960
C4AB  970    {-------------------------------------------------------}
C4AB  980    {Graphics Support Routines (from HISOFT manual)
C4AB  990    {-------------------------------------------------------}
C4AB 1000
C4AB 1010    PROCEDURE drawlinesupport
C4AE 1020                (x, y, signx, signy : INTEGER);
C4AE 1030
C4AE 1040    {
C4AE 1050    Aim - Used in conjunction with the LINEDRAW procedure.
```

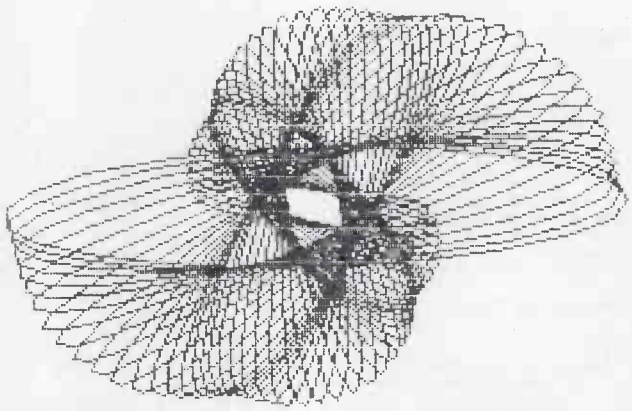
PROGRAM FILE

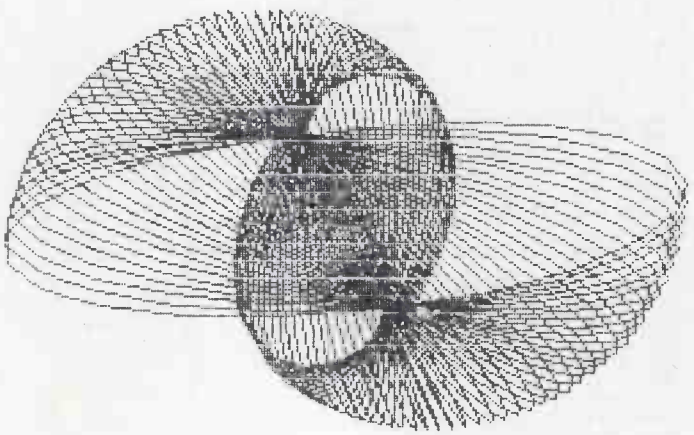
```
C4AE 1060          Machine code sets up Z80 regs &
C4AE 1070          calls Spectrum ROM DRAW routine.
C4AE 1080     )
C4AE 1090
C4AE 1100     BEGIN
C4BE 1110
C4BE 1120     INLINE
C4BE 1130     (
C4BE 1140     #FD,#21,#3A,#5C,   (LD IY,#5C3A)
C4C2 1150     #DD,#56,#02,       (LD D,(IX+2))
C4C5 1160     #DD,#5E,#04,       (LD E,(IX+4))
C4C8 1170     #DD,#46,#06,       (LD B,(IX+6))
C4CB 1180     #DD,#4E,#08,       (LD C,(IX+8))
C4CE 1190     #CD,#BA,#24        (CALL #24BA ;ROM DRAW routine)
C4D0 1200     )
C4D1 1210
C4D1 1220     END;
C4DB 1230     {-------------------------------------------------------}
C4DB 1240
C4DB 1250     PROCEDURE drawline (x, y : INTEGER);
C4DE 1260
C4DE 1270     (
C4DE 1280     Aim - To draw a line from the current plot position
C4DE 1290           (CX, CY) to (CX+x, CY+y).
C4DE 1300           (Equivalent to BASIC DRAW command).
C4DE 1310     )
C4DE 1320
C4DE 1330     VAR
C4DE 1340        signx,
C4DE 1350        signy  : INTEGER;
C4DE 1360
C4DE 1370
C4DE 1380     BEGIN
C4EB 1390
C4EB 1400     {Calculate sign of x & y)
C4EB 1410     IF x < 0 THEN
C502 1420        signx := -1
C506 1430     ELSE
C511 1440        signx := 1;
C51A 1450
C51A 1460     IF y < 0 THEN
C531 1470        signy := -1
C535 1480     ELSE
C540 1490        signy := 1;
C549 1500
C549 1510     drawlinesupport (ABS (x), ABS (y), signx, signy)
C56B 1520
C56B 1530     END;
C580 1540     {-------------------------------------------------------}
C580 1550
C580 1560     PROCEDURE plot (x, y : INTEGER);
C583 1570
C583 1580     (
C583 1590     Aim - To plot the specified point (x,y).
C583 1600           Machine code sets up Z80 regs &
C583 1610           calls Spectrum ROM PLOT routine.
C583 1620           (Equivalent to BASIC PLOT command).
C583 1630     )
C583 1640
C583 1650
C583 1660     BEGIN
C593 1670
C593 1680     INLINE
C593 1690     (
C593 1700     #FD,#21,#3A,#5C,   (LD IY,#5C3A))
C597 1710     #DD,#46,#02,       (LD B,(IX+2))
C59A 1720     #DD,#4E,#04,       (LD C,(IX+4))
C59D 1730     #CD,#E5,#22        (CALL #22E5  ;ROM PLOT routine)
C59F 1740     )
C5A0 1750
C5A0 1760     END;
C5AA 1770     {-------------------------------------------------------}
C5AA 1780
C5AA 1790
C5AA 1800
C5AA 1810
C5AA 1820
C5AA 1830     {-------------------------------------------------------}
C5AA 1840     (Harmonograph Routines)
C5AA 1850     {-------------------------------------------------------}
C5AA 1860
C5AA 1870     FUNCTION xcalc : INTEGER;
C5AD 1880
C5AD 1890     (
C5AD 1900     Aim - To calculate & return the new value of X.
C5AD 1910     )
C5AD 1920
C5AD 1930     BEGIN
C5BD 1940
C5BD 1950     xcalc := ENTIER (
C5BD 1960              elliplen * COS (ellipang) * COS (axisang) +
C5E4 1970              ellipwid * SIN (ellipang) * SIN (axisang) +
C60E 1980              circrad * COS (circang) +
C629 1990              xoffset)
C634 2000
C634 2010     END;
C641 2020     {-------------------------------------------------------}
C641 2030
C641 2040     FUNCTION ycalc : INTEGER;
C644 2050
C644 2060     (
C644 2070     Aim - To calculate & return the new value of Y.
C644 2080     )
C644 2090
C644 2100     BEGIN
```

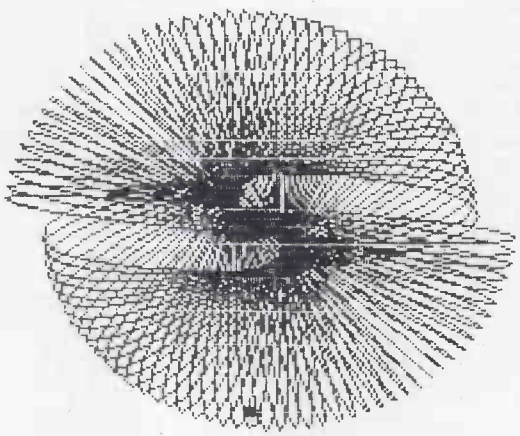
```
C654 2110
C654 2120    ycalc := ENTIER (
C654 2130             ellipwid * SIN (ellipang) * COS (axisang) -
C67B 2140             elliplen * COS (ellipang) * SIN (axisang) +
C6A9 2150             circrad * SIN (circang) +
C6C4 2160             yoffset)
C6CF 2170
C6CF 2180    END;
C6DC 2190    {-------------------------------------------------------}
C6DC 2200
C6DC 2210    PROCEDURE initialisesizes;
C6DF 2220
C6DF 2230    (
C6DF 2240    Aim - To intialise all dimension & angle sizes
C6DF 2250          to their start values as defined in the CONST
C6DF 2260          section.
C6DF 2270    )
C6DF 2280
C6DF 2290
C6DF 2300    BEGIN
C6EF 2310
C6EF 2320    elliplen := elliplenstart;
C6FC 2330    ellipwid := ellipwidstart;
C709 2340    circrad := circradstart;
C716 2350
C716 2360
C716 2370    ellipang := ellipangstart;
C723 2380    circang := circangstart;
C730 2390    axisang := axisangstart;
C73D 2400
C73D 2410    END;
C743 2420    {-------------------------------------------------------}
C743 2430
C743 2440    PROCEDURE incrementsizes;
C746 2450
C746 2460    (
C746 2470    Aim - To increment dimension & angle sizes by the
C746 2480          values defined in the CONST section.
C746 2490          Sizes can be decreased by using -ve increments.
C746 2500    )
C746 2510
C746 2520    BEGIN
C756 2530
C756 2540    elliplen := elliplen + elliplenincr;
C76F 2550    ellipwid := ellipwid + ellipwidincr;
C788 2560    circrad := circrad + circradincr;
C7A1 2570
C7A1 2580    ellipang := ellipang + ellipangincr;
C7BA 2590    circang := circang + circangincr;
C7D3 2600    axisang := axisang + axisangincr;
C7EC 2610
C7EC 2620    END;
C7F2 2630    {-------------------------------------------------------}
C7F2 2640
C7F2 2650
C7F2 2660    {-------------------------------------------------------}
C7F2 2670    {MAIN PROGRAM BODY}
C7F2 2680    {-------------------------------------------------------}
C7F2 2690
C7F2 2700    BEGIN
C7FB 2710
C7FB 2720    WRITE (CHR (12)); {clear screen}
C802 2730
C802 2740    initialisesizes;
C807 2750
C807 2760    {Calculate & plot 1st point as a reference}
C807 2770    xold := xcalc;
C811 2780    yold := ycalc;
C81B 2790    plot (xold, yold);
C828 2800
C828 2810       WHILE
C82B 2820       (
C82B 2830       Loop until limits reached.
C82B 2840       'Comment-out' checks as reqd. for speed.
C82B 2850       )
C82B 2860             (axisang > axisanglimit)
C84E 2870       (
C84E 2880             AND
C84E 2890             (elliplen > elliplenlimit)
C84E 2900             AND
C84E 2910             (ellipwid > ellipwidlimit)
C84E 2920             AND
C84E 2930             (circrad > circradlimit)
C84E 2940       )
C84E 2950       DO
C851 2960       BEGIN
C851 2970
C851 2980          incrementsizes;
C856 2990
C856 3000          {Calculate new point}
C856 3010          xnew := xcalc;
C860 3020          ynew := ycalc;
C86A 3030
C86A 3040          {Draw line from old point to new}
C86A 3050          drawline (xnew - xold, ynew - yold);
C889 3060
C889 3070          {Transfer new point to old for next time}
C889 3080          xold := xnew;
C88F 3090          yold := ynew;
C895 3100
C895 3110          END;
C898 3120
C898 3130
C898 3140    (
C898 3150    Loop-stop to prevent PASCAL prompt from racking up
```

PROGRAM FILE

```
C898 3160     the picture & losing the top line!
C898 3170     Can break in using SHIFT+SPACE as normal.
C898 3180     }
C898 3190     WHILE TRUE DO;
C8A4 3200
C8A4 3210     END.
End Address:  C8A6
Run?
```







BBC Decelerator

by Neil Gunton

This program slows down the operation of the BBC Micro. It is useful for debugging programs, Basic or machine code, as it slows down everything including the operating system. It uses the key-pressed event and so can be activated at any point, even in the middle of a program.

BBC Decelerator works by POKEing certain values into two memory locations in the Sheila memory map — the part associated with the 6522 VIA and OS input/output. The routine is written in machine code and must be assembled in a suitable area of memory.

The program has four functions: fastest, slowest, faster and slower. At the start of the program, you are asked which keys in conjunction with Shift and CTRL activate which function; then you are asked where the code should be assembled. Depending upon your system and programming needs, there are a number of locations for the code. Possible locations are:

Page nine (&900-&9FF) — this holds the cassette, the RS423 and the speech output buffers.

Page 10 (&A00-&AFF) — this holds the cassette and the RS423 input buffers.

Page 12 (&C00-&CFF) — this holds the font for characters 224-255.

When the code has been assembled, you are given the option of storing it on tape or disk; simply enter the file name, and the code will be saved. Typing *filename will reload and activate the code, and you are then given the option of activating the code immediately.

```
 10 REM Routine for slowing down the operation of the BBC Micro
 20 REM Using the 'Key pressed' Event
 30 REM By Neil Gunton 18.03.86
 40
 50 REM The variables:
 60
 70 REM slowest  : This holds the value of the key which makes the routine
 80 REM            slow the machine down to the minimum speed.
 90 REM slower   : This holds the value of the key which makes the routine
100 REM            slow the machine down more, if not already at minimum
110 REM fastest  : This holds the value of the key which makes the routine
120 REM            return the machine to completely normal speed.
130 REM faster   : This holds the value of the key which makes the routine
140 REM            speed the machine up, if not already at normal speed.
150 REM A$       : This is used to hold the string version of the start
160 REM            address of the code before it is converted to a number.
170 REM start    : This is the start address of the machine code.
180 REM pass     : This is used in the two pass assembly to set OPT
190 REM temp     : This holds the old contents of the OS event vector.
200 REM key      : This is used for temporary storage & keyboard entry.
210 REM hexedecimal : If set to TRUE, then a hex number has been entered.
220 REM               Used only for decision making
230 REM decimal     : If set to TRUE, then a decimal number was entered.
240 REM               Also used for clarity in decision making.
250 REM test   : Flag used to return results of number validation.
260 REM count  : Used to ensure correct interpretation of size of number
270 REM          when decoding the hexedecimal
280 REM number : Used to return value of start from decoding function.
290 REM end    : The end address of the machine code routine.
300 REM name$  : Holds the filename entered to save code
310 REM OSBYTE : General purpose OS routine} function chosen by A
320 REM OSFILE : OS routine for actions on files
330
340 OSBYTE = &FFF4
350 OSFILE = &FFDD
360
370
380 REM The BASIC routines:
390
400 REM FNvalidate      : Decides if number entered is valid dec or hex
410 REM FNdecode_hex    : Turns A$ into a real number
420 REM FNvalidate_hex  : Used by FNvalidate to validate hex numbers
430 REM FNvalidate_dec  : Used by FNvalidate to validate dec numbers
440 REM PROCactivate    : Activates the event handling routine.
450 REM PROCsave_code   : Saves the assembled machine code
460
470
480 MODE 7
490 REM First a helpful message :
500 PRINT"When entering the keys, use SHIFT and"
510 PRINT"CTRL together with your chosen key."
520 PRINT''
530
540 REM Now you input the keys which will be used for the various functions.
550
560 PRINT"Input key to go slowest : ";
570 slowest = GET
580 IF slowest > 31 THEN VDU slowest,10,13 ELSE PRINT} slowest
590
600 PRINT"Input key to go slower  : ";
610 slower = GET
620 IF slower  > 31 THEN VDU slower,10,13  ELSE PRINT} slower
630
640 PRINT"Input key to go fastest : ";
650 fastest = GET
660 IF fastest > 31 THEN VDU fastest,10,13 ELSE PRINT} fastest
670
680 PRINT"Input key to go faster  : ";
690 faster = GET
700 IF faster  > 31 THEN VDU faster,10,13  ELSE PRINT} faster
710
720 REM Next you enter the start address for the Machine Code.
730 REM This includes some validation routines in BASIC.
740 REM I have not documented these as much as the Assembly Language,
750 REM because it would make it more difficult to read.
```

PROGRAM FILE

```
760 REM Hopefully these routines will be found to be generally
770 REM self explanatory.
780
790 REPEAT
800   REPEAT
810     INPUT"What address to assemble code at ",A$
820     UNTIL FNvalidate = TRUE
830   IF hexedecimal THEN start = FNdecode_hex
840   IF decimal     THEN start = VAL(A$)
850   IF start > PAGE - &100 AND start < TOP THEN
        PRINT"That address will corrupt program"
860   UNTIL start > TOP OR start < PAGE - &100   :REM &100 = length of code
870
880
890 FOR pass = 0 TO 2 STEP 2
900   P% = start
910   [
920   OPT pass
930     \ Abbreviations used :
940       \ A  = Accumulator
950       \ X  = X register
960       \ Y  = Y register
970       \ S  = the Stack
980       \ OS = the Operating System
990       \ This is the start of the initialisation routine, which activates
1000      \ the event intercept routine.
1010  LDA &220 :STA temp          \ Save low byte , then high byte of the
1020  LDA &221 :STA temp+1        \ event vector EVENTV . This is the
1030                              \ indirect address normally used by the OS
1040  LDA#Event_entry_point MOD 256 :STA &220  \ Replace the old contents of
1050  LDA#Event_entry_point DIV 256 :STA &221  \ the vector with the address
1060                                           \ of our new routine
1070  LDA#14 :LOX#2 :JSR OSBYTE  \ Tell OS to enable the user key pressed
1080                             \ event , i.e. jump to our new routine
1090                             \ whenever a key is pressed .
1100  RTS  \ End of initialisation routine.
1110
1120  .temp EQUW &0000   \ This is where we store the old EVENTV .
1130
1140  .Event_entry_point
1150          \ This is the start of the Event intercept routine.
1160          \ As with any event handling routine , we have to preserve all
1170          \ the registers , so here goes :
1180  PHP     \ First to go on the Stack is the Status Register , followed by
1190  PHA     \ the accumulator .
1200  TXA     \ Cannot push X register direct , so transfer to Accumulator ,
1210  PHA     \ and push onto stack .
1220  TYA     \ The same goes for the Y register
1230  PHA     \ the last to go on the Stack will be first off at exit .
1240
1250  LDX#0                \ Now we use the operating system routine OSBYTE
1260  LDY#255              \ to find out whether or not both the SHIFT and
1270  LDA#202 :JSR OSBYTE \ CTRL keys are pressed .
1280  TXA                  \ The Keyboard Status byte is returned in X ,
1290  AND#72               \ and we transfer X to A so that we can see if bits
1300  CMP#72  :BNE exit    \ 3 and 6 are set (=72). If not, goto exit
1310  PLA :PHA \ The Y register held the last key pressed on entry , and was
1320           \ the last to go on Stack . Pull into A and replace on Stack.
1330  CMP#slowest :BEQ go_slowest \ If key = slowest , branch to go_slowest
1340  CMP#slower  :BEQ go_slower  \ If key = slower  , branch to go_slower
1350  CMP#fastest :BEQ go_fastest \ If key = fastest , branch to go_fastest
1360  CMP#faster  :BEQ go_faster  \ If key = faster  , branch to go_faster
1370  JMP exit \ If we haven't branched by now , ignore key and exit .
1380
1390  .go_slowest          \ This slows things down as far as they'll go.
1400  LDA#0 :STA &FE46     \ A zero in &FE46 slows the machine down to
1410  LDA#1 :STA &FE47     \ the slowest speed .
1420  JMP exit             \ Now goto exit...
1430
1440  .go_slower           \ This slows things down a little each time.
1450  LDA#1 :STA &FE47     \ Initialise &FE47.
1460  LDA &FE46 :BEQ exit \ If &FE46 is already rock bottom , goto exit
1470  DEC &FE46            \ Decrement &FE46 . The smaller the number, the
1480  JMP exit             \ slower you go . 0 is slowest . Now goto exit...
1490
1500  .go_fastest          \ This returns things to normal speed.
1510  LDA#14 :STA &FE46    \ These are the numbers I found are usually in
1520  LDA#39 :STA &FE47    \ these two locations , in OS 1.20
1530  JMP exit             \ Now goto exit...
1540
1550  .go_faster           \ This makes things go a little faster each time.
1560  LDA &FE47            \ We check here to see if we are already going
1570  CMP#39 :BEQ exit     \ full steam ahead. If so goto exit.
1580  LDA &FE46            \ Here we check to see if trying to go faster will
1590  CMP#255 :BEQ go_fastest  \ result in going slowest! If you increment a
1600  INC &FE46            \ memory location which has 255 , you get 0 ,which
1610                       \ means slowest as stated above.
1620
1630  .exit   \ Now for the grand finale, we tidy up and restore registers:
1640  PLA     \ Y was last on Stack , so it's first off . However we cannot
1650  TAY     \ pull direct to Y , so we pull to A and transfer to Y.
1660  PLA     \ Next is X, again we cannot pull direct off the stack into X
1670  TAX     \ so we do it through A, then transfer to X.
1680  PLA     \ Now we pull the value that was in the Accumulator.
1690  PLP     \ And last off, because it was first on, we restore the Status
1700          \ register .
1710  JMP (temp)  \ Finally we jump to the OS vector we saved, to exit.
1720
1730  .end
1740  ]
1750  NEXT pass
1760
1770
1780 REM Option of saving code
1790 PRINT''"Code now assembled."
1800 PRINT"Do you want to save the code? (Y/N)";
1810 REPEAT
1820   key = GET
1830   UNTIL key = ASC"Y" OR key = ASC"N"
1840 IF key = ASC"Y" THEN PROCsave_code
1850
1860 REM Option of activating the routine
1870 PRINT''"To activate the routine , use "
1880 PRINT"CALL "¦start¦" or"
1890 PRINT"CALL &";~start
1900 PRINT"Activate routine now ?  (Y/N) ";
1910
1920 REPEAT
1930   key = GET
1940   UNTIL key = ASC"Y" OR key = ASC"N"
1950 IF key = ASC"Y" THEN PROCactivate
1960 PRINT
1970 END
1980
1990
```

```
2000 DEF FNvalidate :REM This checks that the start address is valid
2010 hexedecimal = FALSE
2020 decimal     = FALSE
2030 IF LEFT$(A$,1) = "&" THEN hexedecimal = TRUE . = FNvalidate_hex
2040 decimal = TRUE : = FNvalidate_dec
2050
2060 DEF FNvalidate_hex :REM This checks for valid hexedecimal number
2070 test = TRUE
2080 FOR X = 2 TO LEN(A$)
2090   IF (ASC(MID$(A$,X,1)) < ASC"A" OR ASC(MID$(A$,X,1)) > ASC"F") AND
          (ASC(MID$(A$,X,1)) < ASC"0" OR ASC(MID$(A$,X,1)) > ASC"9") THEN
          test = FALSE
2100   NEXT
2110 IF LEN(A$) > 5 THEN test = FALSE
2120 = test
2130
2140 DEF FNvalidate_dec  :REM This checks for valid decimal number
2150 test = TRUE
2160 FOR X = 1 TO LEN(A$)
2170   IF ASC(MID$(A$,X,1)) < ASC"0" OR ASC(MID$(A$,X,1)) > ASC"9" THEN
          test = FALSE
2180   NEXT
2190 =test
2200
2210 DEF FNdecode_hex  :REM This translates the string into a number
2220 count  = -1
2230 number =  0
2240 FOR X = LEN(A$) TO 2 STEP -1
2250   count = count + 1
2260   IF ASC(MID$(A$,X,1)) >= ASC"A" THEN
          number = number + (ASC(MID$(A$,X,1)) - 55) * 16^count :
          NEXT : = number
2270 number = number + (ASC(MID$(A$,X,1)) - ASC"0") * 16^count
2280 NEXT
2290 = number
2300
2310 DEFPROCactivate   :REM This activates the routine by calling start
2320 PRINT''
2330 CALL start
2340 PRINT"Now the routine should be activated ."
2350 PRINT"Using the SHIFT and CTRL keys together"
2360 PRINT"with the keys you chose , you can "
2370 PRINT"accelerate or decelerate at any time ."
2380 PRINT"The routine may be deactivated by"
2390 PRINT"pressing BREAK."
2400 PRINT"The 'fastest' key should return "
2410 PRINT"everything to normal speed ."
2420 PRINT
2430 ENDPROC
2440
2450 DEFPROCsave_code   :REM This saves the assembled machine code
2460 PRINT
2470 P% = end
2480 [
2490 OPT 2
2500 .file_name EQUS STRING$(20," ")    \ Reserve space for filename
2510 .OSFILE_parameters    \ Now we have the control block used by the OS
2520                       \ routine OSFILE for saving a section of memory
2530                       \ as a complete file.
2540 EQUW file_name        \ First the address of the filename to be used
2550 EQUD start            \ The address to which the file is loaded in future
2560 EQUD start            \ The execution address of the code
2570 EQUD start            \ The start address in memory for save
2580 EQUD end              \ The end address in memory for save
2590 ]
2600 VDU11,32,32,32,32,13
2610 PRINT"Disc or tape ? (D/T) ";
2620 REPEAT
2630   key = GET
2640   UNTIL key = ASC"D" OR key = ASC"T"
2650  PRINTCHR$(key)
2660  IF key = ASC"D" THEN name_length = 7 ELSE name_length = 12
2670 REPEAT
2680   PRINT"Enter filename : ";
2690   INPUT name$
2700   IF LEN(name$) > name_length THEN PRINT"Too long"
2710   UNTIL LEN(name$) <= name_length
2720
2730 $file_name = name$
2740 A% = 0
2750 X% = OSFILE_parameters MOD 256
2760 Y% = OSFILE_parameters DIV 256
2770 CALL OSFILE
2780 PRINT"Code saved."
2790 ENDPROC
```

Atari ST Calculator

by Bernard Fromson

This program produces a desk-top Reverse Polish Notation calculator on the screen of the Atari 520ST. The program is written in Basic, and illustrates how to use the Gem system from Basic.

The Gem operating system consists of the Virtual Device Interface which is responsible for all the graphic functions and I/O, and the Applications Environment System which provides the window and mouse interface. This program demonstrates how to set up and use an AES resource.

Resources are central to the use of AESs; they are tree-like structures which define objects to be drawn on-screen. Each node of the tree defines an object to be drawn. The tree used in this program is a simple one, and only uses a few object types.

Each object on the tree is defined by a 12-word block which takes the following format:

Word 0: pointer to the next object in

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the tree at the same level as the current object; this is −1 for the root object
Word 1: pointer to the first subordinate object
Word 2: pointer to the last subordinate object; both of these are set to −1 for an object at the lowest level of the tree
Word 3: object type; only two types are used in this example —
20=empty box
27=box holding single character
Word 4: specifies how an AES deals with an object; it consists of a series of flags — these are the ones used in the program:
bit 0 = object can be selected with the mouse
bit 1 = default to this when Return is pressed
bit 2 = exit from AES after selection
bit 4 = radio button type; when object is selected, all other objects at this level are released
bit 5 = last object in the tree
Word 5: status of object; 0=normal is used throughout this tree
Word 6: high byte specifies the character in the box for the buttons and 0 is for blank boxes; low byte gives thickness of border around the box
Word 7: colour of the box; hex 1180 specifies black-on-white border with black-on-white character inside
Word 8: x and
Word 9: y coordinates of object relative to the parent object at previous level in the tree
Word 10: w and
Word 11: h; width and height of the object

The tree is defined in the data lines 20010-20420. These are read into a string variable at lines 190-240 to fix them into memory at a known address.

A call to AES is made via a parameter block which consists of six four-byte words, each of which specifies the start address of an array which AES uses for its parameters. These arrays are:
control — specifies the operation code and number of items in the other arrays
global — various system constants, not changed in the program
gintin — input values to the call
addrin — input addresses used by the call
gintout — output values
addrout — output values

The Basic language has a system variable called GB which contains the address of an AES parameter block, and from which the addresses of the above arrays can be derived as in lines 10040-10190.

When the required values are in these arrays, AES is called using the Basic function GEMSYS(x) where x is the desired AES opcode.

The program only uses four AES calls. The opcodes for these and their functions are as follows:
opcode 51 — initialisation and restoration of the screen are all done by this one routine
opcode 42 — this draws the resource specified by the tree passed to it
opcode 22 — waits for the mouse to enter a specified area of the screen and returns control to caller
opcode 50 — activates AES to watch the mouse and wait for an event
VDI — a single VDI call is used at line 9110 to write a number directly to the calculator screen.

```
100   rem ***************************************************
110   rem * This is a reverse polish logic calculator with four *
120   rem * element stack that demonstrates the possibility of  *
130   rem * using GEM function calls from within the BASIC      *
140   rem * language on the ATARI 520 ST                        *
150   rem *                                                     *
160   rem * programmer : Bernard Fromson                        *
170   rem *      date  : 17th April 1986                        *
180   rem ***************************************************
185   rem get the gem bits
186   gosub getgem
187   rem
188   rem and now read in the object tree to a string variable
189   rem
190   read n
200   tree$=space$(255)
210   place=varptr(tree$)
220   for i=0 to 12*n-1
230   read a:poke place+2*i,a
240   next i
241   rem *
242   rem * now go and perform the GEM calls to draw the object
243   rem * this requires to reserve the screen area, draw the exploding
244   rem * box and then draw the object (the calculator)
245   rem *
246   gosub setup
900   siz=0:pt=0
910   dim stack$(4):stkptr=1
920   nwnum=0
930   enterd=1
990   rem ***************************************************
991   rem * The main body of the program works by making a GEM *
992   rem * call to activate the calculator and then reading   *
993   rem * the number of the pressed key from the GEM output  *
994   rem * array.                                            *
995   rem ***************************************************
1000  getin:
1005  poke control+2,1:poke control+4,2:poke control+6,1
1010  poke control+8,0:poke gintin,0:poke addrin£,place
1020  gemsys(50)
1030  code=peek(gintout)
1040  if code=18 then gosub setdn:end
1050  if code<=10 then goto digit
1060  if code =11 then goto decpt
1070  if code=12 then goto enter
1080  if code=13 then goto plus
```

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```
1090  if code=14 then goto minus
1100  if code=15 then goto times
1110  if code=16 then goto divide
1120  if code=19 then gosub clrs:goto getin
1130  if code=20 then goto chsgn
1500  finish:gosub display
1510  goto getin
1990  rem *
1991  rem * There now follow the sections of code that deal with the
1992  rem * individual calculator buttons
1993  rem *
1994  rem * When accepting a new digit first check to make sure there
1995  rem * isn;t a number on the screen that is waiting to be stacked
1996  rem *
2000  digit: rem accept a new digit
2005  if nwnum=1 then nwnum=0:siz=0:pt=0:gosub stackup:gosub clrs
2006  if enterd=1 then enterd=0:siz=0:pt=0:gosub clrs
2010  if siz>=6 then goto getin
2015  if siz=0 and code=10 and pt=0 then goto getin
2020  siz=siz+1
2030  if code=10 then code=0
2040  num$=num$+chr$(code+48)
2050  goto finish
2060  decpt:rem insert decimal point
2070  if nwnum=1 then nwnum=0:siz=0:pt=0:gosub stackup
2075  if enterd=1 then enterd=0:siz=0:pt=0:gosub clrs
2080  if pt=1 then goto getin
2090  pt=1:num$=num$+".":goto finish
2100  enter:stack$(stkptr)=num$
2110  gosub stackup
2120  enterd=1
2130  goto getin
2135  rem *
2136  rem * and now for the mathematical functions
2137  rem *
2200  plus:
2210  gosub getxy
2220  ans=x+y
2230  goto restack
2250  minus:
2260  gosub getxy
2270  ans=x-y
2280  goto restack
2300  chsgn:
2310  if left$(num$,1)="-" then goto mkpos
2320  num$="-"+num$
2330  goto finish
2340  mkpos:num$=right$(num$,len(num$)-1)
2350  goto finish
2400  times:
2410  gosub getxy
2420  ans=x*y
2430  goto restack
2500  divide:
2510  gosub getxy
2520  if y=0 then goto zerodiv
2530  ans=x/y
2540  goto restack
2690  rem *
2691  rem * subserving the mathematical functions are these two routines
2692  rem * that get the current x and y values and then adjust the stack
2693  rem * and put the result back in it
2694  rem *
2700  getxy:
2710  y=val(num$)
2720  xptr=stkptr-1
2730  if xptr=0 then xptr=4
2740  x=val(stack$(xptr))
2745  stkptr=xptr
2750  return
2800  restack:
2810  if abs(ans)>999999 then goto oflow
2815  if abs(ans)<.000001 then ans=0
2820  num$=str$(ans)
2830  stack$(stkptr)=num$
2835  nwnum=1
2840  goto finish
2990  rem *
2991  rem * a few error messages
2992  rem *
3000  zerodiv:num$="ERROR-DIV 0":gosub display:goto pause
3010  oflow:num$="OVERFLOW":gosub display:goto pause
3200  pause:
3210  for inx=1 to 2000:next inx
3220  gosub clrs
3230  goto finish
4000  stackup:
4010  stkptr=stkptr+1:if stkptr=5 then stkptr=1
4030  return
6990  rem *
6991  rem * The setup routine does the four required GEM calls
6992  rem * to reserve,explode and display then wait for the mouse
6993  rem * to enter the calculator before starting
6994  rem *
7000  setup:
7010  poke control+2,9:poke control+4,1:poke control+6,1:poke control+8,0
7020  poke gintin,0:poke gintin+2,150:poke gintin+4,160:poke gintin+6,30
7030  poke gintin+8,20:poke gintin+10,20:poke gintin+12,20:poke gintin+14,280
7040  poke gintin+16,280
7060  gemsys(51)
7070  poke gintin,1:gemsys(51)
7071  poke control+2,6:poke control+4,1:poke control+6,1:poke control+8,0
7072  poke gintin,0:poke gintin+2,1:poke gintin+4,30:poke gintin+6,30
7073  poke gintin+8,270:poke gintin+10,260
7074  poke addrin£,place
7075  gemsys(42)
7076  poke control+2,5:poke control+4,5:poke control+6,0
7077  poke gintin,0:poke gintin+2,30:poke gintin+4,30:poke gintin+6,270
7078  poke gintin+8,260:gemsys(22)
7080  return
7090  rem *
7091  rem * Setdn does the implode and restores the screen
7092  rem *
7100  setdn:
7110  poke control+2,9:poke control+4,1:poke control+6,1:poke control+8,0
7120  poke gintin,2:poke gintin+2,150:poke gintin+4,160:poke gintin+6,30
7130  poke gintin+8,20:poke gintin+10,20:poke gintin+12,20:poke gintin+14,280
7140  poke gintin+16,280
7160  gemsys(51)
7170  poke gintin,3:gemsys(51)
7180  return
8990  rem *
8991  rem * This routine will display the current value of num$ directly
8992  rem * into the calculator screen area, by using the VDI call to
8993  rem * write. (see PCW April 1986 program file)
```

```
 8994  rem *
 9000  display:
 9030  chrs=len(num$)
 9040  poke contrl,8:poke contrl+2,1
 9050  poke contrl+6,chrs+1
 9060  poke ptsin,180-8*chrs:poke ptsin+2,100
 9070  for inx=1 to chrs
 9080  poke intin+2*inx,asc(right$(num$,chrs+1-inx))
 9090  next inx
 9100  poke intin+2+2*chrs,32:poke intin,32
 9110  vdisys(1)
 9120  return
 9190  rem *
 9191  rem * To clear the screen set num$ to blanks then use display
 9192  rem *
 9200  clrs:
 9210  num$=space$(10)
 9220  gosub 9030
 9225  num$="":siz=0:pt=0
 9230  return
10000 rem ******************************************************
10010 rem *  Get addres of basic aes parameter block and then *
10020 rem *  the addresses of the individual parameter arrays *
10030 rem ******************************************************
10040 getgem:
10120 af=gb
10130 control=peek(af)
10140 global=peek(af+4)
10150 gintin=peek(af+8)
10160 gintout=peek(af+12)
10170 addrinf=peek(af+16)
10180 addrout=peek(af+20)
10190 return
20000 rem ************************************************************
20001 rem *     This is the data to define the object tree           *
20002 rem ************************************************************
20009 data 21
20010 rem the stem is a box
20020 data -1,1,20,20,0,16,004,&h1100,40,40,240,250
20030 rem sub 1 is number 1
20040 data 2,-1,-1,27,21,0,&h3102,&h1180,40,160,20,30
20050 rem sub 2 is number 2
20060 data 3,-1,-1,27,21,0,&h3202,&h1180,70,160,20,30
20070 rem sub 3 is number 3
20080 data 4,-1,-1,27,21,0,&h3302,&h1180,100,160,20,30
20090 rem sub 4 is number 4
20100 data 5,-1,-1,27,21,0,&h3402,&h1180,40,120,20,30
20110 rem sub 5 is number 5
20120 data 6,-1,-1,27,21,0,&h3502,&h1180,70,120,20,30
20130 rem sub 6 is number 6
20140 data 7,-1,-1,27,21,0,&h3602,&h1180,100,120,20,30
20150 rem sub 7 is number 7
20160 data 8,-1,-1,27,21,0,&h3702,&h1180,40,80,20,30
20170 rem sub 8 is number 8
20180 data 9,-1,-1,27,21,0,&h3802,&h1180,70,80,20,30
20190 rem sub 9 is number 9
20200 data 10,-1,-1,27,21,0,&h3902,&h1180,100,80,20,30
20210 rem sub 10 is number 0
20220 data 11,-1,-1,27,21,0,&h3002,&h1180,70,200,20,30
20230 rem sub 11 is char . (dec. pt.)
20240 data 12,-1,-1,27,21,0,&h2e02,&h1180,40,200,20,30
20250 rem sub 12 is char up arrow for enter (default)
20260 data 13,-1,-1,27,23,0,&h0104,&h1180,98,198,24,34
20270 rem sub 13 is char +
20280 data 14,-1,-1,27,21,0,&h2b02,&h1180,130,80,20,30
20290 rem sub 14 is char -
20300 data 15,-1,-1,27,21,0,&h2d02,&h1180,130,120,20,30
20310 rem sub 15 is char x
20320 data 16,-1,-1,27,21,0,&h7802,&h1180,130,160,20,30
20330 rem sub 16 is char divide
20340 data 17,-1,-1,27,21,0,&hf602,&h1180,130,200,20,30
20350 rem sub 17 is blank screen
20360 data 18,-1,-1,20,0,0,002,&h1100,40,40,140,30
20370 rem sub 18 is close for off
20380 data 19,-1,-1,27,21,0,&h0504,&h1180,0,0,25,30
20390 rem sub 19 is C for clear
20400 data 20,-1,-1,27,21,0,&h4302,&h1180,160,80,20,30
20410 rem sub 20 is change sign
20420 data 0,-1,-1,27,53,0,&hf102,&h1180,160,120,20,30
```

Epson HX20 Tape-Man

by Amanda Parfitt

This tape manager program saves itself at the start of each tape, and maintains a directory of files on the tape as they are added. The listing has been kept short to leave more room in the HX20 for other programs. The program can be loaded into any one of the five program areas, but ideally should be kept only in one area to establish a standard procedure.

When run, the program displays a menu which asks whether a new tape is being used, whether one is returning from saving a file, or whether to go straight to the main menu. If it's a new tape, Tape-Man asks for the title and the side of the tape being used, rewinds it, saves itself at the beginning and writes the initial directory. This can be considered equivalent to formatting a disk.

When returning from saving a file, the program has to update the directory and save it to tape before moving to the main menu. This allows you to load a file, save a file or print the directory. At this point, the program will have read the current directory and will know all the details about the programs on the tape.

When the load option is selected, the program asks for the file name, winds the tape to just before the correct file and ends, allowing the user to log-in to the appropriate program

before accessing the file.

The save option causes the program to find the next free space on the tape, and asks the user for the program area. The program logs into that area and ends, allowing the user to save the required file with the tape already correctly positioned. The user should then run the program again to allow it to update the directory at the start of the tape.

The final option prints a brief or lengthy directory of the tape. It then returns to the main menu.

Variables

The program allows up to 20 files on one side of a tape. Some of the variables used are as follows:

NDT — array holding name, date and time of saving each file

SFT — array holding start tape count, finish tape count and file type

D — array holding the names of the months

```
>LIST
   10  TITLE "TAPE-MAN"
   20  CLEAR 650,700
   30  WIDTH 20,4
   40  CLS
   50  PRINT "**** TAPE-MAN ****"
   60  PRINT "By  Amanda Parfitt"
   70  DEFINT T,S,F
   80  DEFSTR Z,D,N
   90  DIM NDT(20,2),SFT(20,2),D(11)
  100  L1$="************************"
  110  L2$="ooooooooooooooooooooooo"
  120  FOR J=0 TO 11
  130    READ D(J)
  140    NEXT J
  150  DATA "Jan","Feb","Mar","Apr","May","Jun"
  160  DATA "Jul","Aug","Sep","Oct","Nov","Dec"
  170  PRINT "Press any key..."
  180  Z=INKEY$
  190  IF Z="" THEN 180
  200  CLS
  210  PRINT "New Tape.....1"
  220  PRINT "Return from SAVE..2"
  230  PRINT "Main Menu.....3"
  240  Z=INKEY$
  250  IF Z="" OR VAL(Z)>3 THEN 240
  260  ON VAL(Z)+1 GOTO 240,270,1580,420
  270  CLS
  280  INPUT "Name of Tape         ";NT
  290  INPUT "Side of Tape ";NS
  300  CLS
  310  PRINT "*** Please Wait ***"
  320  PRINT "* Saving Tape-Man *"
  330  WIND
  340  SAVE"TAPE-MAN"
  350  T=2
  360  SFT(1,0)=0:SFT(1,1)=TAPCNT:SFT(1,2)=0
  370  SFT(2,0)=400:SFT(2,1)=900:SFT(2,2)=256
  380  NDT(1,0)="TAPE-MAN":GOSUB 1680:NDT(1,2)=TI$
  390  GOSUB1660
  400  NDT(1,1)=D:NDT(2,0)="DIR":NDT(2,1)=D:GOSUB 1680:NDT(2,2)=TI$
  410  GOSUB1130
  420  IF Z="3" THEN GOSUB1260
  430  CLS
  440  PRINT "Load a File.....1"
  450  PRINT "Save a File.....2"
  460  PRINT "Print Directory...3"
  470  Z=INKEY$
  480  IF Z="" OR VAL(Z)>3 THEN 470
  490  ON VAL(Z)+1 GOTO470,510,610,720
  500  END
  510  CLS
  520  INPUT "Name of File         ";NF
  530  JJ=-1
  540  FOR J=1 TO T
  550    IF NF=NDT(J,0) THEN PRINT NF;" found":JJ=J
  560    NEXT J
  570  IF JJ=-1 THEN PRINT NF;" not found":GOTO 430
  580  WIND SFT(JJ,0)
  590  PRINT "** TAPE-MAN ENDS **"
  600  END
  610  CLS
  620  PRINT "Finding free space    Please  Wait"
  630  IF T=2 THEN WIND 1000 ELSE WIND SFT(T,1)+100
  640  CLS
  650  PRINT "LOGIN & SAVE file"
  660  PRINT "Then RUN Tape-man"
  670  PRINT "LOGIN to what area"
  680  Z=INKEY$
  690  IF Z="" OR VAL(Z)>5 OR VAL(Z)<1 THEN 680
  700  LOGIN VAL(Z)
  710  END
  720  CLS
  730  PRINT "Full Directory....1"
  740  PRINT "Brief Directory...2"
  750  Z=INKEY$
  760  IF Z="" OR VAL(Z)>2 OR VAL(Z)<1 THEN 750
  770  CLS
  780  GOSUB 1660
  790  GOSUB 1680
  800  IF VAL(Z)<>1 THEN GOTO 1020
  810  PRINT "** Full Directory **"
  820  LPRINT L1$
  830  LPRINT "Directory of ";NT
  840  LPRINT "Side ";NS;" @ ";D;" ";TI$
  850  LPRINT NDT(1,1);" to ";NDT(T,1)
  860  FOR J=1 TO T
  870    LPRINT L2$
  880    LPRINT "File Name : ";NDT(J,0)
```

PROGRAM FILE

```
 890    LPRINT "Tape Count:";SFT(J,0);"-";SFT(J,1)
 900    LPRINT "File Type : ";
 910    Z1="BASIC-ASCII"
 920    IF SFT(J,2)=0 THEN Z1="BASIC"
 930    IF SFT(J,2)=256 THEN Z1="DATA"
 940    IF SFT(J,2)=2 THEN Z1="OBJECT"
 950    LPRINT Z1
 960    LPRINT "Date Saved: ";NDT(J,1)
 970    LPRINT "Time Saved: ";NDT(J,2)
 980    NEXT J
 990  LPRINT L2$
1000  LPRINT L1$
1010  GOTO 430
1020  PRINT "* Brief Directory *"
1030  LPRINT L1$
1040  LPRINT "Directory of ";NT
1050  LPRINT "Side ";NS;" @ ";D;" ";TI$
1060  LPRINT NDT(1,1);" to ";NDT(T,1)
1070  LPRINT L2$
1080  FOR J=1 TO T
1090    LPRINT NDT(J,0);TAB(10);NDT(J,1);TAB(18);SFT(J,0)
1100    NEXT J
1110  LPRINT L1$
1120  GOTO 430
1130  CLS
1140  PRINT "Saving New Directory"
1150  PRINT "   Please  Wait"
1160  NDT(2,1)=NDT(T,1)
1170  NDT(2,2)=NDT(T,2)
1180  WIND 400
1190  OPEN"O",£1,"CAS0:DIR"
1200  PRINT£1,NT,NS,T
1210  FOR J=1 TO T
1220    PRINT£1,NDT(J,0),NDT(J,1),NDT(J,2),SFT(J,0),SFT(J,1),SFT(J,2)
1230    NEXT J
1240  CLOSE£1
1250  RETURN
1260  CLS
1270  PRINT "Loading Directory"
1280  PRINT "   Please Wait"
1290  WIND400
1300  OPEN "I",£1,"CAS0:DIR"
1310  INPUT£1,NT,NS,T
1320  FOR J=1 TO T
1330    INPUT£1,NDT(J,0),NDT(J,1),NDT(J,2),SFT(J,0),SFT(J,1),SFT(J,2)
1340    NEXT J
1350  SFT(2,1)=TAPCNT
1360  CLOSE£1
1370  SFT(2,1)=TAPCNT
1380  RETURN
1390  NDT(0,0)=""
1400  P=0
1410  FOR J=0 TO 10
1420    ZC=CHR$(PEEK(822-J))
1430    IFJ>2 AND ZC<>" " THEN P=1
1440    IF ZC<>" " OR P=1 THEN NDT(0,0)=ZC+NDT(0,0)
1450    IF J=2 AND LEN(NDT(0,0))<>0 THEN NDT(0,0)="."+NDT(0,0)
1460    NEXT J
1470  SFT(0,1)=TAPCNT
1480  GOSUB 1660
1490  NDT(0,1)=D
1500  GOSUB 1680:NDT(0,2)=TI$
1510  SFT(0,2)=PEEK(823)+PEEK(824)
1520  RETURN
1530  FOR J=0 TO 2
1540    NDT(T,J)=NDT(0,J)
1550    SFT(T,J)=SFT(0,J)
1560    NEXT J
1570  RETURN
1580  GOSUB 1390
1590  GOSUB 1260
1600  IF SFT(T,1)<1000 THEN SFT(0,0)=1000 ELSE SFT(0,0)=SFT(T,1)+100
1610  SFT(2,1)=TAPCNT
1620  T=T+1
1630  GOSUB 1530
1640  GOSUB 1130
1650  GOTO 430
1660  D=MID$(DATE$,4,2)+D(VAL(LEFT$(DATE$,2))-1)+RIGHT$(DATE$,2)
1670  RETURN
1680  TI$=LEFT$(TIME$,2)+MID$(TIME$,4,2)+"hrs"
1690  RETURN
```

ð-LINESð- ð-REMARKSð-

120-160 Set up months names

200-260 Initial Menu options

270-410 New Tape (formatting)

420 Read Directory if Main Menu is selected from Initial Directory

430-490 Main Menu

510-600 Load a File

610-710 Save a File

```
720-1120  Print Directory
1130-1250 Save Directory
1260-1380 Load Directory
1390-1520 Get details after Save
          Name of last file saved is from memory
          locations 822-812 (reverse)
          File type is determined from memory
          locations 823-824
1530-1570 Copy file info from dummy
1580-1650 Return from save
1660-1670 Date subroutine
1680-1690 Time subroutine
```

MBasic Polynomial Root Finding

by GG Haigh

This set of programs provides an alternative to the standard iterative methods for calculating the roots of polynomial equations. The methods given improve on Newton's method, the time-honoured choice, in two ways: the speed at which the root is found; or accuracy. Newton's method has the disadvantage that it can quite often diverge from a root, rather than converging onto it.

Newton's method makes a linear approximation to the root in its presumed vicinity. The result of this approximation should be another approximation which is closer to the correct result. This process is repeated until the difference between successive approximations is negligible. The only problem arises when the linear approximation is further away from the root than the original estimate; the process then diverges and moves away from the root, failing to solve the problem.

A more accurate approach is to make the approximation by a curve, rather than by a straight line, and this set of programs gives three alternative methods for doing this. The methods chosen must be curves which can have only one possible solution, and there are three intrinsic functions provided on micros that satisfy this criterion: the rectangular hyperbola; logarithms; and exponential functions. The last two of these are, mathematically speaking, almost identical, but lead to quite different root-determining formulae.

The price to pay for the improvement in performance over Newton's method is that both the first and second derivatives have to be calculated. In return, the methods converge more quickly to the root and are more certain to converge at all.

The formulae are as follows, where the function is referred to as y; its first derivative as y'; its second derivative as y''; the first estimate of the root as r; and the newly calculated value as x.

For the rectangular hyperbola method:

x=r+1/(y''/y'/2-y'/y)

For the exponential method:

x=r+y'/y''*LOG(1-y*y''/(y'*y'))

For the logarithmic method:

x=r+y'/y''*(1-EXP(y*y''/(y'*y'))

The above formulae are derived from the initial formulae for these functions.

As an alternative, a program for the standard difference method is also given for comparison. There is no difficulty in devising functions that these programs cannot cope with, but Newton's method similarly cannot cope. Other numerical analysis tools are required for these programs.

```
10 CLS:PRINT:PRINT"              CALCULATION OF THE REAL ROOTS OF AN EQUATION "
20 PRINT"          ----------------------------------------------":PRINT
30 PRINT" This programme calculates the real roots of an equation,y=f(x),by iter
ation of"
40 PRINT"a hyperbolic approximation to f(x).It requires the first and second der
ivatives of the function.":PRINT
50 PRINT"First enter the three functions y,y' and y'' by moving the cursor past
"
60 PRINT"each '='sign, typing each function in BASIC form and pressing [CR] afte
r each"
70 PRINT"line entry.Then press:-":PRINT
80 PRINT    "                    [RUN 100] [CR]":PRINT
90 LIST 100-120
```

PROGRAM FILE

```
100          DEF FNA(X)=                                    '<-----enter y
110          DEF FNB(X)=                                    '<-----enter y'
120          DEF FNC(X)=                                    '<-----enter y''
130 PRINT
140 INPUT "Enter your initial estimate of a root---> ",X:M=0
150 F=X
160 X=X+1/(FNC(X)/FNB(X)/2-FNB(X)/FNA(X))
170 IF ABS(X/F-1)<.01 THEN 200 ELSE IF M>10 THEN 260
180 M=M+1
190 GOTO 150
200 PRINT
210 PRINT "                                  ROOT = ";X:PRINT
220 INPUT "Calculate another root?Enter Y or N---> ",A$
230 IF A$="N" OR A$="n" THEN 280
240 IF A$="Y" OR A$="y" THEN 130
250 PRINT"Use y,Y,n or N":GOTO 220
260 PRINT"Query the presence of a root near this estimate"
270 FOR I=1 TO 2000:NEXT:GOTO 140
280 END
Ok
```

CALCULATION OF THE REAL ROOTS OF AN EQUATION

This programme calculates the real roots of an equation,y=f(x),by iteration of a hyperbolic approximation to f(x).It requires the first and second derivatives of the function.

First enter the three functions y,y' and y'' by moving the cursor past each '='sign, typing each function in BASIC form and pressing [CR] after each line entry.Then press:-

[RUN 100] [CR]

```
100          DEF FNA(X)= X^4+6*X^3-X^2-3*X+.5               '<-----enter y
110          DEF FNB(X)= 4*X^3+18*X^2-2*X-3                 '<-----enter y'
120          DEF FNC(X)= 12*X^2+36*X-2                      '<-----enter y''
Ok

RUN 100

Enter your initial estimate of a root---> -10

                              ROOT = -6.081095

Calculate another root?Enter Y or N---> y

Enter your initial estimate of a root---> 10

                              ROOT =  .6601876

Calculate another root?Enter Y or N---> y

Enter your initial estimate of a root---> -2

                              ROOT = -.7460333

Calculate another root?Enter Y or N---> y

Enter your initial estimate of a root---> .2

                              ROOT =  .1669408

Calculate another root?Enter Y or N---> n
Ok
```

```
10 CLS:PRINT:PRINT"              CALCULATION OF THE REAL ROOTS OF AN EQUATION"
20 PRINT"                  ------------------------------------------------":PRINT
30 PRINT"    THis programme calculates the real roots of an equation,y=f(x)."
40 PRINT" The method is derived from a hyperbolic approximation to the function
and,"
50 PRINT" using finite differences, does not require differentiation of the func
tion.":PRINT
60 PRINT" First enter the function by moving the cursor past the '=' sign and ty
ping"
70 PRINT" the function in BASIC form. Then press:-":PRINT
80 PRINT"                    [CR]  [RUN 100]  [CR]":PRINT
90 EDIT 100
100        DEF FNY(X) =                                    '<-----enter y
110 PRINT
120 PRINT
130 INPUT"           Enter your initial estimate of a root---> ",X:M=0
140 F=X
150 A=FNY(X)
160 B=FNY(X+.01)
170 C=FNY(X+.02)
180 X=X-.02/(C*(B-A)/A/(C-B)-1)
190 IF ABS(X/F-1)<.01 THEN 220 ELSE IF M>10 THEN 280
200 M=M+1
210 GOTO 140
220 PRINT
230 PRINT"                         ROOT = ";X:PRINT
240 INPUT"          Calculate another root? Enter Y or N----> ",A$
250 IF A$="N" OR A$="n" THEN 300
260 IF A$="Y" OR A$="y" THEN 120
270 PRINT" Use y,Y,n or N":GOTO 240
280 PRINT" Query the presence of a root near this estimate"
290 FOR I=1 TO 2000:NEXT:GOTO 130
300 END
```

```
10 CLS:PRINT:PRINT"              CALCULATION OF THE REAL ROOTS OF AN EQUATION "
20 PRINT"          ----------------------------------------------":PRINT
30 PRINT" This programme calculates the real roots of an equation,y=f(x),by iter
ation of"
40 PRINT"an exponential approximation to f(x).It requires the first and second
       derivatives of the function.":PRINT
50 PRINT"First enter the three functions y,y' and y'' by moving the cursor past
"
60 PRINT"each '='sign, typing each function in BASIC form and pressing [CR] afte
r each"
70 PRINT"line entry.Then press:-":PRINT
80 PRINT     "                    [RUN 100] [CR]":PRINT
90 LIST 100-120
100          DEF FNA(X)=                                  '<-----enter y
110          DEF FNB(X)=                                  '<-----enter y'
120          DEF FNC(X)=                                  '<-----enter y''
130 PRINT
140 INPUT "Enter your initial estimate of a root---> ",X:M=0
150 F=X
160 X=X+FNB(X)/FNC(X)*LOG(1-FNA(X)*FNC(X)/(FNB(X))^2)
170 IF ABS(X/F-1)<.01 THEN 200 ELSE IF M>10 THEN 260
180 M=M+1
190 GOTO 150
200 PRINT
210 PRINT "                                  ROOT = ";X:PRINT
220 INPUT "Calculate another root?Enter Y or N---> ",A$
230 IF A$="N" OR A$="n" THEN 280
240 IF A$="Y" OR A$="y" THEN 130
250 PRINT"Use y,Y,n or N":GOTO 220
260 PRINT"Query the presence of a root near this estimate"
270 FOR I=1 TO 2000:NEXT:GOTO 140
280 END
```

```
10 CLS:PRINT:PRINT"              CALCULATION OF THE REAL ROOTS OF AN EQUATION "
20 PRINT"          ----------------------------------------------":PRINT
30 PRINT" This programme calculates the real roots of an equation,y=f(x),by iter
ation of"
40 PRINT"a logarithmic approximation to f(x).It requires the first and second de
rivativesof the function.":PRINT
50 PRINT"First enter the three functions y,y' and y'' by moving the cursor past
"
60 PRINT"each '='sign, typing each function in BASIC form and pressing [CR] afte
r each"
70 PRINT"line entry.Then press:-":PRINT
80 PRINT     "                    [RUN 100] [CR]":PRINT
90 LIST 100-120
100          DEF FNA(X)=                                  '<-----ENTER Y
110          DEF FNB(X)=                                  '<-----ENTER Y'
120          DEF FNC(X)=                                  '<-----ENTER Y''
130 PRINT
140 INPUT "Enter your initial estimate of a root---> ",X:M=0
150 F=X
160 X=X+FNB(X)/FNC(X)*(1-EXP(FNA(X)*FNC(X)/(FNB(X))^2))
170 IF ABS(X/F-1)<.01 THEN 200 ELSE IF M>10 THEN 260
180 M=M+1
190 GOTO 150
200 PRINT
210 PRINT "                                  ROOT = ";X:PRINT
220 INPUT "Calculate another root? Enter Y or N---> ",A$
230 IF A$="N" OR A$="n" THEN 280
240 IF A$="Y" OR A$="y" THEN 130
250 PRINT"Use y,Y,n or N":GOTO 220
260 PRINT"Query the presence of a root near this estimate"
270 FOR I=1 TO 2000:NEXT:GOTO 140
280 END
```

Oric Function Key

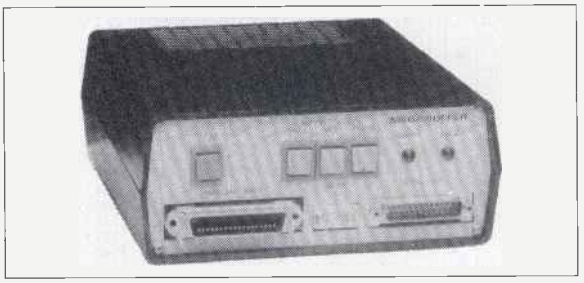
by Tim Richards

This routine provides a Home key, which is operated by the FUNCTion key and is completely relocatable. It interrupts the vector held at location #245 and moves the cursor if necessary, and allows the interrupt to continue.

To enable the FUNCTion key, use DOKE #245,#400; to disable it, use DOKE #245,#EE22.

```
10 FOR I=#400 TO #41A
20 READ A$:POKE I,VAL("#"+A$)
30 NEXT
40 DATA 48,8A,48 'save register contents
50 DATA AD,09,02 'load keyboard contents
60 DATA C9,A5 'function key check
70 DATA F0,6 'if check positive jump
80 DATA 68,AA,68 'restore registers
90 DATA 4C,22,EE 'continue interrupt
100 DATA A2,1E 'load X with CHR$(30)
110 DATA 20,7C,F7 'print character
120 DATA 68,AA,68 'restore registers
130 DATA 4C,22,EE 'continue interrupt
```

MULTIPLY COMPUTER PRODUCTIVITY with the MEGABUFFER



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MICROCHESS

Man vs Mainframe? Kevin O'Connell is the referee.

How do you set about beating a chess computer or a chess program playing on a big computer?

The best advice is still: 'Get out of book' as soon as possible and then keep everything very simple. The 'book' is the computer's possibly exhaustive knowledge of opening theory which consists of a simple IF... THEN... IF... THEN... sequence, although this can be very deep indeed.

Here is an example of an amateur player following just this advice and winning, fairly easily, against one of the strongest programs in the world running on a Cray.

White: PG Bakker. Black: Cray Blitz. Opening: Queen's Pawn.

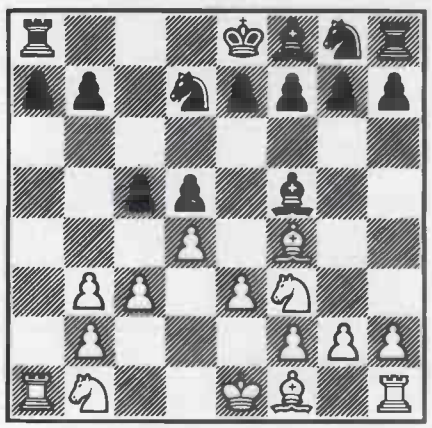
1	d2-d4	d7-d5
2	Ng1-f3	Bc8-f5
3	c2-c3	

This takes the computer out of its book knowledge.

3	...	Nb8-d7
4	Bc1-f4	c7-c5
5	e2-e3	Qd8-b6
6	Qd1-b3	Qb6×b3

This is none too good. 6... e7-e6 was better.

7 a2×b3



7	...	Bf5×b1

In a very simple position, Black plays a move that no human would ever consider. True, the white rook is pulled, temporarily, off the half-open a-file, but this is only achieved at the cost of conceding the bishop pair to White.

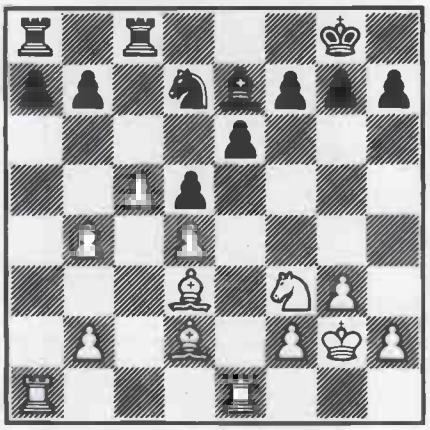
8	Ralxb1	c5×d4
9	e3×d4	e7-e6
10	Bf1-d3	Ng8-f6
11	0-0	Nf6-h5
12	Bf4-d2	Bf8-d6
13	g2-g3	Nh5-f6
14	Rf1-e1	0-0
15	Rb1-a1	

White has a very clear advantage and it is extremely difficult for Black to find anything constructive to do.

15	...	Bd6-c7
16	c3-c4	

White wants to take advantage of his queen-side pawn majority (3 v 2 on the a,b and c-files).

16	...	Rf8-c8
17	Kgl-g2	Bc7-d6
18	c4-c5	Bd6-e7
19	b3-b4	



19	...	a7-a6

Black's task is extremely difficult, but this makes it easier for White to convert his pawn majority.

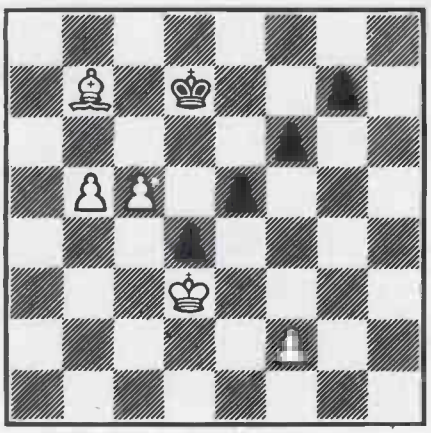
20	b4-b5	a6×b5
21	Bd3×b5	h7-h6
22	b2-b4	Kg8-f8
23	h2-h4	Kf8-e8

This is the end, losing material to the followjng, positional, combination. Unfortunately for computers, positional combinations tend to run to large numbers of ply which make them too deep for the computers to see.

24	Nf3-e5	Rc8-d8
25	g3-g4	Ra8×a1
26	Re1×a1	Ke8-f8
27	g4-g5	h6×g5
28	h4×g5	Nd7×e5
29	g5×f6	Be7×f6
30	d4×e5	Bf6×e5
31	Ra1-a7	Rd8-b8
32	Kg2-f3	Be5-d4
33	Bb5-a4	Bd4-e5
34	Bd2-f4	Be5×f4
35	Kf3×f4	f7-f6
36	Ba4-d7	

This is stronger than 36 b4-b5, which would allow the black king to get into the game.

36	...	e6-e5+
37	Kf4-e3	d5-d4+
38	Ke3-d3	Kf8-e7
39	Bd7-c6	Ke7-e6
40	Ra7×b7	Rb8×e6
41	Bc6×b7	Ke6-d7
42	b4-b5	



42	...	1-0
		(Black resigns)

White not only has the overwhelming material superiority of bishop v pawn, but the connected passed b and c-pawns are bound to force their way through to queen.

NUMBERS COUNT

Mike Mudge examines S_k — sets and their extension.

Sets (ti) for which $t_it_j + k$ is always a square. . .s_k — sets and some possible extensions

Definition (i) An S_k — set of size n is a set $(t_1, t_2, \ldots .tn)$ of distinct positive integers such that $t_it_j + k$ is the square of an integer whenever $i \neq j$; k being constant.

For example, (1,2,5,) is an S_{-1} — set of size 3 since $1\times2 - 1 = 1^2$,
$1\times5 - 1 = 2^2$ & $2\times5 - 1 = 3^2$.
(1,79,98) is a P_2 — set of size 3 since
$1\times79 + 2 = 9^2$,
$1\times98 + 2 = 10^2$ & $79\times98 + 2 = 88^2$.

Definition (ii) AC_k — set of size n is similarly defined using the condition that $t_it_jt_p + k$ is the cube of an interger whenever $i \neq j \neq p$.

It should be observed that these definitions are capable of modification in many natural ways; typical illustrations being
(a) $t_it_j + k$ is the cube of an integer,

NUMBERS COUNT

(b) $t_i + t_j + k$ is the square of an integer,
(c) $t_i + t_j + t_p$ is the cube of an integer.

Definition (iii) An S_k — set is 'extendable' if there exists a positive integer, y say, not a member of S_k such that the union of y and S_k is still an S_k — set.

For example, the S_1 — set (1,3,8) of size 3 can be extended using the integer y = 120 to generate the S_1 — set (1,3,8,120) of size 4.

It has been shown (A Baker and H Davenport, *Quart Journal Math* Oxford Ser (3) v 20, 1969, pp129-137) that no further extension of this S_1 — set is possible.

The extendability of C_k — sets is similarly defined.

Problem A Catalogue, according to their size, all possible S_k — sets with elements less than some given N_0.

Problem B Investigate the 'extendability' of these S_k — sets using integers y up to some given Y_{max}.

Problem C Repeat (A) & (B) above for C_k — sets.... of which none are known to the author.

Problem D Modify definitions (i) & (ii) above and attempt (A), (B) and (C) as appropriate.

Some reference to the theoretical literature on these matters may be helpful. Details of the history of this problem are to be found in P Heichelheim's; *The Study of positive integers (a,b) such that ab + 1 is a square.* Fibonacci Quarterly. v17, 1979, pp269-274, also LE Dickson; *History of the Theory of Numbers,* vol II, pp513-520.

Readers are invited to submit their attempts at some (or all) of the above problems to: Mike Mudge, 'Square Acre', Stourbridge Road, Penn, near Wolverhampton, Staffordshire WV4 5NF, tel (0902) 892141. Submissions, which must reach me by 1 October 1986, will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a suitable stamped, addressed envelope is provided.

Expanded reviews of previous problems, together with, subject to the approval of the contributor, copies of detailed programs from the winning entry may also be requested. In the interests of efficiency, interested readers are encouraged to contact the prize-winner directly.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and computationally-related mathematics, and will endeavour to reply to all letters.

January review

This subject area produced responses ranging from 'What a load of rubbish!' to 'In order to produce a genuine program to perform two-way arithmetic, it seems one would have to start from Peano's axioms and communicate with the computer in machine-language. . .

The subject is self-explanatory; readers requiring further background and state-of-the-art reports are encouraged to take out a subscription to *Colsen News* (two-way numbers) with Cedric AB Smith Cedric Smith at 141 Portland Crescent, Stanmore, Middlesex HA7 1LR.

Detailed computer programs received were minimal. This month's prize-winner is A Sumner of 14 Western Elms Avenue, Reading RG3 2AN who has already received a complimentary copy of *Colsen News.*

LEISURE LINES

Brain teasers courtesy of JJ Clessa.

A friend of mine has just had a birthday. If he multiplies the two digits of his age in years, and doubles the result, the answer comes to one less than his age. How old is he?

Prize puzzle

This problem can be solved fairly easily by analytical methods. But if you can't manage that, then it shouldn't be too difficult to write a computer program to do the trick.

(1) There are three numbers (5, 7, and 11) which have no factors in common (except unity) with the number 12.

(2) There are seven numbers (3, 7, 9, 11, 13, 17, and 19) which have no factors in common (except unity) with the number 20.

(3) How many numbers are there which have no factors in common (except unity) with the number 720?

There's no need to list the numbers — just tell me how many there are.

Answers, on postcards only please, to reach *PCW,* 32-34 Broadwick Street, London W1A 2HG, no later than 31 July 1986.

April prize puzzle

Although the problem was slightly harder than usual to program, it had rather more solutions than we anticipated — about 400 or so more! Perhaps that explains why there were less than 50 submissions.

We accepted any valid entry that matched the requirements:
The lowest was 124 739 586 with a divisor of 3.
The highest was 785 926 314 with a divisor of 9 and there were hundreds inbetween.

The winning entry, chosen at random, came from Mr Roy Filkins of Basingstoke, Hants. Congrulations, Roy, your prize is on its way.

'Oh, look — he knows it's walkies time.'

ACC NEWS

A look at the local club scene with Rupert Steele.

The ACC is the national umbrella organisation for computer clubs. It provides clubs with publicity, advice, cheap insurance and a speakers' list, as well as an opportunity to take part in running the ACC through its council meetings. Clubs should contact me, Rupert Steele, to find out about these benefits, as should commercial organisations wishing to take advantage of the club's mailing service.

The ACC is also able to put people in touch with their local computer clubs; to use this, or to find the User Group for your machine, contact Mike Mudge at the address given at the end of this column.

John Palmer writes from the Microbeacon Project at 29 Guthrie Street, Edinburgh. This group works among community workers, the unemployed and the disabled, and is aimed at spreading computer literacy. Attached to the project is the 'Microbeacon Supporters Group' which meets on the first and third Thursdays of each month; the latter group acts as a computer club, with its members being encouraged to assist in the work of the centre at other times. Areas of interest include programming, word processing, using spreadsheets or databases and printers. Write to John at the project for details.

Mr L Howarth has written from 41 St Walburge Avenue, Preston, Lancs PR2 2QT to tell me about the Preston Computer Club (PACE). The letter gives little else away, so if you live in the Preston area, I'd advise dropping Mr Howarth a line.

Also near Preston is the Chorley Computer Club. The secretary, John Moore, lives at 3 Stanley Road, Farington, Preston PR5 2RH. If you want to know more about the group, write to him at the above address.

Ralph Quarton has written from 44 Whitley Spring Crescent, Ossett, West Yorkshire WF5 ORE. He runs Wakefield Amateur Computer Club, which meets on the first and third Fridays of each month (except for August) from 7-10pm at Kettlethorpe Community Centre, Wakefield. The annual subscription is £6 (£3 for children), plus a further charge of 25p for each meeting.

Mr SJ Stanner has written about the Manchester Amstrad User Club (MAU Club), of which he is the editor. For more information, write to the MAU Club at 21 Gatling Avenue, Longsight, Manchester M12 5SX.

From 19 Walgrave Close, Congleton, Cheshire CW12 4TS, Mr GA Harratt writes. He is secretary of the Congleton & District Computer Club. Why not drop him a line if you live in the area?

Not far from Cheshire is the Derbyshire Glossop Computer Club. Most, but not all of its members are BBC owners, and newcomers are welcome to the meetings which take place on Monday evenings throughout the year. For more information, call the secretary, Mr TS Fox, on New Mills (0663) 44260 or write to him at 4 Park Lane, Little Hayfield, Stockport, Cheshire SK12 5NW.

Over in west Wales lives Basil Sparrow, who runs a computer club in Fishguard, mainly for 8-12 year olds (but the age range embraces 6-13 years). His letter fails to mention the times and dates of meetings, but with children involved, Saturday morning or afternoon might be a fair bet. Anyway, give him a call on (0348) 873480 or write to him at 10 Wallis Crescent, Fishguard, Pembs, Dyfed SA65 9HY.

Further south, Matthew Tydeman has written to tell me of the Lea Valley Atari Users' Club, of which he is vice president and editor (indicating a newsletter?). The address for enquiries is 125 Cadmore Lane, Cheshunt, Herts EN8 9JH.

I have received a news sheet from the Harpenden Microcomputer Users' Group (HUMBUG). Recent meetings have included a demonstration of an EPROM 'blower' attached to a BBC Micro, a demonstration of the sound facilities on the BBC, a showing of an Apple Macintosh and a talk on how to use an Amstrad Computer to teach Bridge. Coming soon are a DIY burglar alarm (30 June), a games evening (14 July) and the annual general meeting followed by games (8 September). All meetings are in the Silver Cup Public House, Harpenden; call Peter Cowley on Harpenden 5127 for confirmation and details.

Bob Ibbotson has written from Southwark ITEC, South Bank Technopark, London Road, London SE1 6LN (near the Elephant & Castle). He is hoping to run a club for Apricot users (including the 'F' series) based at Southwark ITEC, which owns eight Apricots as well as various other kits including BBCs. For more information, contact Bob at the ITEC or on (01) 928 2900 × 261. ITEC stands for Information Technology Centre, and its function is to provide young, unemployed people with an introduction to computers (concentrating par-

ACC NEWS

ticularly on work skills — that is, operation of packages, simple maintenance, and so on). The Southwark ITEC is located in the South Bank Technopark, a purpose built block comprising small industrial high-tech workshop units.

Some months ago, the Sanyo MBC-550 User Group, run by Tom Drake, had to shut down as it was taking up all of Tom's time. Mr MH Syed of Wistaria, 53 Acacia Grove, New Malden, Surrey KT3 3BP (01) 942 9009 has written saying that he would like to help start a new group offering similar facilities to the original. Anybody wanting to join or able to help should contact him directly.

Finally, from Brighton, I have received a newsletter from the TI99/4A Exchange. This non-profit making organisation (as are, to my knowledge, the others mentioned here) publishes a quarterly magazine with over 60 pages of information, articles, hints and programs for an annual subscription of £6. Billed as the only active nationwide TI (Texas Instruments) User Group, it organises national meetings and exhibitions for the public and its members. For more details, contact Clive Scally at the TI99/4a Exchange, 40 Barrhill, Patcham, Brighton, BN1 8UF or call (0273) 503968 after 7:30pm.

For a mention in this column, to tell the ACC about your club, or to obtain address labels for mailing to UK computer clubs, contact: Rupert Steele, 12 Philbeach Gardens, London SW5 9DY.
For any other enquiry, contact: Mike Mudge, 'Square Acre', Stourbridge Road, Penn, near Wolverhampton WV4 5NF or call (0902) 892141.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printers' errors, and so on.

London	Olympia; Computers in Manufacturing Exhibition. Contact: Independent Exhibitions (01) 891 3426	17-20 June
Manchester	G-Mex Centre; Computer Show — COMPUTER. Contact: Reed Exhibitions (01) 643 8040	24-26 June
London	Wembley Conference Centre; Knowledge Based Systems '86. Contact Online Conferences (01) 868 4466	1-3 July
London	Royal Lancaster Hotel; Computers in Personnel Exhibition, Contact: Peter Mirrington Exhibitions (0787) 277354	8-10 July
London	Olympia; PC User Show & Conference. Contact: EMAP International Exhibitions (01) 608 1161	16-18 July
London	Barbican Centre; Acorn Computer User Christmas Show. Contact Edition Scheme (01) 349 4667	24-27 July

WRITING FOR PCW

Your chance to contribute to the magazine.

We're offering readers the chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing, with margins top and bottom and on each side.

We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well for reference.

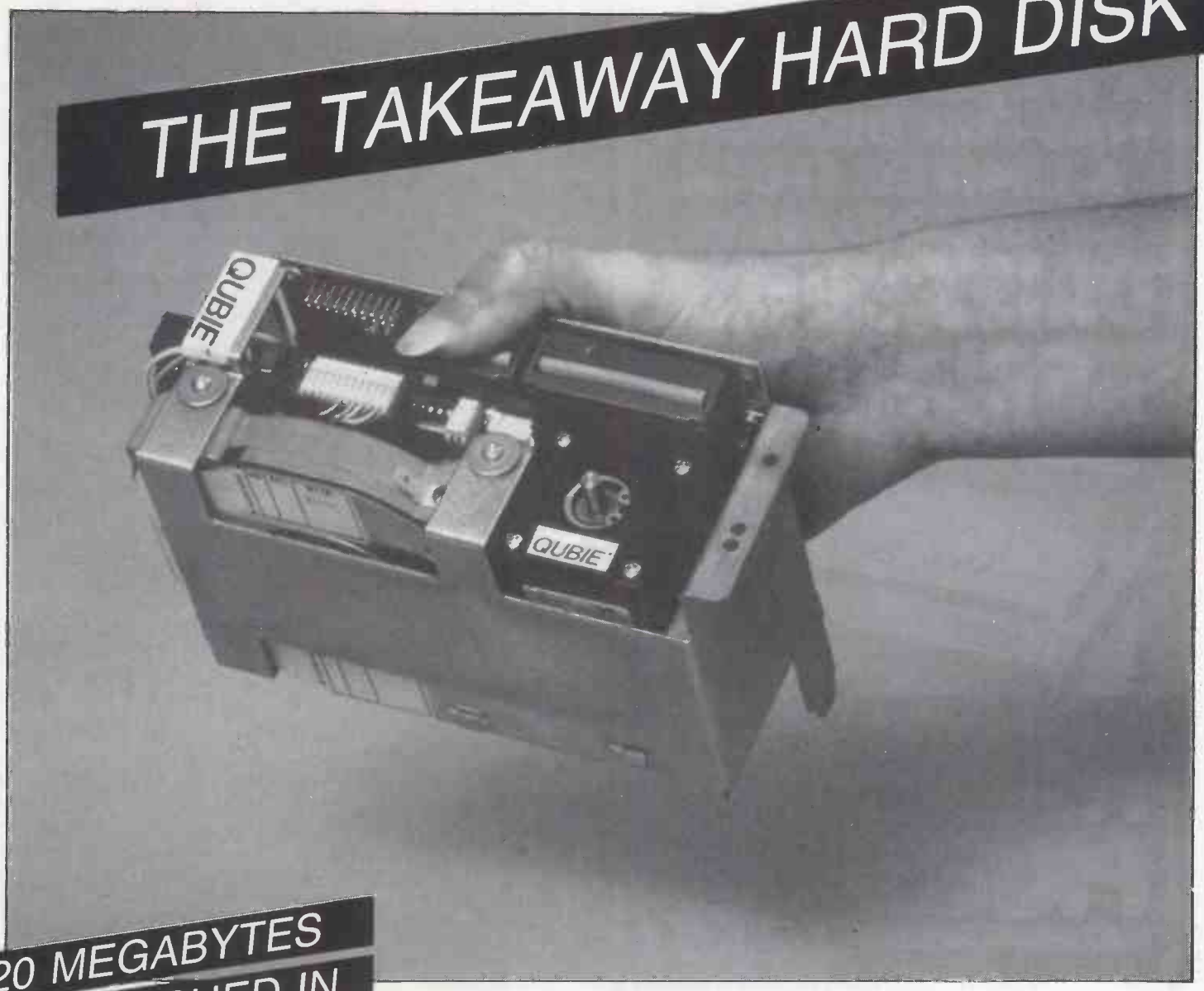
Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

Bear in mind that it's worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frank.y, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication.

So, get writing. END

THE TAKEAWAY HARD DISK



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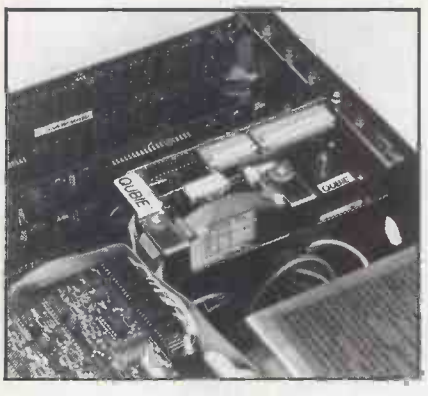

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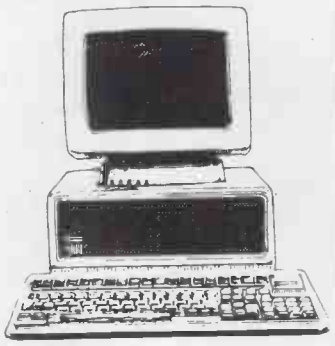

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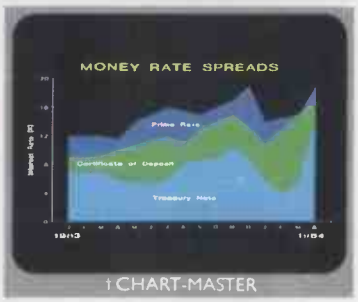

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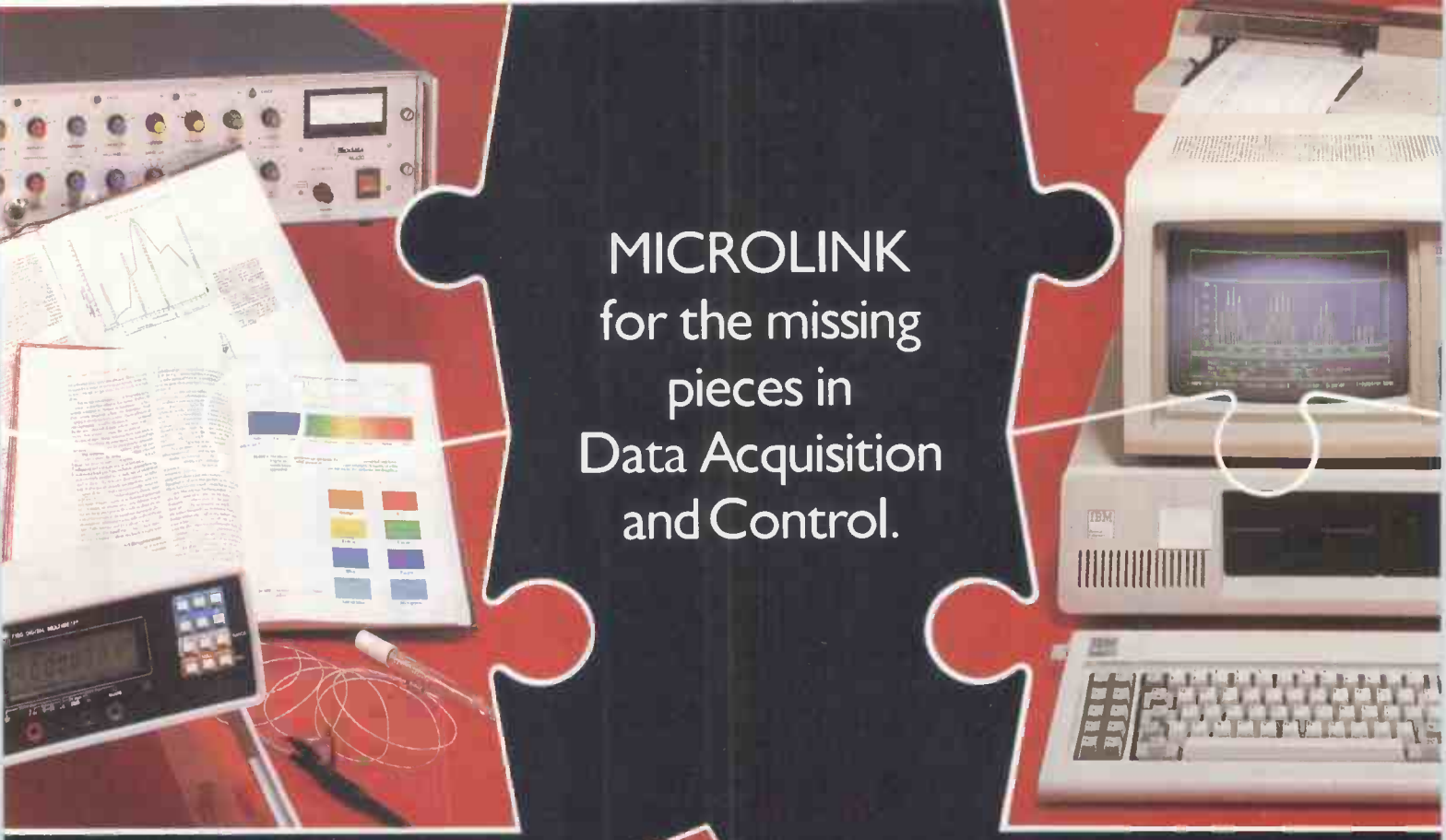

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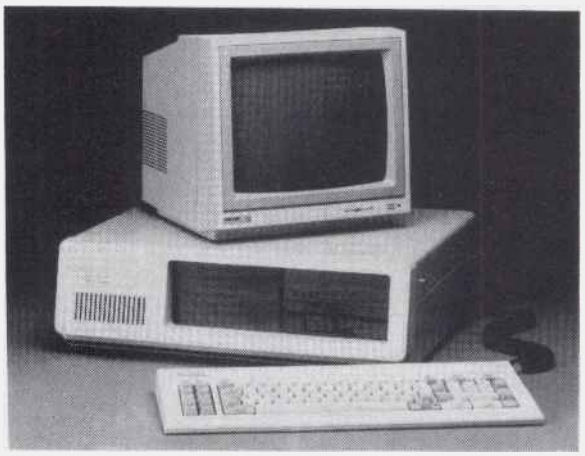

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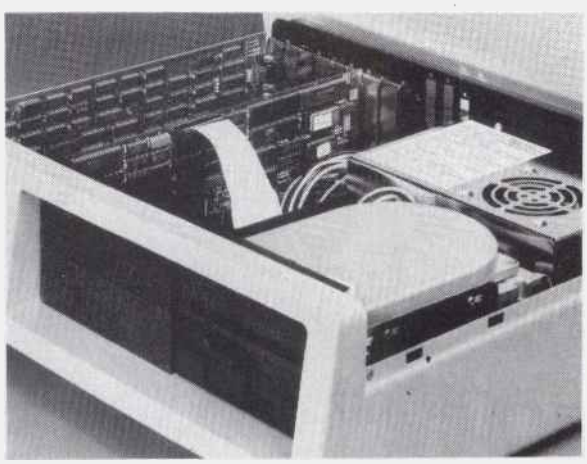

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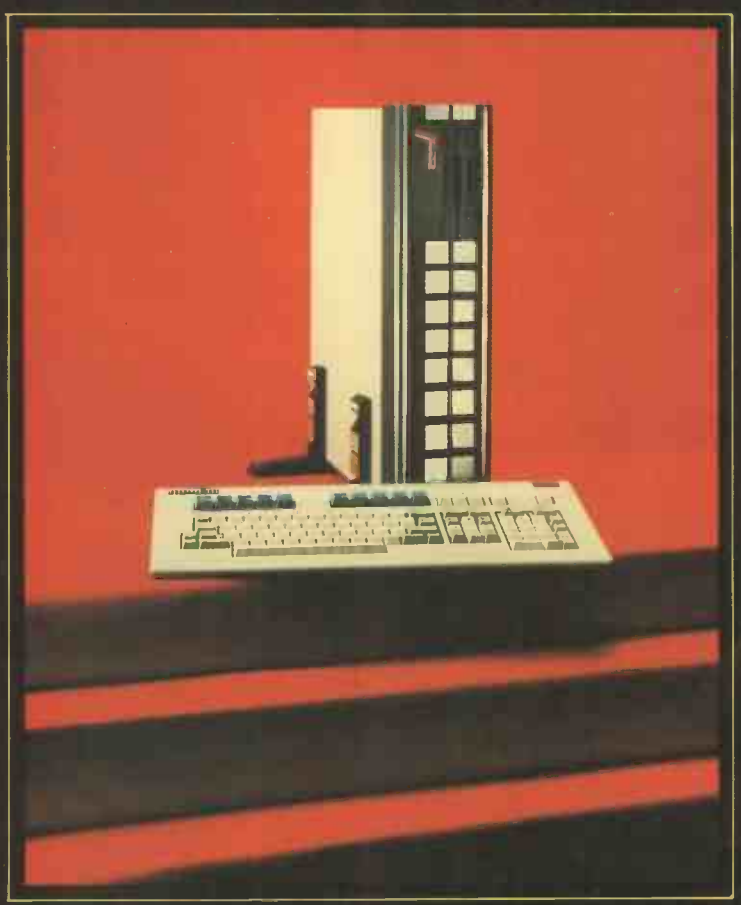

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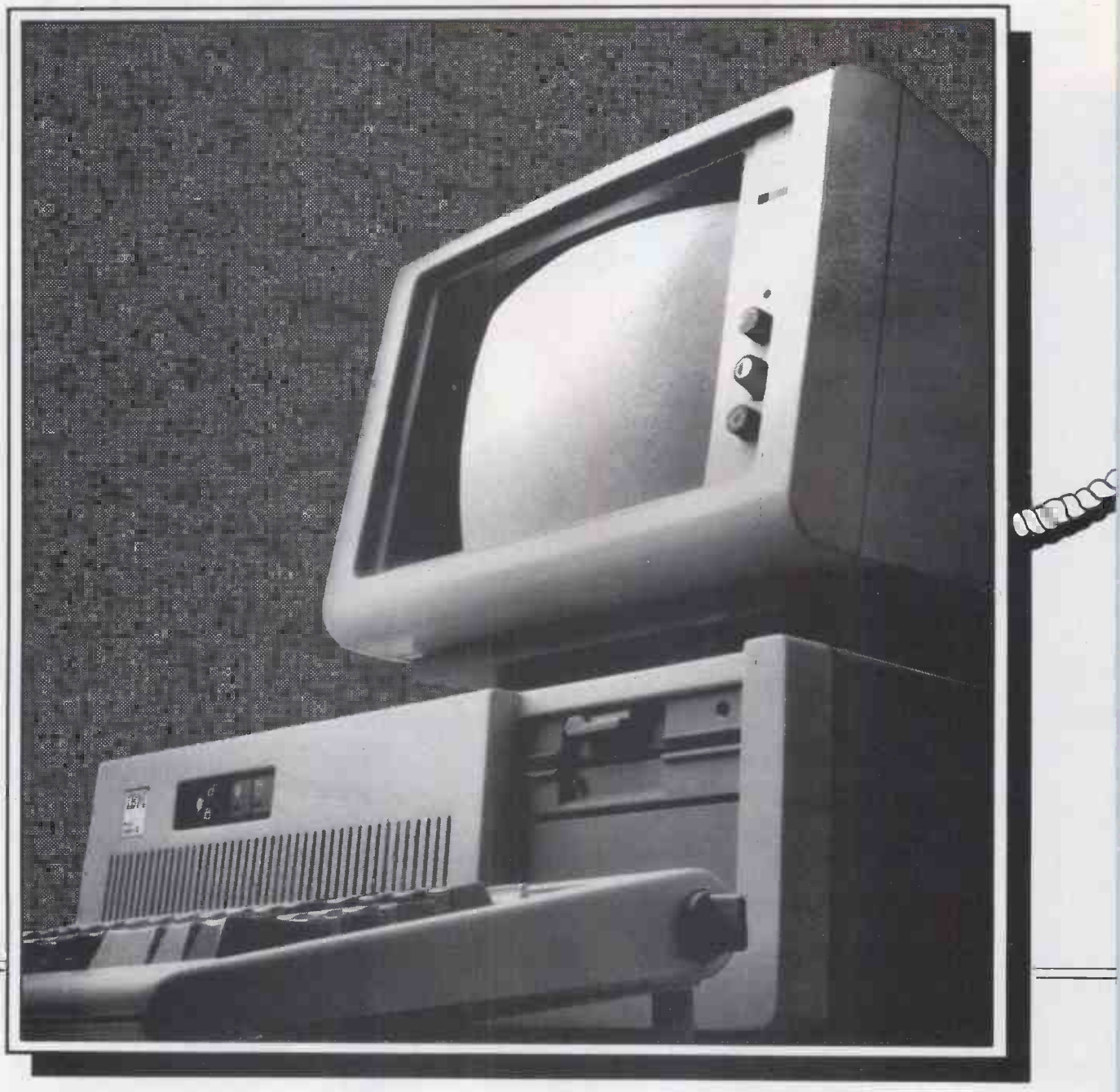

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'InterGem' offers an additional 720 kilobytes of storage space, four times the amount offered by a single disk drive system. A 5.25"/3.5" disk-drive may be used in exactly the same way as the AMSTRAD PCW 8256 second disk drive, without the use of software overlays. Instructions for its use can be found in the 8256/8512 operating manual. (N.B. This product can only be fitted to the 8512 if the second disk drive is removed).

'InterGem' is supplied in the form of a PCB, mounted on a replacement front panel. The PCB of 'InterGem' has the necessary connectors for linkage to the PCW 8256 second disk drive connectors. Another socket on the front panel is provided for disk drives without their own power supply.

'InterGem' comes complete with extensive utility software, available on 5.25" disk (or 3.5" to order), allowing the user to configure a 5.25"/3.5" BBC compatible disk drive to accept CP/M disks in double density format for nearly 80 other machines as listed. Therefore 'InterGem' will offer you the facility to access a wide range of commercial CP/M software not yet available on 3" disk format. Many companies and educational establishments with information stored on 5.25"/3.5" disks, in CP/M, MS-DOS/PC-DOS, or ACORN 1770 DFS (or equivalent) formats, would find 'InterGem' an invaluable asset if they wished to take advantage of the AMSTRAD PCW 8256 and its facilities.

The software enables the user to READ FROM and WRITE TO disks created by the MS-DOS/PC-DOS operating system, as well as the BBC Microcomputer. It also enables the PCW, via 'InterGem', to READ FROM and WRITE TO computers running MS-DOS/PC-DOS, including the IBM PC/PC-XT and compatibles, Apricot computers (using 3.5" disk drives) and the BBC Microcomputer using a double density disk controller. A separate program is also included to allow the transfer of information on single density BBC disks to double density, (using BBC).

INTERGem

RRP £99.95 (inc. VAT)

Alternatively, 'InterGem' may be used with Locoscript and CP/M in exactly the same way as with the second PCW 3" disk drive.

The package comes complete with a comprehensive, user-friendly manual which explains installation and use of 'InterGem' and the software.

The cost of 'InterGem' plus a new 40/80 track, double sided 5.25" disk drive without power supply, is comparable to the cost and installation of the Amstrad PCW 3" second disk drive. An important advantage is the low cost and availability of 5.25" disks, which are at least a third of the cost of comparable 3" disks. (A company which would anticipate using 50 or more disks would benefit by more than the cost of 'InterGem' plus disk drive, because of the price difference between 5.25" and 3" disks.)

INTERGEM was designed and developed in conjunction with Dynamic Data Technology - "Welsh Young Business Persons of 1986"

FORMATS SUPPORTED:

MACHINE	FORMAT	SIZE	FILENAME
AMSTRAD DRIVE A	SS/40T	(173K)	AMPCW
AMSTRAD DRIVE B	DS/80T	(706K)	AM720
AMSTRAD DATA FORMATS	SS/40T	(178K)	AMDAT
AMSTRAD SYSTEM FORMAT	SS/40T	(169K)	AMSYS
ANDROMEDA ALFA	SS/80T	(380K)	ANDRO A
BBC	ALL FORMATS		VARIOUS
OLYMPIA BOSS 2C	DS/80T	(698K)	BOSS 2C
CROMEMCO DD	DS/40T	(384K)	CROMEMCO
FUTURE FX20	DS/80T	(784K)	FUTURE FX2
IBM PC CP/M 86 (8SPT)	DS/40T	(314K)	IBM86DS
IBM PC CP/M86 (9SPT)	DS/40T	(350K)	IBM XT
ICL PC2	DS/80T	(776K)	ICL PC2
IOTEC IONA	DS/40T	(384K)	IONA
IBM PC CP/M86 (8SPT)	SS/40T	(154K)	IBM86SS
K.DAVIDSON	DS/80T	(704K)	K.DAVID
KAYPRO 2	SS/40T	(193K)	KAYPRO 2
LUCAS LOGIC	SS/80T	(384K)	LUCAS
LYNX	SS/40T	(188K)	LYNX
MICROBEE	DS/40T	(386K)	MICROB
BRITISH MICRO MIMI 801	DS/40T	(384K)	MIMI 801
BRITISH MICRO MIMI 803	DS/40T	(376K)	MIMI 805
MICRONIX MX 400	SS/40T	(184K)	MX400
NEWBRAIN	SS/40T	(188K)	NEWB 40
NEWBRAIN	DS/80T	(784K)	NEWB 80
PIED PIPER	DS/80T	(776K)	PIPER
DEC RAINBOW	SS/80T	(386K)	RAINBOW
RML 480Z	SS/40T	(164K)	RML 480/40
RML 480Z	SS/80T	(342K)	RML 480/80
STAN SMITH	DS/40T	(384K)	SMITH
TATUNG EINSTEIN	SS/40T	(188K)	EINST
TIKI 100	DS/80T	(786K)	TIKI100
TS100 SARACEN	DS/40T	(388K)	TS100
DEC VT180	SS/40T	(169K)	DEC VT 180
AMPRO LITTLE BOARD	DS/40T	(384K)	AMP LB
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TRANSTEC	SS/80T	(398K)	TRANSTEC
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MORROW DECISION	SS/40T	(184K)	MORRDM 2
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HEWLETT PACKARD HP125	DS/35T	(264K)	HP125
ANDROMEDA ZITA P3	SS/80T	(310K)	ANDRO P3
DTI BULLET	DS/80T	(788K)	DTI BULL
ICL DR320	DS/80T	(624K)	ICLDRS 20
EQUINOX IMS 5000	DS/40T	(310K)	EQU5000
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GENIE III	DS/80T	(688K)	GEN 80 DS
GENIE III	SS/80T	(342K)	GEN 80 SS
FRENCH GEMINI	DS/80T	(628K)	GEM FR 80
HEATH H89	SS/40T	(148K)	H89/40
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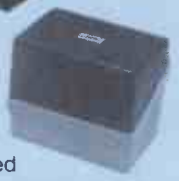

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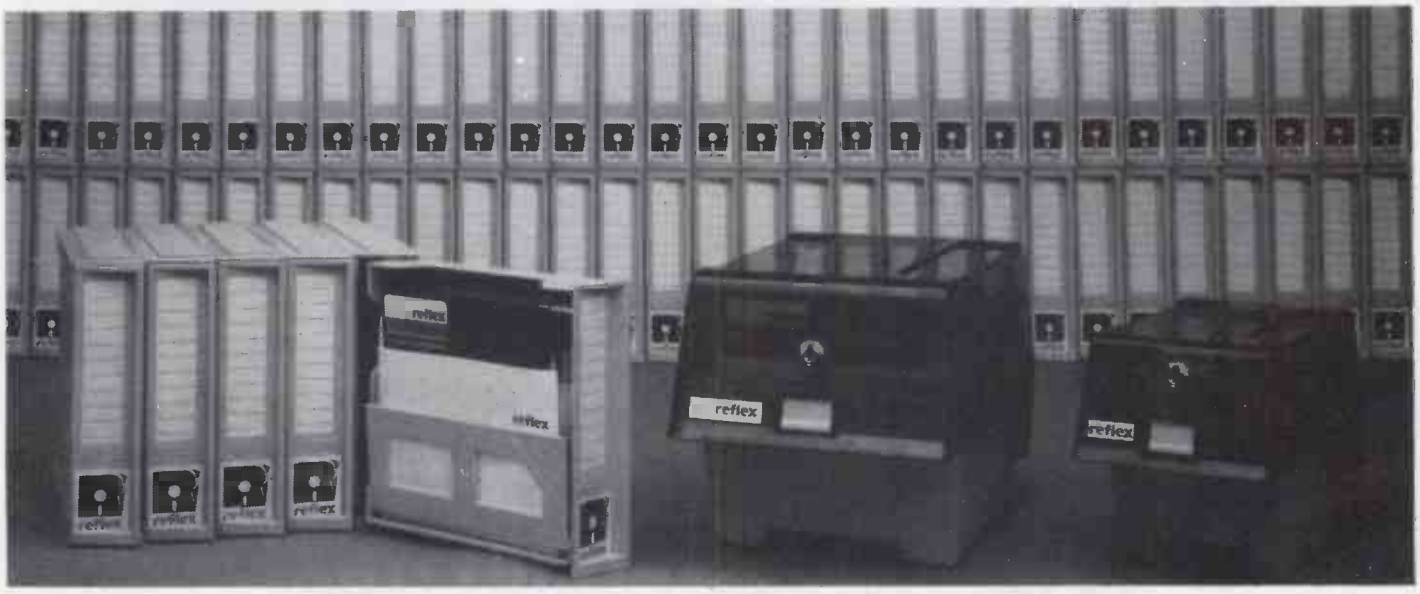

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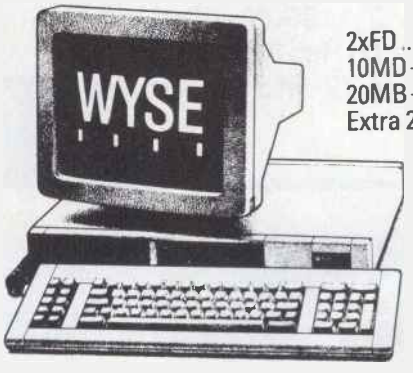

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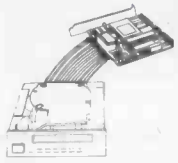

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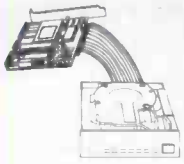

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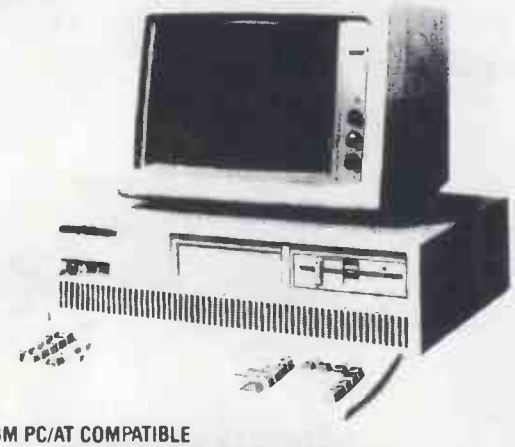

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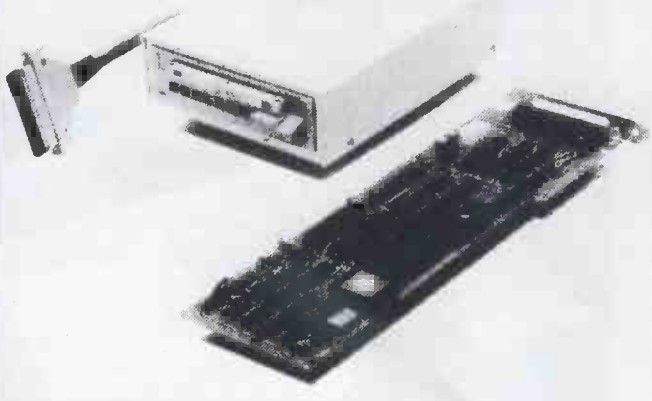

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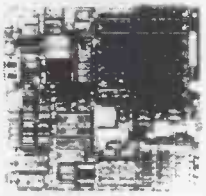

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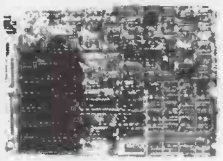

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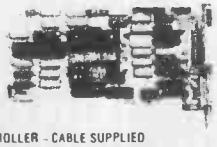

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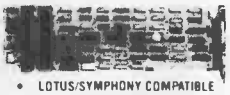

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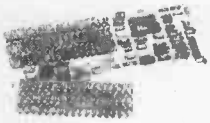

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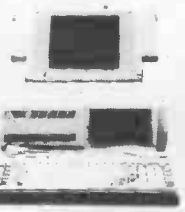

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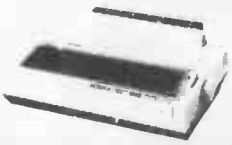

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Turbo-Pascal	CP/M-80	£ 49
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UCSD Pascal (Pecan)	APPLE][	£ 65

We have many Pascal Libraries. Enquire

PASCAL LIBRARIES

New products for use with Turbo Pascal keep coming, otherwise fairly quiet.

TURBO PASCAL LIBRARIES

Blaise Power Tools	PC-DOS	£ 75
Blaise Turbo Asynch	PC-DOS	£ 75
Paragon Supertools	PC-DOS	£ 45
Turbopower Utilities	PC-DOS	£ 75
Turbo Gameworks	PC-DOS	£ 49
MetaWINDOWS	PC-DOS	£ 49
Turbo Graphix Toolbox	PC-DOS	£ 39
Turbo Editor Toolbox	PC-DOS	£ 49
Turbo Database	CP/M & MS-DOS	£ 39
Turbo Tutor	CP/M & MS-DOS	£ 25

GENERAL PASCAL LIBRARIES

Blaise Tools (s'ce)(MS)	PC-DOS	£ 95
Blaise Tools 2 (s'ce)	PC-DOS	£ 75
Blaise Asynch (s'ce MS)	PC-DOS	£145
Btrieve (MS,SBB)	PC-DOS	£245
MetaWINDOWS (MS)	PC-DOS	£120
Multi-Halo (MS)	PC-DOS	£165
Blaise View Mngr. (MS)	PC-DOS	£205
Source extra		£135
Shark database (Propas)	MS-DOS	£250
Prospect Graphics (Pro)	MS-DOS	£ 70
Panel (Screen) (MS)	MS-DOS	£225
Shark database (Propas)	CP/M-86	£250
Prospect Graphics (Pro)	CP/M-86	£ 70
Shark database (Propas)	CP/M-80	£150

The excellent XTC Editor comes with MS-Pascal source code @ £ 70

PRICES & DELIVERY

Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

For other products in our range see our other page in this issue or ask us to send you a complete price list.

MODULA-2 COMPILERS

The Logitech range has been repriced and repackaged. Every Atari programmer should consider the TDI Modula-2.

Interface M2-SDS	PC-DOS	£ 75
Interface M2-SDS-XP	PC-DOS	£185
Modula 2/86 BLS v2.0	PC-DOS	£ 95
Modula 2/86 BLS/8087	PC-DOS	£135
Modula 2/86 BLS/512K	PC-DOS	£180
Volition Mod.2	PC-DOS	£410
Modula Corp.PC Mod.2	PC-DOS	£120
Modula 2/86	CP/M-86	£410
Volition Mod.2	APPLE][	£195
Hochstrasser Mod.2	Z80/CP/M-80	£145
TDI Modula-2	ATARI 520ST	£ 75
MacModula-2	MACINTOSH	£125

Library source is available with some compilers. Please enquire about other utilities available.

PROLOG LANGUAGE

New to our catalogue are Chalcedony Prolog V & V-Plus. Arity continues to establish a professional reputation.

PROLOG INTERPRETERS

Arity Standard	PC-DOS	£ 85
Arity Prolog v4.0	PC-DOS	£310
Chalcedony Prolog V	MS-DOS	£ 65
Chalcedony Prolog V-Plus	MS-DOS	£ 90
Micro-PROLOG Professnl.	MS-DOS	£265
Micro-PROLOG v3.1	MS-DOS	£150
PROLOG-86 v2.01	MS-DOS	£115
PROLOG-1 v2.2	MS-DOS	£299
ADA Educ.Prolog	MS-DOS	£ 45
ADA PS Prolog	MS-DOS	£ 55
ADA VMI Prolog	MS-DOS	£ 85
ADA VML Prolog	MS-DOS	£165
Micro-PROLOG V3.1	CP/M-86	£150
Prolog-1 V2.2	CP/M-86	£299
Micro-PROLOG V3.1	CP/M-80	£ 75
Prolog-1 V2.2	CP/M-80	£225

PROLOG COMPILERS

Arity Intrprtr+Compiler	PC-DOS	£685
Prolog-2 Compiler	PC-DOS	£1995

PROLOG LIBRARIES

Arity Exprt.Sys.Package	PC-DOS	£260
Arity SQL Develop.Pack.	PC-DOS	£260
Arity Screen Dsgn.Tools	PC-DOS	£ 49
Arity File Interchng.	PC-DOS	£ 49
APES Expt.Sys for micro-PROLOG		£150

ADA COMPILERS

The Janus C pack gives an entry to ADA which everyone can afford. Augusta is for budding compiler writers.

JANUS/Ada C-Pack	MS-DOS	£ 75
JANUS/Ada D-Pack	MS-DOS	£ 860
JANUS/Ada S-Pack	MS-DOS	£1275
Augusta (Source)	CP/M-80	£ 75
JANUS/Ada C-Pack	CP/M-80	£ 130
JANUS/Ada D-Pack	CP/M-80	£ 260
Supersoft Ada	CP/M-80	£ 250

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CHIP CHAT

Light on the feet, heavy on the irony . . . look, there's something about Californians that just — well, can you see where I'm coming from? These people jump from jacuzzi® to en-suite saunarama™ in two shakes of a Diners' Card (probably™), pausing only for 20 push-ups and a half-marathon along the beach at Clint Eastwood's Carmel. They avoid 'red meat', possibly because they don't know that chickens have blood too, and get mellow on a (definitely ®) Paul Masson carafe of unpleasant white wine mixed with gassy club soda that has probably been recycled via the digestions of half the population of Sacramento.

And now, at last, they can plug their running shoes into their yuppie computers.

One can forgive Puma, maker of trainers to the upwardly-mobile, for putting a custom gate array chip into the heel of its new products. One can even forgive the company — just — for bundling a software program that will read the gate array's output into an Apple IIe, a Commodore 64 or 128, or an IBM PC.

But words fail us when it comes to the company's English. Words do not, unfortunately, fail Puma.

'Serious runners know it takes more than great running shoes to improve performance. It takes knowledge. Now Puma gives you both. With the RS Computer Shoe. The first training shoe to combine advanced footwear technology with computer technology.' The. Short sentences. Are to make you think. That what Puma is saying. Is. Important.

It is not.

These people are serious . . . there are times when paranoia just seems like reasonable caution in the face of the facts. Paranoia is, we fear, the only reaction to the wild-eyed fanatics of International Resources Development Inc.

We have told you here before about this company's crazed views on AIDS, rectal (or even retinal) pattern recognition, and how we can all be aquanauts mining our nodules from computerised bubbles on the sea bed. But now IRD's pontifications are increasing in frequency, well beyond the average dose for an adult. One a month is amusing. Three a week is persecution.

For instance, IRD's Peter Kibler, obviously another in the long line of banana-heads at the company's Norwalk, Connecticut, HQ, says that if it weren't for batteries, 'our lifestyle might be closer to that enjoyed by our 19th-century counterparts than we enjoy today.' And if it weren't for fire, oddly enough, our lifestyle might be closer to that of the Stone Age than the 19th century, but that's by the way.

'Younger people have a more positive perception of batteries and battery-operated appliances than do older people,' says Kibler, digging himself deeper. 'Batteries simply work better today that they did in the past.'

The conclusion, from Kibler's 215-page report, is that people buy a lot of batteries and that the Japanese want a bigger share of the market. We stand amazed.

But hardly has the dust settled from Kibler's backside hitting the pavement than another IRD pronouncement flutters through the transom.

'Health care for the elderly, in particular, will be increasingly dominated by the use of prostheses and artificial organs,' says our old burbling pal Mark Pine (he of the aquatic astronauts). 'Literally, we may be talking about factory-installed kidneys in just a few years time. Very, very specialised surgeons actually operating on an assembly line, handling hundreds of thousands of patients per day.'

But until we reach this Nirvana, Pine sees some lean years ahead with a need for prosthesis companies to diversify. 'A particular conspicuous example of this trend is supplied by Thoratec, an artificial heart company, whose Bion-II plastic material is expected to become the chief competitor in the performance textile market,' whatever a 'performance textile' may be.

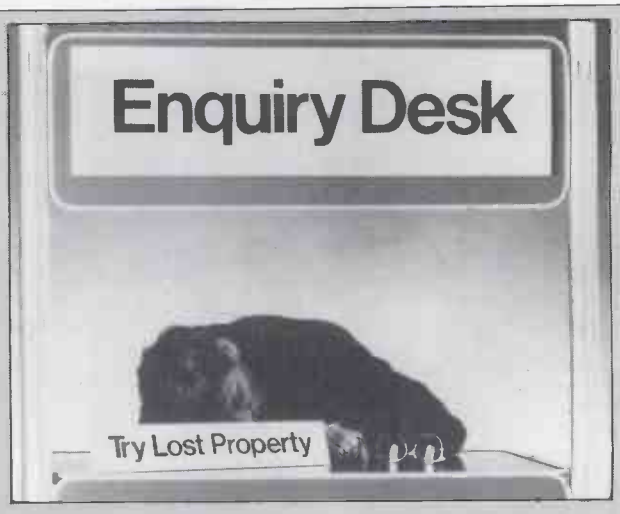
And Christiaan Barnard's line of Glycel cosmetics, based on chemical materials developed to aid healing after transplants, is another example. 'If Christiaan Barnard — a name synonymous with heart transplants — can sell eye cream for $75 an ounce, perhaps some day we'll see charismatic Willian DeVries figuring in an ad for ski clothing!' concludes Pine impenetrably.

And perhaps some day we'll find Kibler and Pine running a double act at the Grimsby Palace of Varieties. Form a queue for the tomatoes.

(PS — IRD's public relations person is called Suzanne Bores. We just thought you'd like to know that.) END

Congratulations to Cetronic for shipping the Reguvolt 'M' range of mains conditioners, designed 'functionally to eliminate the problems of irregular voltage and mains interference, and aesthetically for the modern office enviroment.'

The congratulations are due for the company's proof, as our picture shows, that mains conditioners cannot be made to look like anything but great lumps of unidentifiable negligible-scale-integration electronics in a box. Of course, it's hard to tell from the picture whether the 'M' range is 12 feet high or the size of a matchbox. But it would be nice to think that this neo-brutalist design will be the shape of the next headquarters of the DHSS, and win the Sir Hugh Casson award for the most rebarbative piece of architecture of 1986.



We were going to run an exciting, new competition this month, asking you to give us a witty balloon or caption for this picture, along with an explanation of what it has to do with computers.

But then we thought, why bother? It's only CRA Software showing off its enquiry management package, said to make sure that half your sales enquiries don't spend time 'dozing in your in-tray'. Geddit?

Please send your entries to anywhere else but here.

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JUKI 2100/2200

Even with the advent of low-cost wordprocessors, the low cost electronic typewriters still offer the easiest and most flexible means of putting the printed word onto paper. The JUKI 2100 & 2200 offer unparalled features at a realistic price. Printing at 10cps in either 10, 12 or 15 pitch they will print up to 135 characters on a line. The portability of the JUKI electronic Typewriters allow you to produce true letter quality print almost anywhere. While the JUKI 2100 offers all the standard features such as auto correcting, centering and tabulation, the JUKI 2200 offers the additional feature of either parallel or serial interface to enable connection to almost any micro-computer.

JUKI 6100

Ideal for the small business/home/educational user alike, the JUKI 6100 includes many features normally only found on more expensive printers. With its Diablo 630 compatible protocols it will run most wordprocessing packages including WordStar and even offer a graphics capability – all at a speed of up to 20cps. The JUKI 6100 will print in 10/12/15 pitch as well as proportional spacing and features a 2k buffer, parallel interface, revolutionary linear motor mechanism and uses IBM Selectric ribbons. Optional extras include tractor feed, sheet feeder and serial interface.

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