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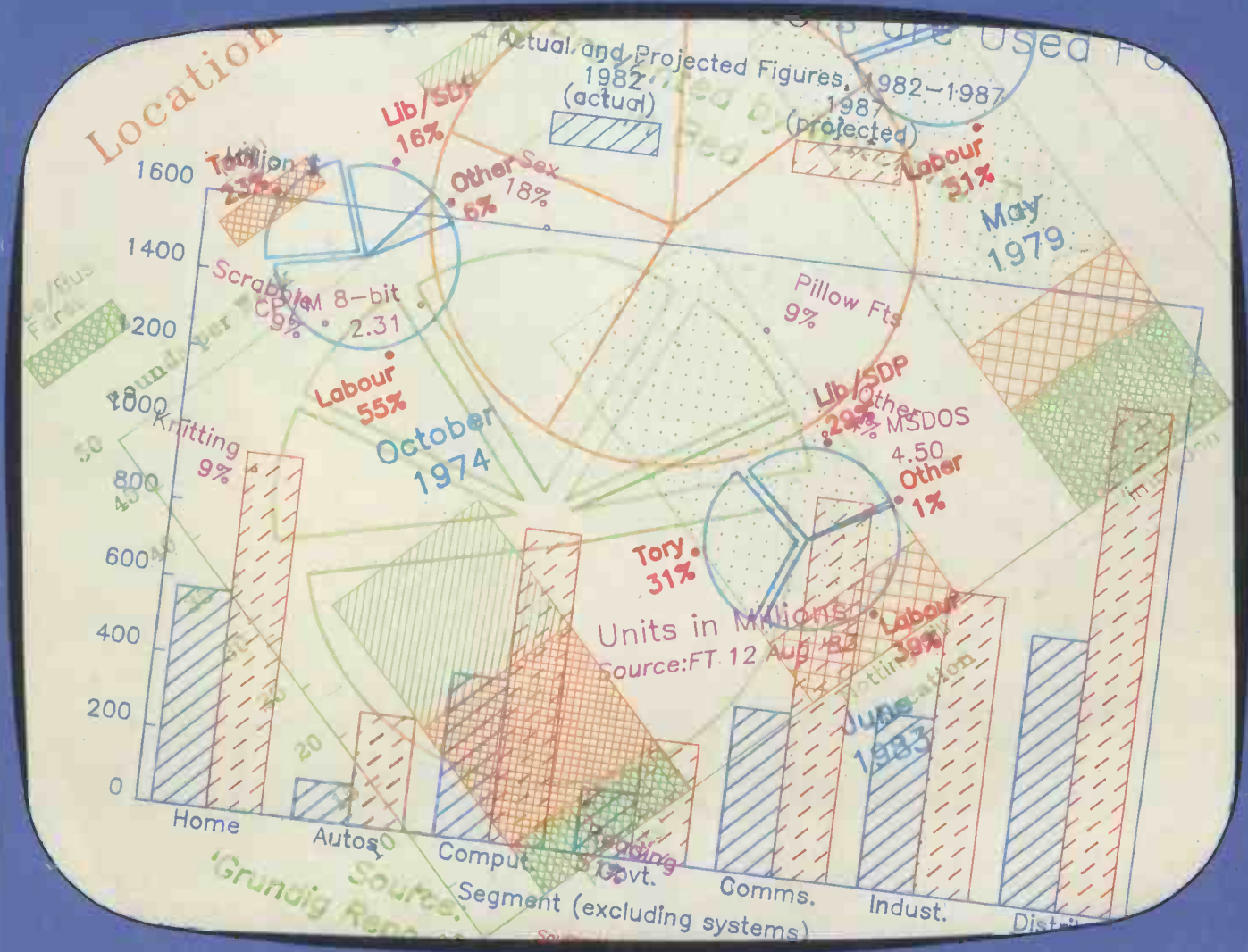
Practical Computing

85p October 1983 Volume 6 Issue 10



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PRACTICAL COMPUTING OCTOBER 1983

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>VDU'S AND GRAPHICS

>FEATURES

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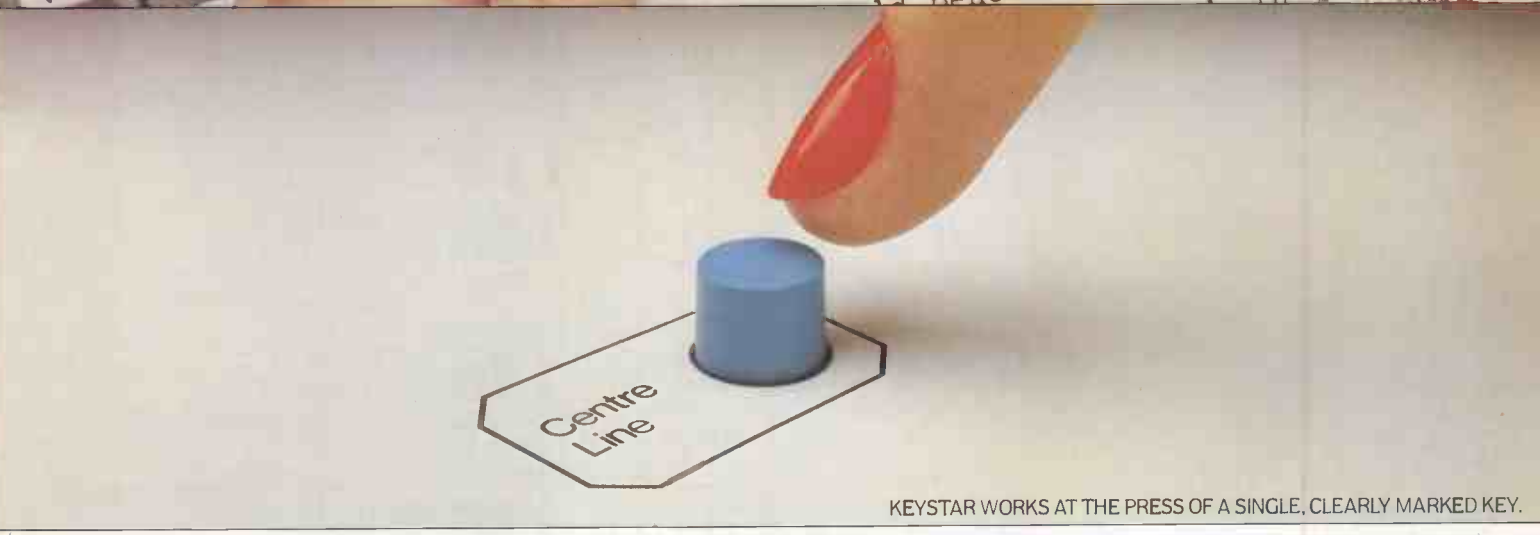
This month's cover illustration was created by Steve Miller and Ian Stobie using a Hewlett Packard Series 200 Model 16 with HP-7470A plotter.



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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program. Handwritten material is liable to delay and error.
Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

Overkill

ONE OF THE moans that issues from these offices is that there are too many microcomputers. One of the moans of the micro manufacturers is that there are too many magazines. They do not have time to read them, and do not know where to place their advertisements.

Of course both moans are sweeping generalisations, and all generalisations are false. There may be too many badly designed micros, but there is still room for a few more good ones. Similarly there may be too many magazines, but there is surely a market for one or two more with something new to offer.

With this in mind we are currently planning a new magazines called *Computer Choice,* which will be edited by *Practical's* soon to be former deputy editor, Bill Bennett. It will deal exclusively with micros costing less than £200.

The last bookstall magazine launched from the *Practical Computing* office was *Your Computer*. Its brief was to concentrate on the home/games market, leaving us free to focus on the more serious side of computing. With the boom in the home market *Your Computer* has grown to be the U.K.'s largest selling micro magazine — by a wide margin.

Practical Computing's circulation has grown by a mere 25 percent over the last six months. The audited average sale for the six months from January to June was 61,100, though recent issues have sold more.

Naturally we are delighted with this response to our efforts, if only because it proves there are people out there who are interested in more than just space invaders. Needless to say we will try to make the magazine even more useful and informative in the future.

Normally we do not boast about our small successes, but the margazine market is becoming very competitive. With new micros being launched there are always new potential readers and new potential advertisers. Almost by definition they start from a position of ignorance.

Some companies, even big companies, know so little about the micro world they do not even know how little they know. Advertisement managers in companies and in agencies, however, often seem to go from ignorance to arrogance in about 15 minutes. They are taken in by unaudited magazine circulation claims that stand no chance of ever being attained. Slick promotional brochures and cut-rate bargain offers must account for the bizarre media buying of some companies. Others can only be put down to naivety. We sometimes wonder why we bother producing magazines when we could be selling these people Tower Bridge or the crown jewels.

The things they say make us laugh. If you owned one of their micros or were employed making them they might make you cry. The reason is that in the next few years some 300 of the 400 companies making and/or distributing micros in the U.K. are likely to be taken over or go out of business. Designers and product managers will wonder where they went wrong, after all, their micro was as good as, or better than, the next one — right? They spent enough money on promotion — right? So why didn't they sell? Well we know the answer already, but in this case there is little joy in being wise before the event.

The forthcoming shake-out of manufacturers will lead to a shake-out of magazines, partly because not all of that misplaced advertising will be paid for. Also, the more aware companies will start to gauge the response they get to their advertisements, and — at last — the number of leads that are converted into sales. The many worthwhile magazines, including *Practical Computing, Your Computer* and, we trust, *Computer Choice* will continue to prosper while the rest quietly slink away.

All this will make the world a more reliable but, some would say, a duller place. We do not agree. Microcomputing is never going to be a dull subject.

5 Years ago...

A hobby computer just coming to the market in the U.K. is the Sorcerer. It is made by the American firm, Exidy Inc, a video games manufacturer.

The main selling point of the Sorcerer is price. You can buy a 16K version for £760 or a 32K version for £950 and, considering its facilities, this represents good value for money.

The system loaned to us was the 32K version. Standard configuration includes a 61-key typewriter keyboard and a 16-key pad. It looks like the Tandy keyboard without the numeric pad. To that you add your own power supply, TV monitor and cassette tape recorder(s).

For expansion purposes it takes the S-100 bus which gives you the ability to interconnect large memories, disc drives, speech and communications facilities.

The striking feature of the Sorcerer, though, is the way you load the Basic. It's a standard Basic which is loaded by way of a cartridge into the side of the keyboard. It looks rather like an eight-track stereo cartridge but inside is a ROM containing the language.

Practical Computing Volume 1, Issue 4

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8216	100
8224	110
8226	250
8228	220
8243	270
8250	850
8251	250
8253	400
8255	255
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8257	400
8259	395
8271	£40
8272	£17
8279	385
8282	450
8283	450
8285	365
8284	350
8287	£17
8288	£10
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8T28A	120
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ZN423E	138
ZN424E	130
ZN425E8	345
ZN426E8	300
ZN427E8	130
ZN428E	410
ZN429E8	210
ZN459	570
ZN1034E	200
ZN1040E	665
ZNA234E	850

74S Series

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74S02	30
74S03	32
74S08	40
74S10	40
74S11	50
74S20	40
74S22	50
74S27	40
74S32	70
74S37	60
74S74	75
74S85	295
74S112	80
74S113	90
74S124	300
74S132	110
74S133	60
74S138	100
74S139	115
74S140	60
74S153	182
74S155	39
74S158	195
74S163	300
74S174	250
74S175	320
74S188	140
74S197	400
74S189	140
74S194	195
74S201	250
74S225	240
74S240	300
74S274	390
74S241	250
74S244	290
74S257	170
74S258	250
74S260	70
74S262	850
74S287	225
74S288	210
74S289	200
74S289	640
74S301	000
74S365	250
74S373	400
74S374	365
74S470	325
74S471	620
74S472	1150
74S474	400
74S475	25
74S571	620
74S573	950

75 Series

75107	95
75110	90
75150/54	125
75182/3	99
75118/9	55
75154/9	125
75324	140
75450	86
75451/2	52
75454	70
75491/2	65
74S112	90

74 LS

LS00	15
LS02	15
LS04	15
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LS243	55
LS244	58
LS245	85
LS273	54
LS362	750
LS364	140
LS373	60
LS374	60
LS393	50
LS471	629
LS640	180
LS641	180
LS645	180
LS668	125
LS669	120
LS670	110
LS673	550

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4025	15
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4450	350
4451	350
4490	350
4500	675
4501	75
4504	75
4505	185
4508	130
4511	46
4512	45
4519	30
4526	60
4528	50
4532	50
4549	375
4569	175
4583	90
4584	40
4585	70
4597	330
4598	290
4599	290
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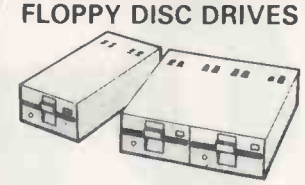

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1.843M	200	20.0MHz	200
2.0MHz	225	24.0MHz	170
3.2768M	150	24.930M	325
3.57594	98	48.0M	175
3.6864M	300	100.0M	375
4.0MHz	150	100KHz	238
4.433619	100	1.28MHz	392
5.0MHz	150	2.4576M	200
6.0MHz	140	3.276MHz	160
6.144MHz	150	4.032MHz	290
6.5536M	200	4.194304	200
7.0MHz	150	4.80MHz	200
7.168MHz	160	5.185MHz	300
7.68MHz	200	5.24288	390
8.0MHz	150	7.7328M	250
9.0MHz	200	8.0833M	395
9.375M	350	8.86723	175
10.0MHz	175		
10.7MHz	150		
10.24MHz	200		
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IDC female receptacle jumper leads

	36" 20way	26way	34way	4way
1 end	160p	200p	260p	300p
2 end	290p	370p	480p	525p

DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	16p	52p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey	Colour
	Price per Foot	
10	15p	28p
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DIL PLUGS (Headers)

	Solder	(IDC)
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DIN41617				
31way	170p		175p	
41612 A8				
2-32way	275p	-	220p	285p
41612 AC				
2-32way	295p	340p	240p	300p
41612 ABC				
3-32way	360p	385p	260p	395p

EDGE CONNECTORS

	.156"	.1"
TWO ROWS		
2 x 18way	145p	180p
2 x 22way	200p	199p
2 x 23way		185p
2 x 25way		225p
2 x 28way		210p
2 x 30way		245p
2 x 36way		295p
2 x 40way		315p
2 x 43way		395p

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	Male 9way	15way	25way	37way
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
	Female			
Solder	110p	160p	210p	350p
Angle	165p	215p	290p	440p
Pins	150p	180p	240p	420p
Covers	85p	80p	80p	100p

IDC 25way 'D' plug 385p Skt 450p

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Pascal semicolon

IN YOUR JUNE 1983 issue, page 7, John Robinson writes that the statement

```
if x = y then if w = z then a: = 1;
        else b: = 1;
```

is a correct Pascal statement. This is not true, see the book by Jensen-Wirth, *Pascal. User Manual and Report,* page 26, "Caution: there is never a semicolon before and else." Hence, the text:

```
if p then begin S1; S2; S3 end; else S4
```

is incorrect. Perhaps even more deceptive is the text:

```
if p then; begin S1; S2; S3 end
```

Here, the statement controlled by the if is the empty statement between the then and the semicolon; hence, the compound statement following the if statement will always be executed.

The syntactic ambiguity arising from the construct:

```
if <expresslon-1> then if <expression-2> then <statement-1>
        else <statement-2>
```

is resolved by interpreting the construct as equivalent to

```
if <expression-1> then
  begin if <expression-2> then <statement-1>
        else <statement-2>
  end"
```

Hence, the correct form of the statement above is:

```
if x = y then begin if w = z then a: = 1 end
        else b: = 1
```

or

```
if x = y then begin if w = z then a: = 1; end
        else b: = 1;
```

In the second case, there are two statements between begin and end: the statement if w = z then a: = 1 and an empty statement. In both cases, there is not a semicolon after b: = 1 because "Pascal uses the semicolon to seperate statements, not to terminate statements; i.e. the semicolon is NOT part of statement." Jensen-Writh, *Pascal. User Manual and Report,* page 22.

Katalin Bauer,
Budapest,
Hungary.

Formcalc

BRIAN LAW'S excellent program in the July and August issues is going to be very useful to me. However I have two difficulties.

First, in the example shown in the article when entering the formula shown under the RF command — I summed column 1(Load) first — results in Error 2/1650 repeatedly. Formulae of the type K1*K2*K3/4 work very well, but as soon as I use powers in something like K1*(K2**K3)/4 — again meaningless except as an example — I get Error code C/1650.

Cursor shift 8, column shift to the right, does not work but cursor shift 5, to the left, does.

Can you throw light on this for an elementary programmer like me? Incidentally, I have altered line 2305 to give results to four decimal places — it works very well.

Leon Jeavons,
Birmingham.

Brian Law replies:
It is difficult to debug programs without having the tape itself. The most likely explanations are:

- line 1840 probably has the ** missing;
- line 1310 probably has = "B" instead of = "8"

Changing the number of decimal places can be done on a more permanent basis using the amendments below. To change the number of places now, enter DP3 to get three places of decimals, or DP4 to get four, or DP0 to get none, etc.

Formcalc.

```
25 LET DP=2
296 IF I$(1 TO 2)="DP" THEN GOTO 2500
2305 PRINT AT R1+2,C(V);(INT(Q(R,C)*(10**DP)+.5)/(10**DP)
2405 PRINT AT 20,C(V);(INT(Q(N,C)*(10**DP)+.5)/(10**DP)
2500 REM CHANGE DECIMAL PLACES
2505 LET DP=VAL I$(3)
2510 GOTO 1315
```

Basicode plea

I WOULD like to draw everyone's attention to a new Basic language called Basicode-2, which creates a way to exchange software between different computers. The computers are Apple II, BBC Micro, Commodore Pet 2001 and Vic-20, CP/M systems, DAI, Exidy Sorceror, Ohio Superboard, Philips P-2000, Sharp MZ-80, SWTPC-68000, Tandy TRS-80 and Video Genie.

The Basicode-2 language contains statements which are the same for all the computers. By using a translation program, which is different for all of them, your micro can understand them. If you have a program in your own Basic you can change it to Basicode-2 by using another translation program; so by using this language you can share your neighbour's programs. I think *Practical Computing* should use Basicode-2 in Open File so more people can use the programs.

Basicode-2 has been developed by NOS Hobbyscoop. It has a program on Radio Nederland every Sunday evening from 19.15 to 19.45 on 747KHz medium wave, and each week it broadcasts a Basicode-2 program. You can order the translation programs and some Basicode-2 programs, plus a manual for 30 florins — about £6. The address is NOS-Hobbyscoop, PO Box 10, 1200 JB Hilversum, Nederland. Alternatively write to me.

Michel Smit,
Zwaagdijk 152D,
1683 NN Zwaagdijk-oost,
Nederland.

The editor replies:
The manual is in both English and Dutch. Basicode is also used by Jonathan Marks on his English-language programme, Media Network, broadcast on Thursday nights on the Dutch International Service, and rebroadcast on the short wave world wide. So far 1200 baud has proved too much for short wave use, and experiments are continuing at 300 baud. For details contact Jonathan Marks at Radio Netherlands, PO Box 222, 1200 JG Hilversum, The Netherlands.

Incidentally, payment for Basicode must be in Dutch Guilders and payable to Nos Algemeen Secretariaat. The book and cassette weigh 370g, so send 25florins plus appropriate postage.

Practical Computing has followed the progress of Basicode with interest, but we have had no requests for coverage from outside the Netherlands. Open File programs would be easier to translate if people wrote more structured programs with sufficient REM's to give outsiders a chance. However, machine-specific tricks seem more popular.

Calculating PI

I WRITE with reference to R A Fairthorne in the Feedback section of the August issue. He seems to have taken my criticism, which I hoped was constructive, to heart. I was merely wondering why he wishes to approximate PI using such a long and tedious division.

Perhaps there is something to be gained from using his method, an unforseen advantage. It may be faster, depending on the computer he is using, but I think I would rather enter the value of PI directly than use his division. The advantage of using my method

(4★ATN (1))

is that it is easy to remember and will evaluate to as many places as the computer can handle.

Perhaps you could have a competition to find the fastest and easiest method of calculating PI? Does anybody know what the exact value of PI is?

S Mehew,
Lanarkshire,
Scotland.

Reader survey

I AM WRITING to you for assistance in writing a series of articles to illustrate how micro

(continued on next page)

(continued from previous page)
computers are playing an increasingly valuable role as a low-cost aid to management and as fast information providers.

Can I ask readers to write to me with their experiences of installing a micro at work, be it a ZX-81 or an IBM. What problems have they encountered in software and hardware? Did the salespeople know what they were selling? Did, and was the buyer aware of the limitations of the computer he was being offered? Was the software adequate for the task it was bought for? If not, what difficulties were encountered to get the software or hardware working correctly?

What questions, in hindsight, would readers ask the salesperson if they had the opportunity to purchase again? Finally, and I think most important, what benefit have they received by installing a micro?

I would be most grateful to readers if they would write to me, all replies will be acknowledged by return of post.

Tom Mcgowran,
Monmouthshire Beacon,
50, Monnow Street,
Monmouth NP5 3XJ.

Epson solution

IN HIS ARTICLE on the Epson FX-80, August issue, page 77, Chris Roper mentions the warning in the Epson manual about control codes that cannot be sent out by certain versions of Basic. Chris points out that Epson do not propose a solution to this problem.

The authors of the Epson manual must have had in mind such quirks as CHR$(9), which Microsoft Basic interprets as a tab character which it expands to a string of spaces.

The solution is easy, at least it is if you are using an RS-232 interface with mark parity. You simply set the high-order bit of the control character to one. The easist way to do this is to add 128 to the number. Thus CHR$(9) becomes CHR$(137). The Basic interpreter does not recognise this as a tab; the interface strips the high-order, parity, bit; and the Epson, or other output device, receives CHR$(9) — so everyone's happy.

Mike Lewis,
London NW3.

Keen on sprites

IN YOUR JULY issue you gave a very useful program for editing sprites on the CBM 64 called 64 Sprite Editor. Being somewhat of a novice myself I was keen to utilise this program as very few magazines seem to publish, little if anything for the 64 anyway — hint, hint.

I did everything to the letter. That is, I turned the computer off and on, entered
Poke 2560,0 Poke 44, 10 return
and started typing from line 30. However, immediately on pressing return after finishing line 30, the thing just crashed and the keyboard was completely disabled.

I blamed myself for this error and tried again — and again and again, repeating the instructions as per Mr Irving's article. Still no luck, so am I to blame or is there something else Mr Irving should have mentioned? Can you help — please.

Finally, I enjoy your magazine but you seem slightly biased towards BBC, Tandy, Apple, etc.

E G Reynolds,
Lancashire.

Blunders

IN THE ARTICLE on programming sprites on the Commodore 64, in page 99 of the July issue, we unfortunately missed out two important instructions. The two Pokes entered after turning the machine on should be followed by New <Return>.

We would also like to repeat that lines 10 to 23 must be typed exactly as listed, the important feature being the number of characters entered. In the August issue, Atari Open File, page 145, line 32115 of Les Kneeling's Slow Lister program should have ended "Poke 842,12".

Indian user club

WE HAVE formed a home computer user's club in India. We meet twice a month to exchange the latest news and to try and solve members problems. Owners/users of any home computer are welcome. We have developed a music program for the ZX-81 and a battery back up. In the near future we hope to bring out a 64-column card for the ZX-81.

Arun K Nath,
New Delhi,
India.

BBC corrections

I ENTERED the disassembler program, *Practical Computing*, January 1983, in my BBC micro with the modifications printed in the March 1983 issue. I have two corrections to communicate to other readers.

First, line 260 seems to be a little unlucky; it may have been printed a first time without a part and then wrongly corrected by M Cresswell in the March issue. The definitive — I hope — version will be:

That is the 10th value has 4 "." because the branch instruction set is printed with a 16-bit destination address.

Secondly, the addition by E Ibbotson contains a mistake; in fact, line 1520 must end with
MO$ = OS$(I%)
instead of
MO$ = O$(I%)
That is MO$ must contain the name of the OS call, not the address.

With these corrections the disassembler runs very quickly and with a very nice editing.

P Jenne,
Milan,
Italy.

Spectrum Scrabble

IN HIS REVIEW of computer Scrabble for the Spectrum, Bill Bennett expressed doubt on the validity of four particular words.

According to Chamber's *20th Century Dictionary*, the national Scrabble championship's standard reference guide, while "reiner" cannot be found, definitions of the other three read:
agaze, (arch) adj. and adr. at gaze, gazing
noon. — v.i. to rest at non. — n. nooning — (esp. U.S.) a repast or rest about noon.

(continued on page 13)

BBC correction.

```
260 DATA "A        ","#&..    ","&..    ",
         "&..,X   ","&..,Y   ","&....   ",
         "&....,X","&....,Y","        ",
         "&....   ","(&..),X","(&..),Y";
         "(&....)"
```

sinclair special 4

Inside...
Two special offers...
Six new software titles...
Microdrive!

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Welcome to another Sinclair Special. Even if you're not yet a Sinclair owner, I believe you'll find something of interest in this latest issue.

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Microdrives are being released on an order of priority basis. Spectrum owners who purchased direct from us will be sent order forms, in a series of mailings that begin with the earliest names on our list of Spectrum owners. If you didn't buy direct from us by mail order, send us your name and address (use the coupon in this Sinclair Special). We'll add your name to the list, and send you a colour brochure and details on how to order.

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Nigel Searle

Nigel Searle, Managing Director
Sinclair Research Ltd.

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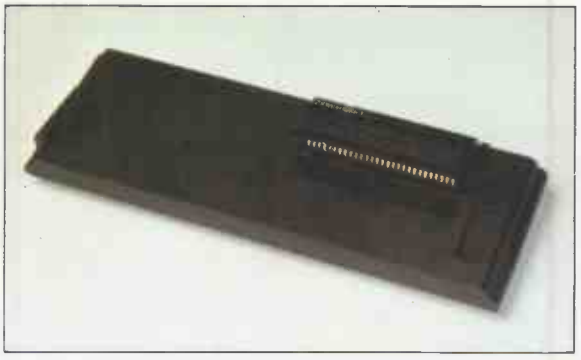

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Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from page 8)

tyre — v.t. to put a tyre on. — n. tyring

Ian Tresman,
Elstree,
Hertfordshire.

Bad timing

IT WAS WONDERFUL to see that the Newbrain was at last given a place in your excellent magazine. I, and many other Newbrain owners in this country, sincerely hope that this will become a regular feature.

L J Fourie,
Pretoria,
South Africa.

Logo

I AM PREPARING a book on the use of Logo in the classroom. The book is primarily aimed at primary school teachers, but will have some relevance to lower secondary school as well.

I would be very interested to hear of any experiences teachers have had using Logo in the classroom, and ways and means they employ to introduce the skills and concepts of computing to different age groups of children. This can include games, etc. All contributions will be acknowledged and postage refunded.

A P Mullan,
54 Copse Road,
Plympton,
Devon.

Euromouse

I AM GLAD that my write up on the Computer Fair Euromouse heats did not miss the boat entirely, despite its long delay in the post. I am sorry that it had to be cut down to fit the remaining space; particularly sorry that an acknowledgement of the Judges' efforts did not appear.

Professor Harry Prime of Birmingham University, Chairman of the Computing and Control Division of the IEE did a splendid job of ensuring technological fairness. While Brian Glover, well known TV actor and the voice behind the Tetley Tea folk asked the contestants some searching questions, Chris Hipwell, publisher of *Practical Computing*, lent an air of authority to the judging.

I have already had an encouraging response to the announcement of a robot ping pong contest, which appeared in May 1983 issue of *Practical Computing*. Over two dozen letters have arrived including one from South Africa and one from Nato headquarters. They stress that their robot will not be an official project, nevertheless, if this letter is read by a robot enthusiast in the Kremlin we might see a needle match.

John Billingsley,
Portsmouth Polytechnic.

Loading trick

I MUST SAY how very much I enjoyed the maze program by Andrew Armstrong in the August issue of *Practical Computing*. There is no need, however, for you to exclude it from your games-of-the-year disc. I find that a short loading program seems to do the trick without causing any problems

Give the program a suitable name, for instance, Mazel and save it on disc along with the main maze program. To use, Chain "Mazel" which will then automatically load then relock the main program. You will get an error message "Bad Mode at line 20". Ignore this, type Run and press Enter. The program should then run perfectly.

I expect other readers will have devised other methods, but I hope you find this useful.

R Dent,
Harrow,
Middlesex.

Loading trick.

```
10 *KEYO LO."MAZE"!M*TAPE12!MF.T=0 TO TO
P-PAGE STEP 4:T!&E00=T!PAGE:N.T!PAGE=&E0
0!MRUN!M
20 *FX138,0,128
```

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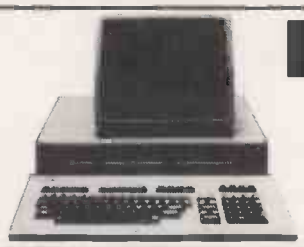

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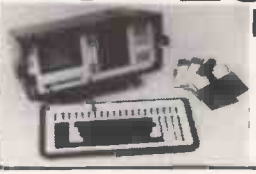

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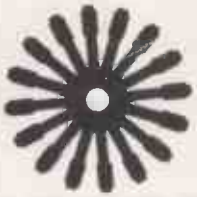

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Expandable Spectrum host to add-ons

SPECTRUM USERS are about to be inundated with a wide range of hardware add-ons, making the most popular microcomputer into one of the most expandable microcomputers. The main product is the expansion interface known as Interface I. Interface I connects the Spectrum to the new microdrives, which are mass-storage devices derived from stringy-floppies. Inside a small case is about 20 foot of very thin video tape which hurls around at very high speeds.

Microdrives can be chained together with up to eight connected to one Spectrum at any moment. Each tape can hold up to 100K of data, but often this is nearer the 85K mark. The main drawback of the Microdrive is that it is not possible to transfer files from one drive to another without first holding the entire file in the memory of the host Spectrum. More to the point is the fact that the tapes may not last for long so users have to be very fastidious about making back-up copies.

The other facilities of Interface I are a local area network, which is invaluable for educational users and may find interesting applications elsewhere. And an RS-232 interface which enables a real printer to be hooked-up.

In effect the Spectrum is now ready to do some serious computing, all that is needed is the software and a real keyboard. Students and some business users will be able to have the same facilities as a proper computer, but in a more primitive form and at a much lower price.

Interface II, due to appear later this year, will provide the Spectrum with a much needed joystick port just in time for the Christmas boom which seems to be a traditional feature in this untraditional market. But what will make the second Spectrum interface essential is the port for cartridge software. Expect some breathtakingly good games to appear around the same time.

Some Spectrum users may feel that a microdrive is not enough, and wish to incorporate a real floppy disc in their system rather than the ersatz microdrive. To the rescue of these users comes Technology Research Ltd, with a knight in shining armour — the disc interface card. The card supports any Shugart drive or the new and trendy 3in. discs, as worn by all the bright young micros.

The interface costs £65 and comes with a utility disc. A complete system with two drives, power supply and a case is £285, a single disc system is £195. Telephone Technology Research Ltd, 01-699 5332.

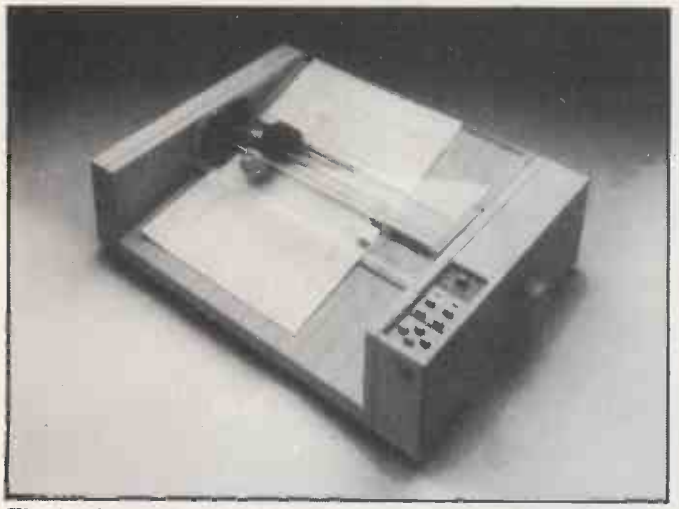
Grundy calls in the receiver

The future of the Newbrain micro from Grundy Business Systems is in doubt and the directors are taking steps to wind up the company. After its successful launch Grundy increased Newbrain production, but sales in fact declined creating a cash-flow problem. Further problems were created by failure to meet projected dates for the introduction of system enhancements, including CP/M. The directors were unable to find further finance, though it is still possible that they will be able to sell the business as a going concern, or alternatively sell the design of the micro.

Intelligent cards from Zenith

ZENITH DATA SYSTEMS has introduced a 256K RAM card for use with the Z-100 series of computers, and any other S-100 bus machine. Z-100 micros have 128K as standard and can be expanded to a total of 768K.

The card is intelligent in that it can tell whether the addressing on the bus is 16- or eight-bit, it can also recognise byte parity and low-power consumption. Because it is on an S-100 card it can be simply inserted on to the bus by the user with a minimum of fuss. The 256K dynamic RAM card is £520, for futher details contact Zenith Data Systems Ltd, Bristol Road, Gloucester GL2 6EE. Telephone: (0452) 29451.



The Apple plotter has four colours and can be used with paper or transparent film in any size up to A3. Capable of working with the Apple IIe and the III the unit will set the user back by around £700. There is a wide range of accessories to support the plotter, including a choice of four types of pen in eight different colours. Further details from Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire. Telephone: (0442) 60244.

New 96K Lynx

THE NEW 96K version of the Camputers' Lynx is now available at Laskys, Spectrum and a number of independent stores. Costing £299, the new machine also includes the printer driver circuitry omitted from the original 48K machine.

Only 37.5K of the memory is accessible to Basic, with another 24K available to machine-code while the high-resolution graphics are in use. Software is available to exploit this. One nice touch is that owners of the 48K machine can upgrade by returning their Lynx to a dealers and coughing up an extra £90. The up-grade board includes an extra 4K of ROM which has printer driving routines — missing from original model — together with some extra Basic commands.

Fortune cuts

FROM THE beginning of September the price of the Fortune 32:16 computer has been cut by 35 percent. There is a wide range of models in the Fortune series including 20, 10 and 5Mbyte systems. The single-user 20Mbyte system did cost £9,245, and can now be purchased for less than £6,000, a 5Mbyte multi-user system is reduced from £5,995 to £4,000.

IBR Microcomputers is the main Fortune distributor in the U.K. The company felt that the higher price of the Fortune meant that it had difficulty competing with other 16-bit micros in the stand-alone sector of the market. The entry-level system now costs only £3,950 and includes a 5Mbyte hard disc. It was reviewed in our January issue.

Seven card Spectrum

THE SPECTRUM only has one expansion port, but the expansion bus system from U-Microcomputers allows up to seven cards to be used in conjunction with a special backplane. So far there are two cards that fit into the backplane, a I/O card and a serial interface, but more will follow. For more information telephone: (0925) 54117/8.

(continued on next page)

(continued from previous page)

Legend helps Vic-20's bad memory

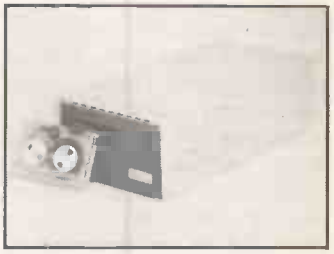
THE VIC-20 is now good value at around £100. But the one thing the machine lacks is memory, only having about 3.5K give or take a byte. To plug this gap comes a 27K memory board from Legend Valley Computer Systems of Newark, Ohio. One advantage of the system is that the board fits inside the Vic's case, and does not sit precariously at the back like most others. The boards cost $129.95

Just in case you are curious about this sort of thing, Legend Valley is the ancesteral home of the Hopewell Indians who now sit around all day building peripherals with their tribal soldering irons. For more details contact Legend Valley Computer Systems, 1474, Newark, Ohio 43055.

Tape back-up for Hal Winchesters on Apples

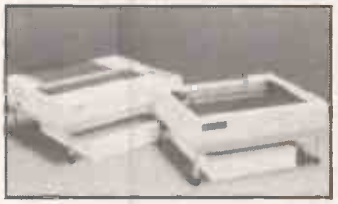
THE WINSTREAM 20 is a tape back-up device for users of the Hal Winchester discs on the Apple range of computers. It is capable of handling 20Mbyte and is a fast and effective security device, allowing the hard-disc user to make a copy of his valuable software and data.

It will also work in conjunction with the Apple Profile disc system and, if used with the right interface, a wide range of other microcomputer systems. For further details contact Stuart Hamilton, Hal Computers Ltd, Invincible Road, Farnbourgh, Hampshire. GU14 7QU. Telephone: (0252) 517171.



Epson on stilts

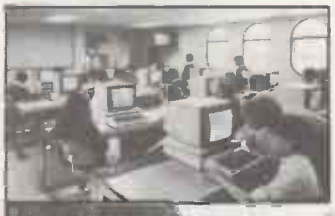
With Stilts attached to your Epson printer you can put a 3in. high stack of paper underneath. Stilts cost £3.95 for the MX-80 or FX-80, or £4.45 for the MX-199. Details from Pete and Pam Computers. Telephone: Rossendale (0706) 212321.



The complete computer system

Computalab is just the thing for the rich parent teacchers associations to buy. It contains 12 BBC Model B-based workstation with Econet interfaces and complete provision for 24 children, right down to 24 black-coated aluminium hat and coat hooks. There are two large wall-mounted colour monitors for classroom demonstrations and a video cassette recorder for playing back educational TV programs.

Teacher has another BBC Model B along with a disc-based Acorn System 5 file server and an Olivetti ink-jet printer. The price, including air-conditioned building, is £38,000. Details from Elliot-Medway Ltd, Glebe Court, Peterborough PE2 8EE. Telephone: (0733) 52151.



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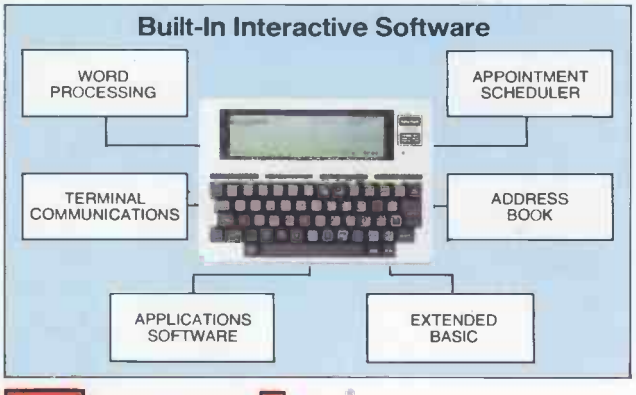

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Apple Prodos

Apple are releasing a new operating system for the Apple II and IIe called Prodos. Aimed at the professional software developer Prodos resembles SOS, Sophisticated Operating System, as used on the Apple III. Prodos uses the same data formats as SOS and provides a similar Unix-like hierarchical file structure.

Apple DOS will continue to be the standard Apple II operating system, but by releasing Prodos Apple are responding to the need for a better development environment. Apple say Prodos allows larger file sizes, more efficient memory-management, better response times, and that it makes disc-based applications device-independent.

Prodos will not be on general retail sale until early 1984, but it is available now to software developers under licence. For details contact Apple Computer (U.K.) Ltd., Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244.

Micro replaces maths teacher

Fun Mathematics on Your Microcomputer, is by Czes Kosnowski. The book discusses mathematical principles with lots of program examples and games written in a non-machine specific Basic. Published by Cambridge University press at £4.95, ISBN 0 521 274 516.

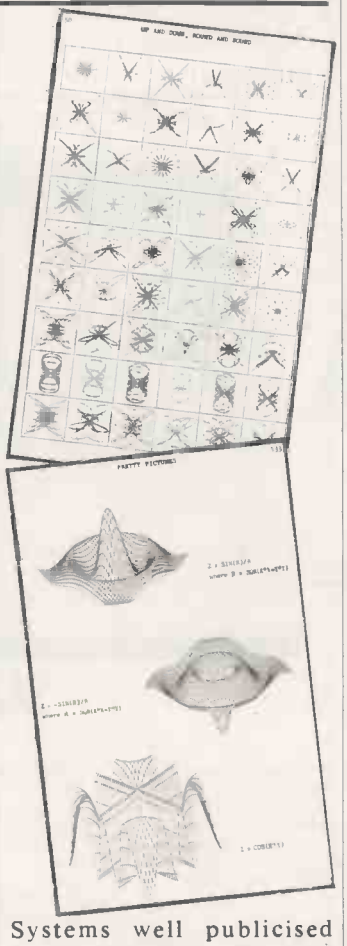
Olivetti comes in from the cold

MS-DOS can now be obtained along with CP/M-86 for the M-20, Olivetti's heavily promoted 16-bit computer. The two operating systems come together with an 8086 add-on processor card for a price of £200. With the card fitted the M-20 should be able to read IBM PC formatted discs. The MS-DOS is MS-DOS version 1.

The M-20 has until recently been out on something of a software limb. The system is built around the rather unusual Z-8000 processor chip and comes supplied with an Olivetti own-brand operating system. The new processor card turns it into a more conventional machine costing, with the 8086 card fitted, £2,695 for a system with twin floppy drives. Contact: British Olivetti Ltd, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

Last One cheap on Commodore 64

The latest serious software product to become available for the Commodore 64 is DJ 'AI' Systems well publicised program generator, The Last One. At £85, the price is lower than versions of the product for other machines, in line with the lower price of the 64 which doubles as a home entertainment machine.



DJ 'AI' Systems has also just released The Last One for the Zenith Z-100 and the Hitachi MB-16001 16-bit machines, this time at the more usual price of £330. Details from DJ 'AI' Systems, Station Road, Ilminster, Somerset TA19 9BQ. Telephone: (04605) 4117.

Ffosswriter

Ffoss's Correspondent Word Processing package for the HX-20, the development of which we described in *Practical Computing*, March 1983 is now on sale. The name has been changed to Ffosswriter because of a name clash with another product, but it is the same ambitious package as described in the "Computing on the Train" feature.

What distinguishes it most from other text-editing packages for the Epson is its disc-like random access handling of the HX-20's microcassette drive. It allows the user to operate conveniently with named documents and makes block copying operations between different documents possible.

Supplied as a plug-in EPROM along with a 50-page reference manual, Ffosswriter runs on the HX-20 with or without the expansion unit fitted, and costs £95. Full details from Ffoss Ltd, 112 Bath Road, Slough SL1 3SZ. Telephone: (0753) 820277.

Apple card

Advanced Logic Systems' CP/M Plus card for the Apple II and Apple IIe is now available in the U.K. At £300 the plug-in processor card is good value, it includes not only the new CP/M Plus operating system from Digital Research but also an extra 64K of RAM, CBasic, GSX Graphics, and various software utilities. The card uses the fast 6MHz version of the Z-80 processor chip. Contact Scope Systems, 13 Carlisle Road, Queens Park, London NW6 6TL. Telephone: 01-969 9365.

Lots of art for the BBC

BBC computer owners have two new drawing packages to chose from. Beeb-Art which is from Quicksilva lets you draw lines or shapes in any of the 16 Mode-2 colours and save them to cassette. It costs £14.95 and comes on cassette for the BBC Model B, with or without joysticks.

Easy Graphics from Hexagon Software is a similar package additionally featuring rubber-band line drawing. Costing £13.50, Easy Graphics also comes on cassette and runs on either a Model A or B machine with at least 32K of RAM. Joysticks are not required.

More details from Quicksilva Ltd, Palmerston Park House,

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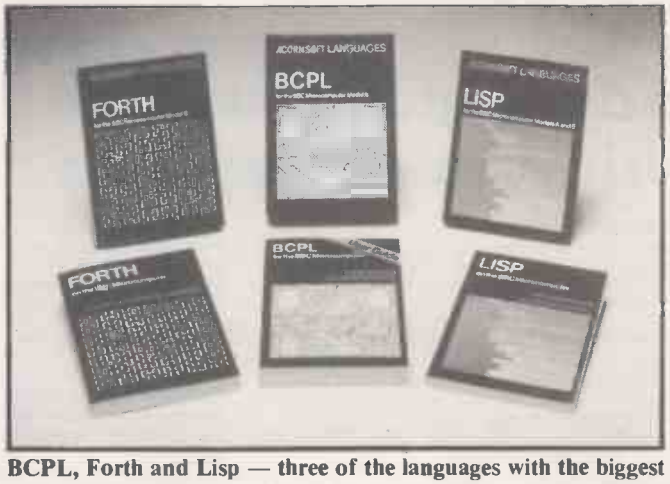

BCPL, Forth and Lisp — three of the languages with the biggest cult followings — are now available for the BBC computer. BCPL is a structured language widely used in universities as an alternative to assembler. Forth is becoming increasingly well known for producing fast, compact code, and is ideal for machine control and graphics applications. Lisp is a list oriented language much used for artificial intelligence research and writing expert systems. Lisp and Forth are available on either cassette at £16.85, or on disc at £19.90. The user guides cost £7.50 each. BCPL is more expensive at £99.95 for a pack containing the run-time system on ROM along with other parts of the system on disc and the user guide. The BCPL user guide costs £15.50 bought separately. More details from Acornsoft Ltd, 4A Market Hill, Cambridge CB2 3NJ. Telephone: (0223) 316040.

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(continued from page 21)

13 Palmerston Road, Southampton SO1 1LL. Telephone: (0703) 20169. And from Hexagon Software, 17 Straits Road, Gornal, Dudley, West Midlands DY3 2UR. Telephone: (0384) 232992.

Sharp and Tandy statistical forecast

Easi-Trend for the Sharp PC-1500 and Tandy PC-2 pocket computers enables users to identify trends and make forecasts from entered data. The program comes with a manual explaining statistical forecasting, and costs £19.95, including VAT. For more details contact Elkan Electronics, 11 Bury Road, Prestwich, Manchester M25 9JZ. Tel: 061-798 7613.

Specific packages for Commodore

Specific Software has released a range of tape and disc-based programs for the Vic-20 and Commodore 64 to do invoicing and sales and purchase accounts. Specific say the disc versions can handle 300 accounts and up to 2,000 transactions, while the cassette versions are good for 60 accounts and 300 transactions.

Prices range from £20 for a Vic-20 invoicing program to £150 for disc-based sales accounts with integrated invoicing for the Commodore 64. Details from Specific Software Ltd, 10 Farlands Road, Stourbridge, West Midlands DY8 2DD. Telephone: (03843) 73377.

Image analysis system on ACT Sirius

Digithurst's image-analysis system will now work with the ACT Sirius computer. The Microsight image-capture package consisting of video camera, interface box and software achieves a resolution of 256 by 256 pixels and costs £495. The Microscale software suite consisting of programs to manipulate images and measure perimeters and areas costs £295. Versions of the system are available for other micros including the BBC and Pet computers. Contact Digithurst Ltd, Leaden Hill, Orwell, Royston, Hertfordshire SG8 5QH. Telephone: (0223) 208926.

The new software package called The Word processor is not quite what it seems. It is the King James Bible on disc. The complete text is contained on a set of discs along with a program which lets you search the scriptures for any word or phrase you wish to refer to. Apple and IBM PC versions are available from Pete and Pam Computers at £149. Contact Pete and Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 212321.

Hewlett-Packard integrated packa

MBA, the integrated spreadsheet, graphics and filing package from Context can now be obtained for Hewlett-Packard's new 16-bit 68000-based machine. Context MBA's core function is a spreadsheet of 95 columns by 999 rows. The user can enter text, numbers and formulae in any cell. As any cell can hold up to 8,000 characters MBA can be used as a database and as a simple word processor. The package allows you to do sorting and searching operations and to construct several different kinds of graphs from cell data.

Context MBA is already available for the IBM PC, requiring the 256K RAM expanded system to run. The standard HP Series 200 model 16 comes with half a megabyte of RAM and uses the powerful 68000 processor, so it is well suited for this type of large,

Software dealer to join Softsel

Software dealer SBD Software is to gradually stop trading. Susan Ben-David, who owns the company, is closing it down and joining Softsel, the large American software distributor which has recently set up an operation in this country. Susan Ben-David's job as product services manager includes the task of selecting British and European software for distribution by Softsel worldwide.

More packages for BBC accounting

Six disc-based business packages for the BBC Computer have been announced by HCCS, covering nominal, purchase and sales ledgers, stock control, order processing and payroll. Each package costs £59.95 and can be used on its own or as a module integrated with the other packages in the range. Details from Home and Continental Computer Services Ltd, 22 Market Square, Biggleswade, Bedfordshire SG18 8AS. Telephone: (0767) 317300.

multi-function general package. The HP keyboard's unusual cursor-control knob can be used to scroll around inside Context MBA.

Context MBA for the HP system costs £593. A Model 16 system with twin Sony microdrives costs £5,213. Details from Personal Computer Literature Department, Hewlett-Packard Ltd, Customer Service Centre, Winnersh, Wokingham, Berkshire RG11 5DZ. Telephone: Crowthorne (0344) 773100.


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The TI Home Computer has got the memory power you might expect from more expensive computers, built in. At its heart is a powerful TMS 9900 16-BIT Microprocessor. Most other home computers have only an 8-BIT. And you can expand the memory from 16K of RAM up to 52K.

The total memory capacity is 114K Bytes.

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Symbolic logic

Boris Allan continues his analysis of Gödel's work in relation to threaded interpretive languages.

"At last in its proper setting, the infinite has assumed a respectable place next to the finite, just as real and just as dependable, even though wholly different in character. Whatever the infinite may be, it is no longer a purple cow."

Edward Kasner and James Newman
Mathematics and the Imagination, 1940

IN GÖDEL'S arithmetisation of mathematics, the key concept is that of the Gödel number. Hilbert, in 1904, had noted that symbolic logic could be treated as though it were a branch of elementary number. But it was Gödel, in 1931, who worked what this actually implied in practice. The method was directed towards Russell and Whitehead's *Principia Mathematica*, and an English translation of his original German title might be "on formally undecidable sentences of principia mathematica and related systems."

Gödel starts with a set of basic axioms of number theory which effectively correspond to three of Peano's axioms of number:

- the successor of any number cannot be zero;
- if the successors of two numbers are equal, then the two numbers are also equal;
- and if a certain property is true for the number zero, and if true for any number it is true for its successor, then the property is true for all numbers. The latter is the axiom of mathematical induction.

In Gödel's logical symbolism, the number zero is shown as 0, the number one is shown by f0, the successor of 0, two is shown by ff0, and so on. There is only one primitive number in his system and that is 0, all other numbers are the results of operations on that number using the primitive f. Other primitives are simple variables, for example, X in his first axiom

$$\sim(fX = 0)$$

it is not true that the successor of any number is zero. These primitives are used to create secondaries, more complex arrangements which on analysis end up being assertions about numbers or variables.

At a different level there are secondaries which involve propositional expressions, or expressions which can be turned into such, and assertions about the relationship between the elements implicated. For example, in his second axiom

$$fX = fY \rightarrow X = Y$$

if the successor of X is equal to the successor of Y, then X is equal to Y. Either side of the implication is ultimately composed of primitives but the implication is of a different order of things.

In the 1931 article Gödel starts his arithmetisation by associating each of the primitive signs in his symbolism with a natural number.

Symbolism and natural numbers.		
	0	1
	f	3
	~	5
	v	7
	P	11
	(	13
	)	17
	X	19
	Y	23

and so forth — any scheme of assignment which uses the prime numbers would obviously do. The Gödel numbers for these primitives correspond to the addresses of the locations for primitives in threaded interpretive languages. If you show a property of X, that is a higher order type, by X2 then this is given the Gödel number $19^{\wedge}2$. A property of a property of X is X3, with a Gödel number $19^{\wedge}3$, and so on until infinity.

A secondary in a TIL or threaded interpretive language also has an address, that is, a number, and that number when used points to an unambiguous set of further addresses, which are either the addresses of primitives or further secondaries. The Gödel numbers of primitives are associated in a special way to enable the content of any formula to be established from the Gödel number of the formula.

The third of Gödel's axioms is

$$X2(0).X\ P(X2(X)) \rightarrow X2(fX)) \rightarrow X\ P(X2(X))$$

that is, if there exists a property of X which is true for 0, and if, for all X, when true for X it is true for the successor of X, then the property is true for all X. Note that mathematical induction cannot be expressed in a single axiom without use of a variable of a higher type that is X2.

The implication $\rightarrow$ is not one of Gödel's set of primitive symbols, but as A $\rightarrow$ B is the same as $\sim$ A v B, part of the above can be re-written

$$X\ P(\sim X2(X) \vee X2(fX))$$

which has the Gödel number

$$2^{\wedge}19 * 3^{\wedge}11 * 5^{\wedge}13 * 7^{\wedge}5 * 11^{\wedge}19^{\wedge}2 * \ldots * 47^{\wedge}17$$

This number, though large, can be unambiguously factorised into its constituent elements so that you can always reproduce the formula. If the numbers of formulae in a proof, a proof is no more than a sequence of logical formulae, are F1, F2, F3, ... Fn, then the Gödel number for the proof is

$$2^{\wedge}F1 * 3^{\wedge}F2 * 4^{\wedge}F3 * 5^{\wedge}F4 * \ldots$$

and this method associates one and only one number with each formula or sequence of formulae. Thjis is the arithmetisation of mathematics — a bootstrapping exercise.

The threading through addresses which characterises TILs has a very close analogue here. You have a Gödel number which is factorised at the first level; you have a TIL word which produces a series of addresses; some or all of the numbers which arise from the factorisation have then to be factorised to produce further numbers; some of the addresses lead to sets of further addresses. The process continues, on both accounts, until you reach the system primitives.

The transfinite numbers are shown by the Hebrew for A, aleph, but to save typographical contortions I will simply use A — though still calling it aleph. A few characteristics of the first transfinite number aleph-null, A(0):

$$A(0) = A(0) + 1$$
$$A(0) = A(0) + A(0)$$
$$A(0) = A(0) * A(0)$$

though

$$A(1) = A(0)^{\wedge} A(0)$$

where A(1) is the next transfinite number, aleph-one. If these strange equalities are studied, it is obvious that they contradict Peano's axioms, for one property of zero is that it is different from its successor. So is it always possible to unambiguously factorise a Gödel number, is there some point at which the number is "too large"?

Return to the TIL. There comes a point at which the physical confines of the computer memory mean that we cannot extend the words in the memory any further. A TIL is manageable, it respects finity and it also asks for the mechanism by which an operation is to be performed. A word may, for example, refer to itself — a TIL asks what that self-reference means in practice.

Any secondary in Gödel's scheme will

(continued on page 38)

Why all other spread

In the early days of micros, the first spreadsheets appeared, using complicated cell co-ordinate references to define plans.

This made the most of limited computing power but plans were tricky to write, and difficult to read later.

Today's micros are much more sophisticated but all the spreadsheets are more or less the same as they always were. All that is, except PlannerCalc and MasterPlanner. Described in a recent university report as "... the best spreadsheet package currently on the Market," PlannerCalc and MasterPlanner are true business aids.

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LINE 2  EXPENSES=GROW 70 BY 15% FOR 4
LINE 3  NET=SALES-EXPENSES
LINE 4  CSALES=CUM SALES
COLUMN 5 YEAR=SUM OF COL 1 THRU COL 4
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So it's much easier to use.

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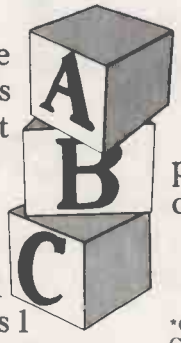

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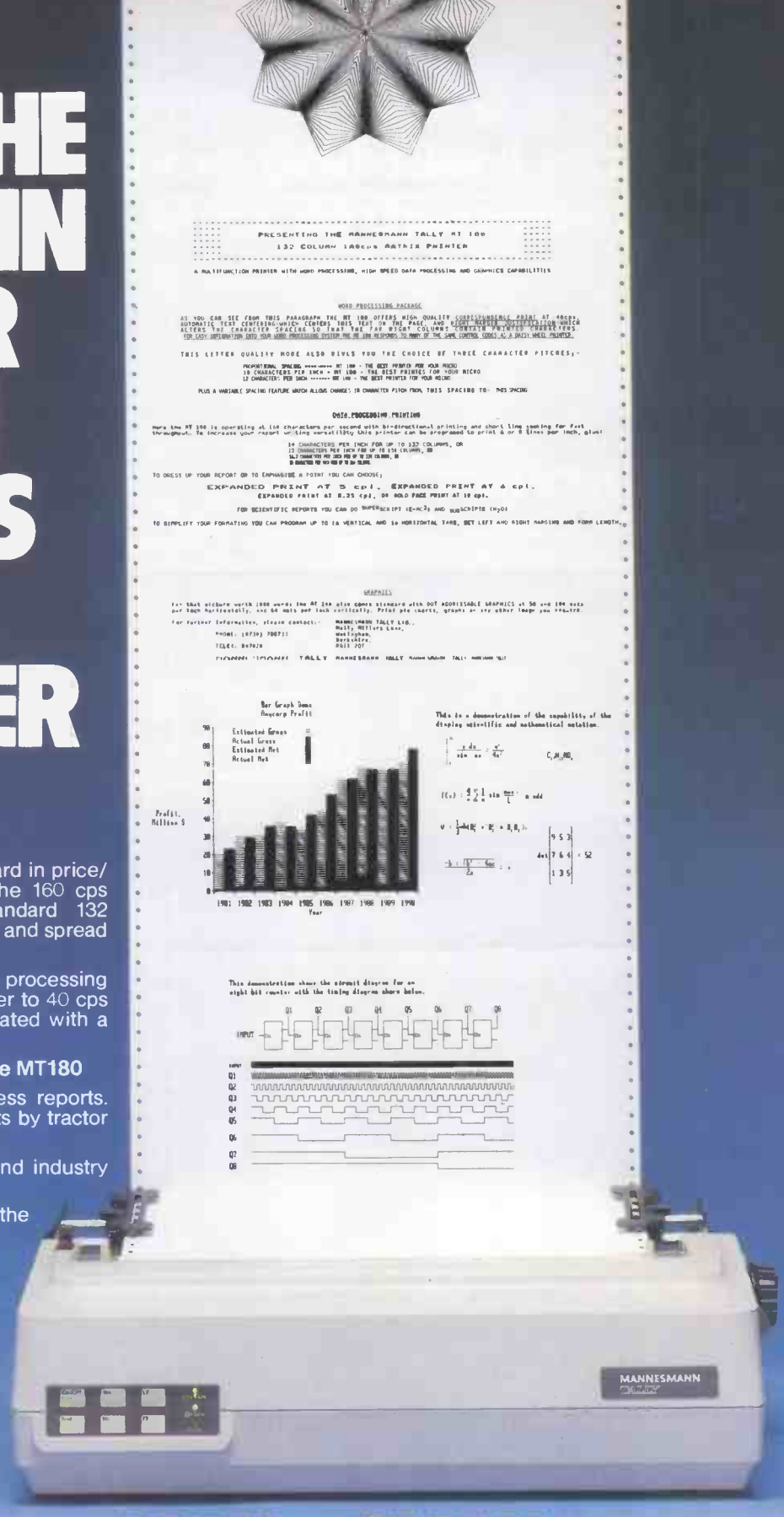

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So cheap to keep in touch

by Ray Coles

THE COMPUTING power now available to the individual user via the new generation of 16-bit microprocessor-based personal computers is quite phenomenal. In many respects it exceeds the capabilities offered by those big expensive mainframe systems, which were once the mainstay of the computer industry. But despite their obvious power, most personal computers still lack one of the most useful features of the mainframes: easy communication with other users and the ability to share a common database.

However, judging by the latest batch of microprocessor peripheral devices this is a drawback which will soon disappear. Before long it will be the exception rather than the rule for personal computers to operate in splendid isolation in a dark corner of the office or living room.

Many multi-user systems particularly, need to communicate over long distances by the public telephone system. This need is currently satisfied by Modem — modulator/demodulator — units, which can be used to convert the serial RS-232 line of a terminal or VDU to the voice band signals expected by the telephone network. Trouble is these Modems are quite complex as they have to convert the logic-level signals from a terminal into audio frequency tones before transmission; they do the reverse at the receive end. They must also cope with the distortions inherent in long distance connections and the many other peculiarities of the telephone link, which may include landlines, microwave links and even a satellite between the transmit and receive terminals. Complexity equals expense and so this form of communication has in the past been largely ruled out for low-cost personal-computer applications.

But the semiconductor chip manufacturers have not been neglecting this problem. Now that the personal-computer revolution is well underway advances in chip technology and the attractions of a huge potential market have spurred the development of self contained Modem devices. These can be built into every micromputer at very low cost to provide a direct telephone connection to even the most humble office system.

The integration of a complete Modem system onto a single silicon chip is by no means a trivial matter. Traditional Modems are essentially analogue — rather than digital — systems, and rely heavily on the use of sine-wave oscillators and inductor filter circuits for correct operation. To satisfy the single-chip requirement an analogue signal is simulated using digital techniques, with the result that the new generation of Modems are really high-speed dedicated microprocessor systems, internally as complex as the 16-bit general purpose microprocessors they will support.

Several of the major chip manufacturers have recently announced sophisticated single-chip modems, which will ensure that competition is fierce and prices low; the one which caught my eye was the AM-7910 from Advanced Micro Devices.

AMD has brought the traditional advantages of VLSI digital circuitry to bear on the problem and has made its device totally programmable in order to suit the various standard communication protocols in use in the U.S. and Europe. Analogue-signal generation and processing is simulated by using a high-speed digital-signal processor, which has its own 24K ROM, 1.3K RAM array, digital-to-analogue and analogue-to-digital converters fabricated on the same chip.

The entire system lives in a tiny 28-pin dual-in-line package and runs from dual 5V supply rails using just 600mW of power. Voice band Frequency Shift Keying, FSK, data rates of 300, 600 and 1200 baud can be selected, as can one of the nine Bell and CCITT recommended communications protocols.

With this sort of capability now available for a few pounds, we can expect all future microcomputer systems to have long distance communication facilities available as a standard feature. This would allow even a basic office micro to keep in close touch with all that lovely data available in the outside world.

Modem links are good for long distance access to a central data base or larger computer, but due to the limited frequency response of the standard telephone network data rates are restricted, making the transfer of large quantities of data a tedious business. Over shorter distances data transfer rates can be increased dramatically by avoiding the restrictions of the telephone system; using instead dedicated high-speed communicaitons links called Local Area Networks, LANs.

Using a LAN, such as Ethernet, data transfer rates of 10 million bits per second are possible. This means all the microcomputers in, say, an office block can be linked together for the interchange of messages and the sharing of precious resources like hard-disc systems and line printers.

Unfortunately LAN controllers are complex and therefore expensive. But the semiconductor manufacturers are falling over themselves to provide cheap VLSI solutions, and a whole flood of new devices are about to be launched into an eager market.

Ethernet controllers are a good deal more complex than the simpler Modems, but their complexity is more easily handled using digital techniques. Again the new generation of single-chip controllers will depend heavily on the use of dedicated microprocessors to provide the clever bits.

Take the Intel 82586 LAN controller: when used with the companion 82501 driver chip, required to drive the coaxial cable used for interconnection, the device will implement the full Ethernet specification as defined by the original sponsors of the standard, the DEC, Xerox and Intel grouping. In the past about 80 integrated circuits have been required for the job, but with the advent of the 82586 a single 48-pin package is all that is needed.

The new Intel device takes the burden of link control away from the associated microprocessor. It merely requires it to assemble a message for transmission in its own memory space, or to retrieve received messages placed back in the microprocessor memory space by the controller. The 82586 has a built in DMA controller which allows it to take control of the system bus for the retrieval and replacement of messages, only interrupting the busy CPU when all the hard work has been completed.

Eventually we can expect LAN controller chips like the 82586 to cost less than £20 each, making the provision of this form of communication a logical option for future 16-bit machines.

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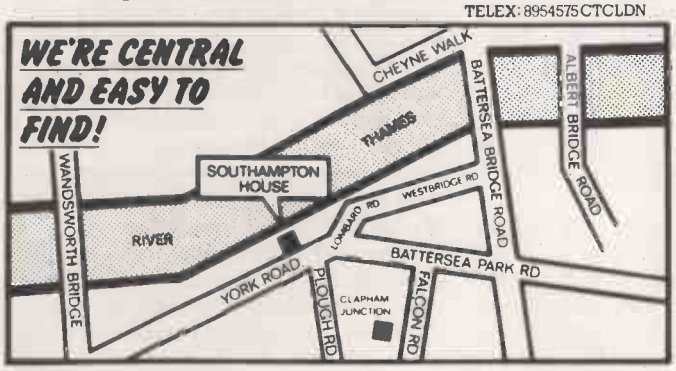

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Symbolic Logic

(continued from page 29)

be shown as Sec? where the ? is replaced by an indentifier — compare my earlier analysis of secondaries for TILs. Each secondary, say a formula, will be given a Gödel number Number.Sec?, and to find what the number means, that is, to unravel the formula, you have to factorise that number. To factorise the Number.Sec? to find what is the formula you

```
NUMBER.SEC? EXECUTE
```

in direct analogy to a TIL.

Take a secondary SecX, and suppose this is composed of a series of other secondaries, taken in order, SecA, SecB, and SecC

```
: SECX SECA SECB SECC ;
```

or

```
: SECX NUMBER.SECA EXECUTE
  NUMBER.SECB EXECUTE
  NUMBER.SECC EXECUTE ;
```

where Number.SecX is the Gödel number of SecX, and likewise for the others. How is it possible to incorporate variables? A variable is effectively a dummy which can be replaced by any value; it is an Inputnumber, in terms of my earlier analysis of TILs. You will assume that Inputnumber.1 is the first variable, and it may appear more than once in a definition, and the same for Inputnumber.2, etc.

The operation ?Provable when applied to a number gives the result true if the sequence of formulae are a valid proof within the system, false otherwise. That is

```
NUMBER.SECX ?PROVABLE
```

and now you can produce Gödel's famous result.

Let SecY be the main secondary in which you are interested, let SecX comprise the main body of the sequence of formulae, and let there be a variable Inputnumber, which corresponds to X in the arithmetic

```
: SECY SECX INPUTNUMBER EXECUTE ;
```

As you saw in the first part, Inputnumber can be replaced by Number.SecY, and so SecY can be re-written as

```
: SECY SECX NUMBER.SECY EXECUTE ;
```

— one form of recursion.

Gödel designs a special formula, SecG, first he makes the simple formula

```
: SECG INPUTNUMBER
  ? PROVABLE NOT ;
```

which asserts that the formula whose number is to be supplied, via Inputnumber, cannot be proven. The number for this formula is Number.SecG, and what Gödel does is substitute for Inputnumber:

```
: SECG NUMBER.SECG
  ? PROVABLE NOT ;
```

and my earlier worries about the meaning of recursion, in part 1 in the September issue, are reinforced.

Consider how a TIL might analyse this formula/definition. It would not come to any conclusion, the process would never end until memory ran out. Gödel assumes, along with many other mathematicians, that in mathematics the story need never end, it could carry on until infinity. However, as noted earlier, this is not to say that at some non-Peano transfinity the solution would not be resolved. People can resolve it.

Computers are not generally used to play meaningless games, apart from in some reaches of AI and computer science — long may it continue. TILs were developed to provide a powerful method of using computers. Interestingly, it seems as if the TIL philosophy is a practical application of metamathematics, the arithmetisation of mathematics.

It is generally acknowledged that Gödel's method is the most powerful method yet devised for studying mathematics and logic, and this corresponds to the power of TILs. Gödel's method does have its problems, the unprovability formula, but these are only the problems inherent in the extension to the infinite of finite ideas.

A TIL is an artificial intelligence language which accepts that there is no infinity but has not — as far as I know — been accepted by the AI community which still believes in the infinite.

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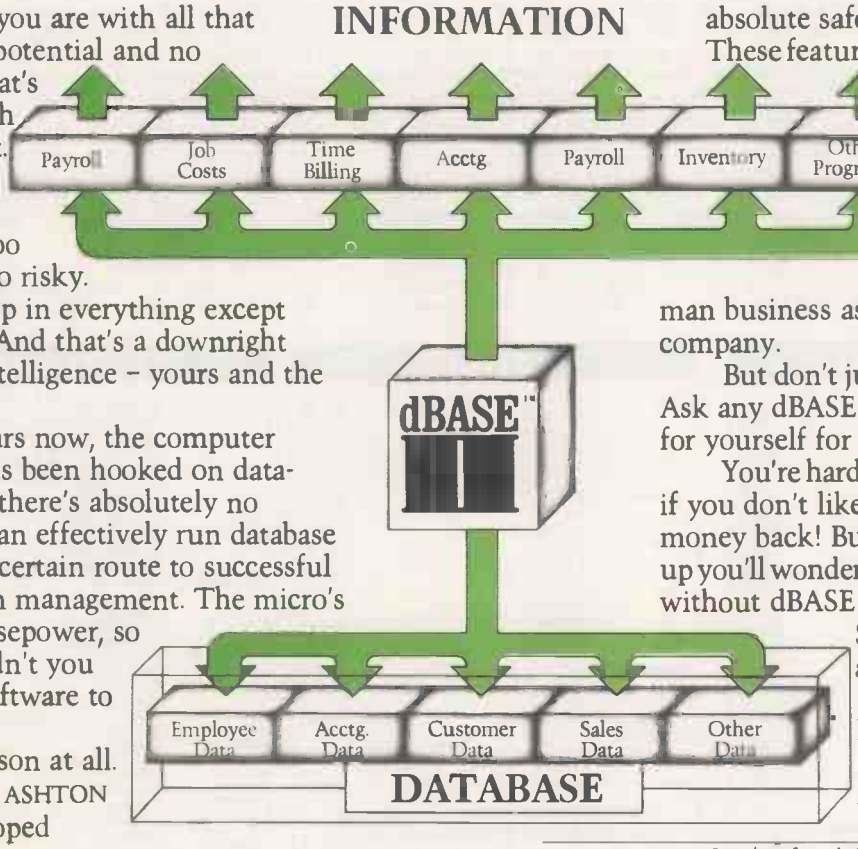

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Features. Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left delete right, tab right-left-up-down' Paint your form as you like directly on the screen.

Text..... Write a letter as you see it on the screen, edit it then simply enter ^P to print.

Calc..... Set into the form, your data fields, "£££££" and specific file-related activities, formulae and validation checks.
Enter values and see the spreadsheet calculate itself.

Database. Search files for data to be inserted to fields specified.
All the features of DBMS III, explained elsewhere in our ad.

Here's an example of an invoice you might design for your stationery .....
You could design your own spreadsheet, order form, statement, or any other kind of form that is required to fit your existing stationery.

INVOICE <0>£££££££££

To £<1>£££££££££
£<2>£££££££££
£<3>£££££££££
£<4>£££££££££
£<5>£££££££££

From: G.W. Ltd
55 Bedford Court Mans.
Bedford Avenue
London W.C.1.
Tel: 01-636 8210

Date <6>£.£ Tax point <7>£.£ Agent <8>£

Quantity	Description	Cost	Tax	Total
<9>£	<10>£££££££	<11>£	<12>£	<13>£
<14>£	<15>£££££££	<16>£	<17>£	<18>£

and so on...

Total...<19>£ Tax...<20>£

<??> items <1> to <5> internal command to request name input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> <9> request quantity, validate range.
<??> <10> request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>

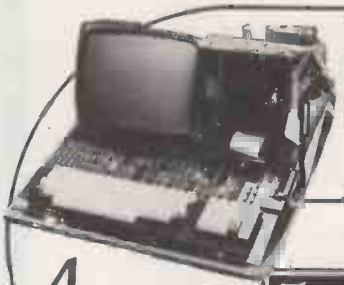
Now comes the more valuable facility, you can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.
EG: Send fields <0>, <1>, <6>, <7>, <11>, <12>, <13>, <19>, <20> to a sales ledger.
Then send fields <9>, <10>, <11>, to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file
Then send fields <10>, <11>, <12>, <13> to Nominal ledger.

Available at present only on SIRUS/IBM PC.

● Circle No. 126

Steps & Adders

Start here with SUPERBRAIN



3 You need to store greater quantities of data with faster access times so Winchester Disc Storage facility now required. If you started with a W6, move forward 4 places. Otherwise . . .

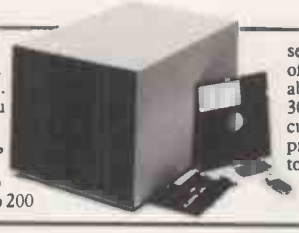
2 Each SUPERBRAIN comes with CP/M operating system, BASIC programming language, twin Z-80 microprocessors and an RS-232 communications port.

1 Choose your SUPERBRAIN. Twin floppy disc, hard disc (W6) or multi-user (COMPUSTAR) models available. If you don't need a W6 or multi-user straight away, don't worry – you can always upgrade later on.

4 Either upgrade your SUPERBRAIN by replacing one floppy drive giving a Winchester plus floppy configuration . . .

5 OR . . .

6 Add on a 5¼" Winchester in a separate box. Whichever way you do it, Icarus Winchesters give 5, 10 or 30 MB of disc storage – enough to accommodate up to 200 separate items of information about each of 300 individual customers/sales prospects or up to 60,000 stock control records.



7 Your company moves to another part of the country to take advantage of regional development grant. SUPERBRAIN servicing well supported by Icarus nationwide dealer network.

8 Data interchange facility required so external 8" floppy disc drive added giving ability to transfer data to and from a mainframe computer.

10 Your financial director decides to use SUPERBRAIN for "What if . . ." budgetary calculations. Icarus supplies specialised software.

9 Enhance performance of SUPERBRAIN by addition of GRAPHICS BOARD and supporting software.

You can now read and create your own IBM 8" format floppy discs.

11 Fit all your existing SUPERBRAINS with ICARUS multi-user chaining adaptor to take advantage of COMPUSTAR facility.

12 A COMPUSTAR system enables you to establish a multi-user network of SUPERBRAINS, with each SUPERBRAIN connected into a central data store giving 10, 96, or 144 MB of storage.

13 Leave nothing to chance. Add a 13 MB CARTRIDGE TAPE BACK-UP UNIT to give file-by-file back up for your SUPERBRAIN hard disc.

14 SUPERBRAIN: the game with no end. Our development continues as your business prospers . . .

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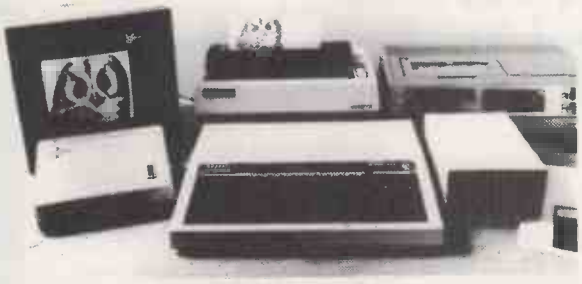

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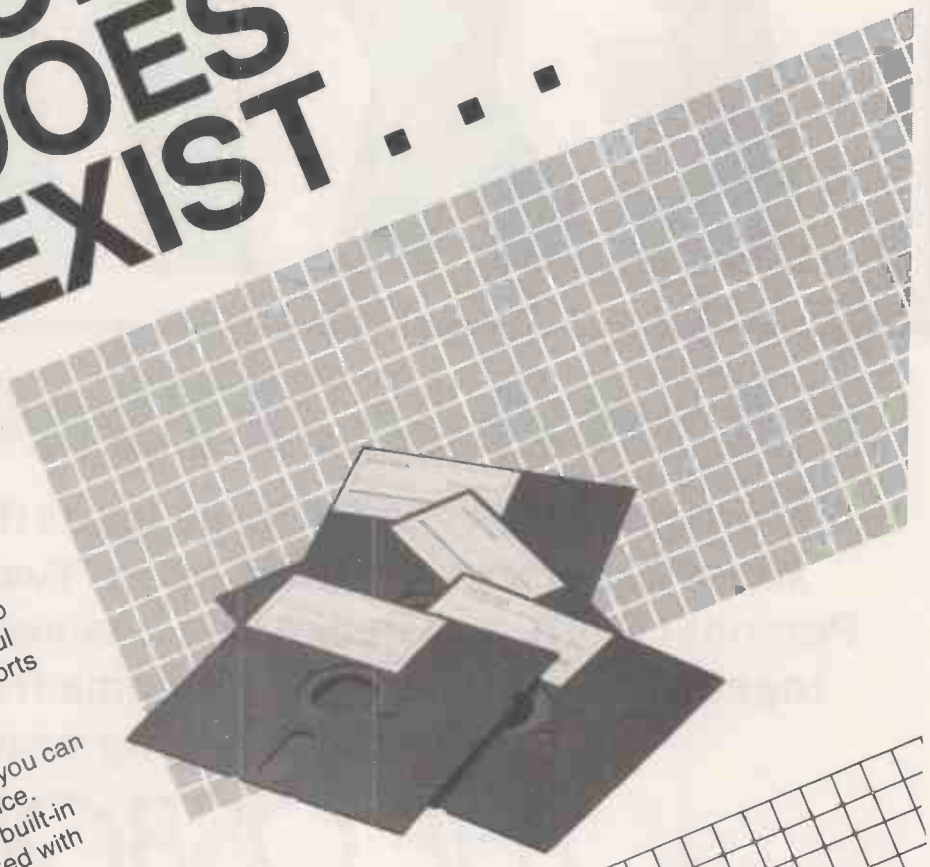

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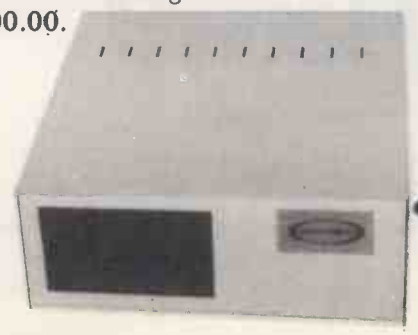

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48 TPI suitable for 35 or 40 track operation. 96 TPI suitable for 77 or 80 track operation. 10 and 16 hard sectored versions available at same prices.

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5022–2000	D/S, D/D, 96 TPI	£3.77

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THE LAST ONE

Got a computing problem? Produce your own solution by using The Last One, a program generator which has helped to solve hundreds of problems in installations throughout the world.

TLO runs on the Apple II and IIe, Commodore 4032 and 8032/96, TRS-80 Model II (TRSDOS or CP/M), most CP/M, CP/M86 and MS-DOS machines including the IBM PC (PC -DOS) and Sirius.

Try out TLO for £50.

A limited demonstration version of TLO is now available for only £50, including full documentation. This cost is fully refundable against your subsequent purchase of a full version.

Full version costs:—

for Apple II	—	£185
all other versions	—	£330

Please specify version requirements when ordering.

DISK DRIVE HEAD CLEANING KITS

Helps to protect your valuable data, and minimise expensive downtime and repair costs. Consists of a flexible jacket, which receives a pre-saturated cleaning disk. Each disk is sealed within a foil sachet to ensure that it contains the right quantity of cleaning fluid when used. After use the disk is disposed of, and the jacket is kept for future use.

Suitable for single or dual head drives. Please specify 8" or 5.25" disks.

STARTER KIT £8.12
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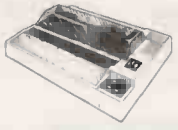
Protect your diskettes and valuable data from external contamination. Lockable, portable and secure. Two part box made from anti-static ABS plastic. Price includes dividers and index labels. Capacity 80 disks.

A5 Storage box (for 8" disks)	£33.60
A6 Storage box (for 5.25" disks)	£23.10

CTI – CP80 PRINTER



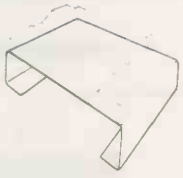
Features:—

Friction and tractor feed as standard
80 c.p.s.
Bi-directional logic seeking.
13 x 9 dot matrix giving true descenders.
Sub and superscripts.
Italic printing and auto underlining.
Condensed, emphasised, expanded and double strike printing (can be mixed in a line).
Parallel interface fitted as standard.
12 month warranty.

Print sample available on request.

CP 80 PRINTER	£289.00
Optional RS-232 interface	£40.00
Special VIC20/VIC 64 Interface	£46.00

PRINTER STAND



Suitable for use with dot matrix printers: Lifts printer sufficiently to enable continuous stationery to self-stack. Painted steel unit.

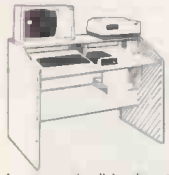
Dimensions: 39cm wide
x 28cm deep
x 10cm high

Comes as package which also contains:—

200 sheets continuous stationery.
1 x 9½" binder.
1 x highlighter pen.
choice of rubber feet/sticky pads.

PRINTER STAND £21.95

COMPUTER FURNITURE



Suitable for use with all leading personal computers. Features a top shelf for monitor/printer, lower shelf for books, paper and general storage; large desk top surface at keyboard height; attractive teak finish, and castors for mobility.

U.K. Manufacture. Comes in flat pack for self assembly – full instructions provided.

A further range of more sophisticated units is available – please ask for details.

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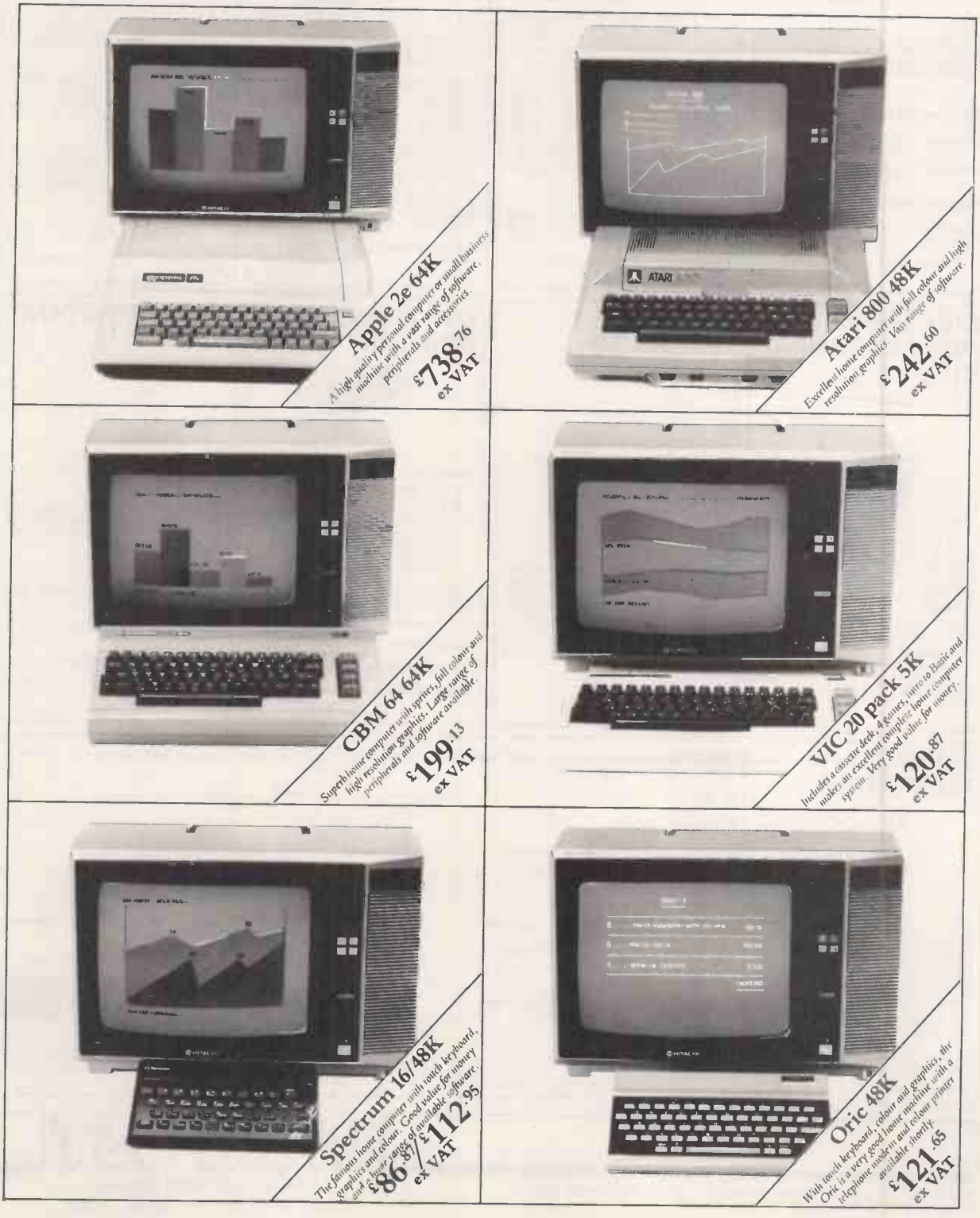
If you think seriously about Micros . . . . .



. . . think seriously who you buy from.

It's surprising where you can buy a micro these days. The chemist, the newsagent, department stores – it won't be long before your local greengrocer is selling Apples as well as apples!

But who do you really trust? Do you honestly believe that the 'Johnny come latelys' can offer you the expertise and in depth knowledge of a specialist?

Do you honestly believe that they have the influence and status in the market, to offer you a full choice of the latest technology and all at probably the best prices around.

In all branches of Laskys, you'll find Micropoint, our specialist micro computer department. And at Micropoint you'll find everything you're looking for. Computers, Peripherals, Software, Programs, expert advice, test play and comparison facilities. It's the complete micro service, plus Laskys free 2 year parts and labour guarantee.*

Unfortunately we can't guarantee that you'll find the same standards anywhere else.

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* All credit offers subject to acceptance. Laskys Credit Brokers. Please ask for written details. Prices correct at time of going to press. But may be subject to variation thereafter. All offers subject to availability. Prices include 15% VAT. † Extra parts and labour guarantee are on Computer peripherals, programs are year. Computers all use on computers, YOU and year. Peripherals, programs & months. Programs will only be exchanged if proven faulty and then only for the same program.

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CARDIFF 122 Queen Street

● Circle No. 141

High speed shredding

Computer printouts often contain the most sensitive information in any company, yet the sheer speed at which the output flows can be enough to make disposal a major problem. To cope with this the Rexel ambassador range offers specialist DP shredders from micro to mainframe user capacity. Up to 180 feet per minute of multi part sets can be destroyed. Why not get in touch, and I'll forward all the details.

426 on enquiry card

Cut company phone costs

Do your staff use the telephone efficiently? If you have a feeling that some of your company's hard earned cash is being unnecessarily donated to British Telecom you should be talking to Callog. The Callog service provides a detailed analysis of outgoing calls and encourages good telephone 'habits' by pinpointing departmental costs. Indeed, the Callog service can immediately show you savings on telephone expenditure — savings that will far outweigh the small annual cost of the service itself. I have all the details.

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PAGE PLUS Computers

COMPILED BY–

Ursula Hewitt

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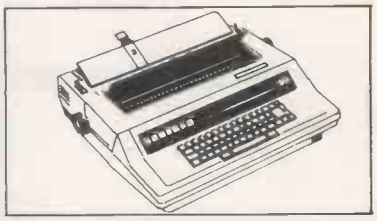
Surrey KT18 5PD 07373 52031



Electronic typewriters with the Xerox touch

With the 600 Series Rank Xerox have produced five electronic typewriters offering a host of features to make typing faster and easier with less effort and impeccable results. The memory eliminates repetitive typing; self correction ends lengthy manual correcting and the Xerox touch of quality and features such as automatic emboldening, centring and underlining give extra authority to all your typing. Text editing models are available too. Whatever your needs, there's one just right for you — contact me now.

432 on enquiry card

A fast and efficient mailing system

If your computer can produce invoices in a matter of minutes it seems crazy to then spend hours mailing them by hand. The Neopost System Five-2 from Roneo Alcatel is designed to fold, insert, seal and frank in a fraction of the time it takes manually. The 'system' can be controlled by a single operator saving many costly man-hours and its modular construction gives it the flexibility to match your needs exactly. If you're interested in saving time and money circle this number today for more details.

428 on enquiry card

The Xerox 820 II micro-computer

The Xerox 820 II is the micro-computer which can really benefit your business. And it comes with a unique piece of extra software — Rank Xerox expertise. Expertise which will not only show you how to ensure you get the best possible out of the Xerox 820 II for your business; but even provides a telephone help-line to advise on using their specially tailored software programmes. Plus Rank Xerox have the engineers and the resources to provide on-site servicing — something few other manufacturers offer. Contact me now for further information.

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More than a word processor

If you want a revolutionary word processor, look no further than the new Dictaphone 6000. It can handle words and numbers. It can edit, arrange, select, count, file, print and answer questions. But it's more than simply a word processor. It copes with a whole range of micro-computer facilities like data processing and can exchange information with other terminals and computers, even mainframes. And for less than the cost of a secretary you can lease the Dictaphone 6000. Circle this number and they will prove it to you.

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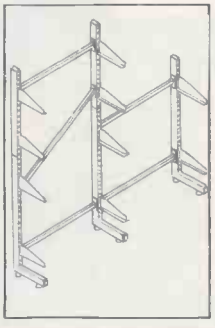
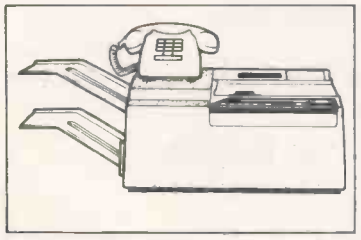


Twinlock Multistor

Ironically, the 'paperless office' always seems to end up producing more paper than it replaces, and finding space to store vital computer printouts and tape reels is often a headache. If the problem is a familiar one, Twinlock's Multistor could be the answer. Tape reels and printout binders are kept in order and easy expansion in any dimension allows you to expand the system as your needs grow. Yet it all costs less than the equivalent cupboard! Make sure you get the details — circle this number now.

434 on enquiry card



Fax it fast

It takes less than 30 seconds to transmit an A4 page of information to any destination in the world using Kalle Infotec's latest digital facsimile transceiver, the Infotec 6400. Similar in size to an office typewriter the 6400 provides a range of big machine features including high resolution scanning and printing, sophisticated operator controls and a local 'log' for management accounting. Naturally compatibility with Group III and Group II is standard. Get the facts from Kalle Infotec. Circle this number now.

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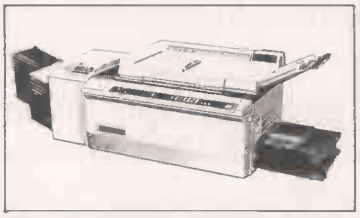

Photocopies for less than a penny each

That's the promise from Roneo with their high speed reduction copier. The Roneo Rapier 230R gives low cost, edge-to-edge, crisp clean copies everytime. The machine copies up to A3 — single sheets, books, etc — onto any kind of plain paper, letterheads, labels and transparencies. The 230R is designed with a touch sensitive panel to give trouble free copying. Features include reduction A3 to A4, A4 to A5, A3 to B4, B4 to A4, automatic document feed and sorter with security key operation to prevent 'use abuse'. Contact me for full details.

431 on enquiry card

A cut above the rest . . .

Continuous stationery can create as many problems as it solves, with paper-cutting bottlenecks holding up output. But according to Bell & Howell their Fimafold 1000 provides a low-cost solution for small or medium computer installations. The accent is on ease of use and maximum versatility, with electronic control systems keeping the operator fully informed and in complete control. Interested? Circle the number and I'll be happy to send you full details.

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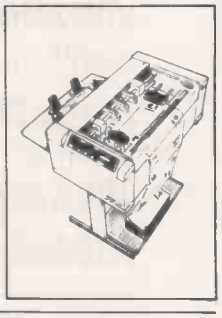

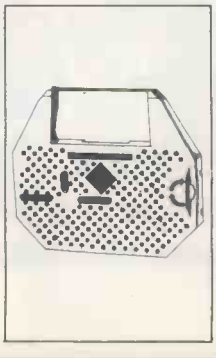

Multistrike printer ribbons

The hidden costs in computing can soon mount up so we're pleased to be able to tell you about a new range of economically-priced multistrike printer ribbons from Melkron International. For those using an electronic typewriter/printer such as the Olivetti ET Series or Silver-Reed EX50/55 or EXP550, Melkron has a new multistrike ribbon which gives approximately 150,000 sharp impressions — double the yield of a similar singlestrike product. Let me put you in touch with your local Melkron dealer.

57

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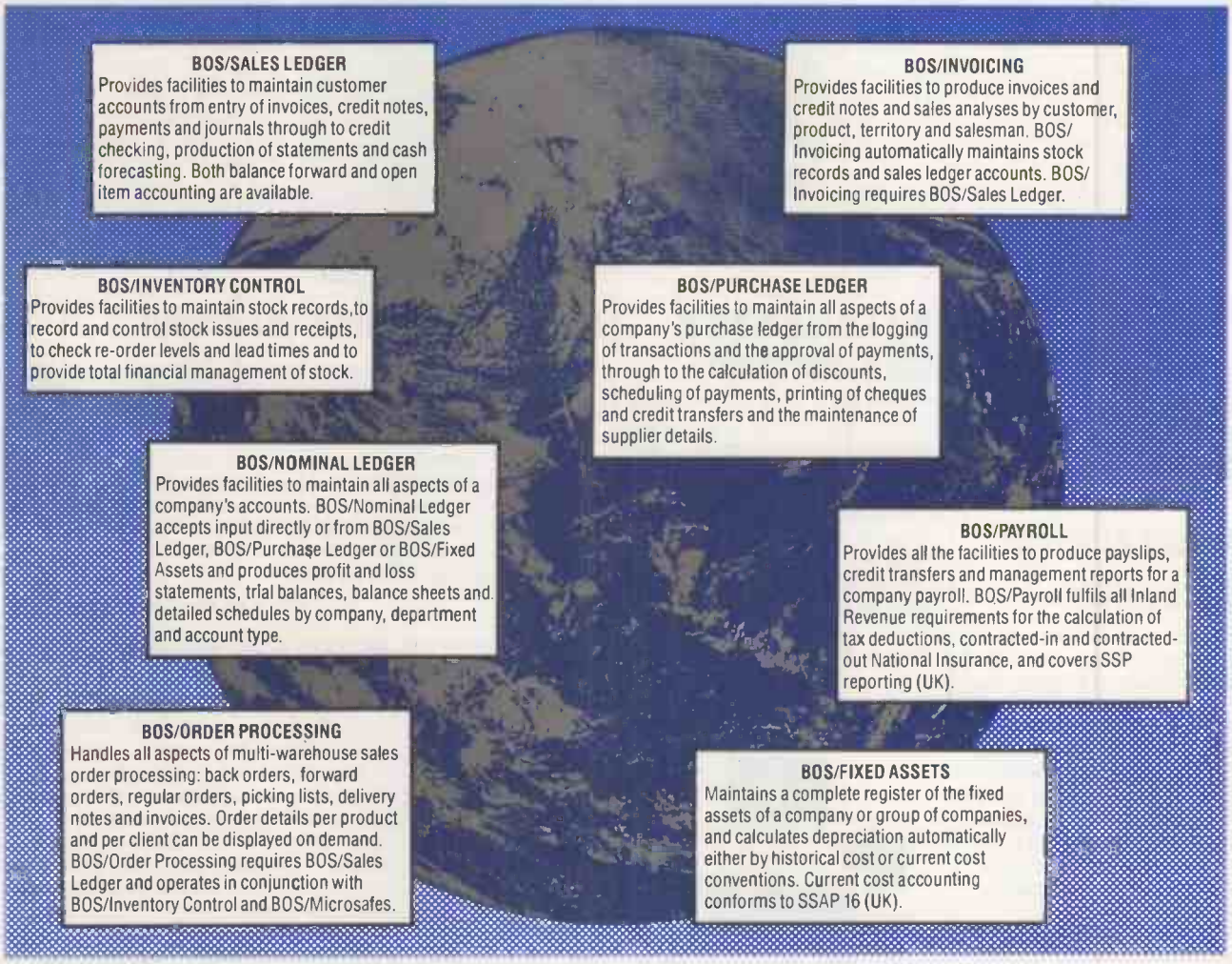

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BUSINESS OPERATING SOFTWARE

Name

Company

Type of Computer

PC 1083

● **Circle No. 146**

PC dongles from Wordcraft

WORDCRAFT SYSTEMS first developed its dongles for Commodore and, later, Sirius micros. Now it has a version for the IBM PC. It fits into the parallel printer port — providing another port for your printer — and contains code without which your software will not run. On the good side, at least the system allows you to make security copies.

PC dongles cost £15, which is somewhat more than the £2.50 for the Vic-20 version. The minimum order is 100 so you cannot get a sample from Mike Lake, Wordcraft Systems, Oak Lodge, Farley Road, Derby DE3 6BW. Telephone: (0332) 683892.

Maximum expansion from Legend

LEGEND has introduced an expansion card which will support up to 768K of directly addressable dynamic RAM, in either 64K or 256K segments. The card maps round the address space are already used to provide the maximum possible, 1Mbyte.

Contact Legend Industries, 2,220 Scott Lake Road, Pontiac, Mi 48054. Telephone: (313) 674 0953.

0.5 Mbyte going cheap

ENCOTEL is now importing the Profit Systems RAM expansion card, which provides an extra 512K for £445. PC-DOS 2.0 is included free.

Contact Encotel Systems, 7 Imperial Way, Croydon Airport Industrial Estate, Croydon, Surrey CR0 4RR. Telephone: 01-686 9687/8

Addressbook

DECISION TECHNOLOGY has adapted its well-known Addressbook program for the IBM PC, with an XT version to follow. It is said to be easy to use and costs only £90. A WordStar interface is provided for use with Mailmerge.

Contact Decision Technology, 7 St Johns Road, East Molesey, Surrey KT8 9JH. Telephone: 01-979 5533.

KPG Hardware House is the distributor of the IDE Associates range of PC disc sub-systems. Latest products are a 3.9in. 5Mbyte removable cartridge system. Either can be fitted into a standard PC in place of an existing floppy drive, or into an external expansion unit. Installation is said to take 15 minutes. Contact KPG Hardware House, 578-586 Chiswick High Road, London W4 5RP. Telephone: 01-995 3573.

Front end revelation

REVELATION is the name of a Pick look-alike front end to PC-DOS, which is useful if you have the PC linked to an IBM Series/1 super-mini running a full version of the Pick operating system. It turns the PC into a minicomputer terminal, with access to a wide range of software, while retaining the ability to run packages under MS-DOS. A new application generator, Appgen, can be run under Pick or under Unix, providing a bridge between the two systems.

Contact Interactive Data Machines. Telephone: (0302) 786677.

Pearls of wisdom

THE SYSTEMS generator Personal Pearl has now been released in a version for the IBM PC. It not only runs under PC-DOS but also under CP/M-86 and Concurrent CP/M. Pearl is a relational database that outputs ASCII files for use in word processing and links to the Supercalc spreadsheet package. It uses the IBM's function keys, and costs £190. Contact Pearl Software, 12 Christchurch Road, Bournemouth BH1 3LD. Telephone: (0202) 20692/3.

Graffcom has been rewriting its 8080/Z-80 machine-code packages in 8086/8 code to make full use of 16-bit CPUs. The new range, designated 2020, includes word-processing, financial-planning and Configurable Manager packages. The series has just been implemented on the IBM PC. Contact: Graffcom Systems Ltd, 102 Portland Road, London W11 4LX. Telephone: 01-385 9422.

Micropro, the publisher of WordStar, now has all its software available on the PC. The latest offerings are CalcStar — improved to offer 1,300 cells — and InfoStar WordStar, SpellStar and Mailmerge are, of course, already familiar under PC-DOS. Contact Micropro International Ltd. Telephone: 01-487 5728/9.

The Strategist

ASHTON TATE, author of dBase II, has launched a new financial package called the Strategist. After you enter 31 key business assumptions, the program tells you if your proposed project will succeed or fail. The information is presented as 44 graphs and three detailed reports. Results can be sent along to dBase II. Contact Skye Quin at Ashton Tate (U.K.) Ltd. Telephone: (0908) 568866.

Edison on PC

THE EDISON portable software system runs on a PDP-11/23 minicomputer, and now also on the IBM PC with 256K of RAM. Edison is a Pascal-like language.

The Edison system includes an operating system, compiler, screen editor, text formatter, print program and assembler. For more information read Per Brinch Hansen's book *Programming a Personal Computer*, published by Prentice-Hall.

Contact Per Brinch Hansen, Computer Science Department, University of Southern California, Los Angeles, Ca 90089.

IBM XT

In the third part of our review, Jack Schofield looks at the operating system, which may not be so easy to get used to. The hard disc and PC-DOS version 2 demand a high level of literacy.

IBM'S MAIN marketing thrust of the Personal Computer has been at presenting it as user friendly. Indeed, the twin-floppy version is easy to use compared with most previous small business micros. This is due to PC-DOS, the IBM version of Microsoft's MS-DOS, and the high quality of much PC software. While PC-DOS is no one's idea of the perfect operating system, it is easier to learn than CP/M. However, with the hard disc version of the IBM PC, the XT, and the essential PC-DOS version 2 the system moves to a higher level of difficulty.

There are several reasons for this. First, DOS 2 has more commands and is inherently more complex than DOS 1; it is not just bigger. Second, controlling the hard disc requires a much more organised approach to keeping files and back-ups. Third, very little current software has been written with hard disc operation in mind. The result is that the IBM XT is currently a much less viable option for the newcomer to computing. At the very least, the typical XT user will require a higher level of dealer support, and greater personal commitment.

This is not because of the hard disc itself, which is big, fast and in principle works just like a floppy. It also takes up the same amount of room but it has two platters, giving four surfaces for data storage. Each surface has 306 tracks of 17 sectors, compared to 40 or 80 tracks on a single- or double-sided 5.25in. floppy. The total storage is thus about 10Mbytes, which is the equivalent of 32 of the 320K standard floppy discs. Access time, the time to read an item of data, is up to 10 times quicker.

IBM does not disclose the manufacturer of the fitted hard disc; likely sources are Seagate Technology of California and Miniscribe Corporation of Colorado. When the XT goes into production in Scotland in November there may be an opening for a Scottish disc. The disc in the XT supplied for review offered initial formatted storage of 10,592,256 bytes or 10,344K. Even after copying on the DOS 2 system files there was more than 10Mbyte free. Such information is very simple to

discover using the ChkDsk utility from DOS, which lists hidden files like DOS.SYS and IO.SYS separately.

The main new commands in DOS 2 are Assign, Backup, Break, Cls, Ctty, Echo, If, For, Shift, Goto, Graphics, Mkdir, Rmdir, Chdir, Path, Prompt, Recover, Restore, Set, Tree, Ver, Verify and Vol. There are four new characters, <, >, | and \. Also some of the existing DOS commands have been enhanced, mainly to cater for hard disc operation.

Backup has been added to allow the contents of the hard disc to be copied to floppy discs, since IBM do not have any kind of tape streamer or cartridge to do this. The simple command Backup C:\ A:/S backs up all the files on C, including those hidden in subdirectories. DOS makes a note in the directory whenever it writes to a file, so the \M parameter is provided to back up only those files which have been modified since the last back up was done. DOS also keeps time and date records, so the \D parameter is provided to back up only those files created after a certain date. That will make you wish you had entered the date every day when booting PC-DOS. In all cases, Restore is used to copy the files back onto the hard disc. In most other respects Backup seems to work like the usual Copy command.

In general the new commands make using DOS 2 much more like using a language than using an operating system. The user is involved in numerous little bits of programming using Copy.Con, an abbreviation of copy from console, to create a file which sends commands just as though they had been typed in at the keyboard. Thus it is the equivalent of Submit in CP/M. Copy.Con is used to create Autoexec and other batch files which enable programs to be customised, so they can be run by inexperienced users. With the Echo Off command the process can be made invisible. Variables can be included using the % sign. Using Goto, For, To, and Cls to clear the screen, it is not unlike programming in Basic except that the system provides virtually no help with debugging.

Most of the other new commands are connected with the provision of tree-structured files, through which DOS 2 is made to resemble Unix — specifically, the Microsoft version called Xenix. The idea is to divide the hard disc into a series of directories, created by typing Md or MkDir for Make Directory. This directory then contains files or sub-directories, which in turn contain files, and so on down through as many levels as you require. The only limitation is that the Path must not be more than 63 characters long.

You start in the root directory but can change to a subdirectory by typing Cd or ChDir for change directory. Typing Dir at the root level lists only files in the root directory and sub-directories, which are identified by <DIR>. Typing Dir inside a sub-directory lists only files in that directory and the names of sub-sub-directories. The root directory is then effectively invisible to the system. The particular directories and files in use can be specified by the Path command. Thus it is simple to set up a password system where the password takes users only to their own set of files, so several different users could use the same machine.

For example, the root directory could contain half a dozen .Bat files for main applications such as word processing, financial planning, etc. Selecting one from a list Echoed to the screen, then typing a name or password could take the user into a directory containing only their own files for

(continued on next page)

```
C>COPY CON:LOGON.BAT
ECHO OFF
CLS
ECHO YOUR PASSWORD IS BEING CHECKED
IF %1==JACK GOTO A
ECHO ACCESS DENIED. GET LOST!
ECHO OFF
GOTO END
:A
ECHO PASS, FRIEND
ECHO ENTER YOUR COMMAND
ECHO A = WORD PROCESSING
ECHO B = MULTIPLAN
ECHO C = STRIP POKER
:END
^Z
        1 File(s) copied
```

Listing 1. A PC-DOS program which shows how you might write password system. Typing Logon Jack offers a slection of programs in a menu, whereas Logon Fred results in a Get Lost message. With more users the variable %1 would have to be compared with other possible entries. Also, it would have to be an Autoexec.Bat file and not send unwanted users straight into the system at :End, but this is just for illustration. Note that three more files have to be created, A.Bat, B.Bat and C.Bat, to run the programs from the menu. Listing 2 changes the directory to MP\JACK and runs MultiPlan, MP.

```
C>COPY CON:B.BAT
CD\MP\%1
PATH\MP
CD
MP
^Z
      1 File(s) copied
```

Listing 2. This routine changes the directory to MP/JACK and runs Multiplan, MP.

Specification

SYSTEM
CPU: Intel 8088 HMOS pseudo 16-bit running at 4.77MHz
Memory: 128K of RAM expandable to 640K; 40K of ROM with socket for expansion to 48K
Discs: single 5.25in. mini-floppy with 360K of formatted storage, plus 10Mbyte Winchester hard disc
Features: 62-pin expansion slots for six full and two short expansion cards, but four slots are required to run basic system.
Interfaces: cards for mono display/parallel printer and asynchronous communications supplied as standard
Dimensions: 500mm. x 410mm. x 124mm.

DISPLAY
Type: 11.5in. green phosphor screen with brightness and contrast controls
Display: 25 lines by 80 characters
Dimensions: 380mm. x 350mm. x 280mm.; 7.9kg. weight

KEYBOARD
Type: two-tone Selectric-style qwerty with 85 sculpted keys, including 10 function keys and 10-key cursor control/numeric keypad
Features: Intel 8084 microprocessor control including 2K of ROM, 20-key buffer and n-key rollover; legs to provide tilt.
Dimensions: 500mm. x 200mm. x 57mm.; 2.8kg. weight.

PRINTER
Type: 80cps. graphics nine-pin dot-matrix printer, Epson MX-80, with parallel interface
Features: tractor feed; range of print styles; stylish perspex stand is optional extra but recommended as it keeps the cables out of the paper feed
Dimensions: 374mm. x 305mm. x 107mm.; 5.5kg. weight

SOURCE
Manufacturer: IBM, available via dealer network
Contact: IBM United Kingdom Ltd, North Harbour, Baltic House, Portsmouth PO6 3AU

(continued from previous page)

that particular application. The Path structure might then be something like

Path\Multiplan\Accounts\Fred

Fred would avoid all confusion with similar files created by Jim in Sales, whose directory would be found by

Path\Multiplan\Sales\Jim

The program can even include If Exist, to see if a file or directory exists, and MkDir to create a sub-directory, for example, for a new user, if it does not. But this is not really a multi-user system nor multi-tasking, and would not meet any company's idea of security. The line "Echo Oh dear, someone erased your file" might well come in useful.

Setting up the system obviously involves a lot of messing about with directories, but fortunately DOS 2 provides facilities to do this. For example, Dir|Sort will produce a directory which is sorted into alphabetical order. Dir|Sort > JimFiles will create a file called JimFiles and pipe the sorted listing to it. It can then be displayed on the screen using Type, or printed out. Numerical sorts can be done, and Dir|Sort/25 will sort files into chronological order, that is, by the 25th column which holds the date.

But operating DOS 2 is not all plain sailing, and the Path instruction proved to be a problem in practice; the system will operate happily inside a sub-directory, but will not fetch files from outside it. According to the manual, specifying a Path such as

Path\Multiplan; \Multiplan\Jim; A: \Sales

should send DOS to look in the current drive, C, then into the Multiplan subdirectory, then into Jim's Multiplan subdirectory, then to drive A, until it finds the file it is looking for. Whether I am misreading the manual or simply failing to observe the incredibly tortuous syntax I do not know, but I cannot make it work.

When running commercial software the Path command seems to be totally ignored by DOS 2. Multiplan is one of the few programs that runs happily from the XT hard disc. The Trendtext/2 word processor gave problems by booting from C but then going to drive A for all subsequent files. The program as configured would not even accept C: as a drive identifier, so not even text files could be saved to the hard disc. TK! Solver, reviewed in our August issue, is copy-protected so it has to be run from floppy drive A anyway. However, it refuses to recognise the existence of drive C, no matter how configured. The only way round it is to Assign C to be B — no fun.

Tomorrow's Office is supplied on six floppy discs which makes it a strong candidate for hard disc operation, otherwise you have to change discs the whole time; at its launch the program was demonstrated on the IBM XT. Again, however, the early review sample supplied proved impossible to configure for the XT in our office. Even when it could be instructed to look through C for files known to be on C, the program would hang up while waiting for the user to insert a disc in drive C.

Inserting a floppy into the IBM hard disc is not a pastime to be encouraged, and Sosoft has responded with an improved version of the product to match the XT. However, not every company is likely to meet the challenge quickly, and not every software package will be easy to change. The Bristol Software Factory, producers of Silicon Office, has complained publicly about the situation. In the weekly trade publication *Computing*, August 4, Mike McDonald said he suspected there was a hardware difference in the interface with the machine's operating system which gave difficulties.

So while some programs can be run from one drive some, like Context MBA, require two drives and cannot be run at all. In any event the most likely result s that the poor user who pays out a large amount of money for permanent ownership of an XT ends up with a single-floppy micro with a built-in 10Mbyte back-up disc.

Obviously this situation is going to change. IBM can currently sell XT's faster than they can make them and a queue is building up outside the sales department. The potential for software sales is immense, and the supply will arise to satisfy that demand. However, it does mean there is little benefit for the ordinary user in being near the head of the queue.

In the long term the XT looks like a winner. The average small-business micro user will find that the ergonomic excellence of the IBM XT, the generous 256K of RAM, and the vast capacity of the hard disc a real boon. Switching from an ordinary eight-bit twin-floppy CP/M machine to the XT is like going from a Metro to a Mercedes. Both get you from A to B but there are differences in style, comfort and convenience, as well as cost.

It is a kind of comfort and convenience that most serious users plan to get used to. With the cost of hard discs dropping significantly at the moment, and with the mass of software and add-on accessories becoming available for the IBM, the XT version looks very much like being the Apple II of the next five years. It is hard to think of a higher compliment than that.

Screen display which results from running the logon batch file.

```
YOUR PASSWORD IS BEING CHECKED
PASS, FRIEND
ENTER YOUR COMMAND
A = WORD PROCESSING
B = MULTIPLAN
C = STRIP POKER

C>CHKDSK
Volume JACK          created Jan 1, 1980 12:04a
```

Screen display from running the check disc utility for hard disc C.

```
 10592256 bytes total disk space
    28672 bytes in 3 hidden files
     4096 bytes in 1 directories
   708608 bytes in 89 user files
  9850880 bytes available on disk

   262144 bytes total memory
   237328 bytes free
```

Conclusions

● The IBM XT with monochrome monitor and printer represents a well designed and well integrated system, which has great versatility and no obvious bugs. Ergonomically the system is outstanding.

● The keyboard has an excellent touch, but the placing of four or five keys may create problems for some people.

● Personal Computer DOS 2.0 is larger, more complex and more sophisticated than the previous versions. It is harder to learn, but the facilities offered will repay study. Many DOS 2 facilities are usable on twin-floppy machines as well as on the hard disc version reviewed.

● DOS 2 offers a learning path and an upgrade path into Xenix, the Microsoft version of Unix.

● Basica has been enhanced for the XT, and again the extra facilities are available to non-XT users. The language is not particularly fast or powerful, but contains an enormous number of commands.

● The XT hard disc requires a lot of effort to organise, but after that should prove trouble free in operation. That there is no alternative to backing up onto floppy discs is to be regretted.

● The system as reviewed, with 256K of RAM, graphics printer plus stand, and all cards and cables costs £5,200 plus VAT from IBM Retail Centres. This makes it good but not exceptional value. However, as the price drops over the coming years the XT could well become the standard small-business micro.

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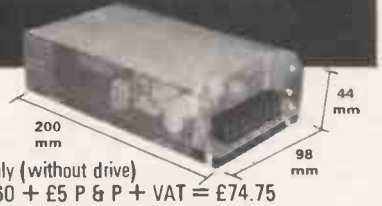

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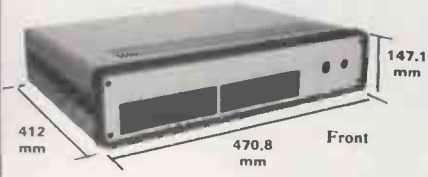

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LOGICA VITESSE

Chris Bidmead reviews a 16-bit micro from a leading U.K. manufacturer, which is also sold as a dedicated word processor and under the Merlin label by British Telecom.

THE VITESSE from Logica is a good-looking relatively simple 8086 micro-computer that comes in a pleasantly designed cream box measuring 34cm. by 46cm. and standing 25cm. high. This main unit holds the processing electronics and a pair of sensible capactiy 592K mini-floppy drives. The tiltable screen and its keyboard are packaged as separate modules.

The illuminated main power switch is on the front panel of the processor unit; after switching it on and waiting 10 seconds the screen comes alive with the single prompt

Disk

and a symbol of a rectangle and a backward-pointing arrow. The same symbol is used on the keyboard to identifiy Carriage Return. With a system disc in drive 1, hitting Carriage Return — or any other key — triggers the CP/M-86 boot sequence. There is no debugging PROM monitor below operating-system level.

In most implementations of the eight-bit progenitor, CP/M-80, the operating system is small enough to fit on the outermost track, track 0, of a floppy disc. The first few bytes of track 0 will be a very simple loader routine supplied by the hardware manufacturer to read in the rest of the system track and make sure it is placed correctly in RAM.

CP/M-86 works in a very similar way, except that the operating system is too large to fit on a single track, and is therefore represented by a file called CP/M.Sys. It still needs a loader on booting up, which is kept on track 0 as in the eight-bit version. ROM initiates the loader, the loader fetches CP/M.Sys and then the system is booted.

As far as I know all CP/M-86 implementations work like this, and MS-DOS is similar though its system software is split across several files. The working of the loader is worth mentioning, however, because one of my main criticisms of this machine centres around this point.

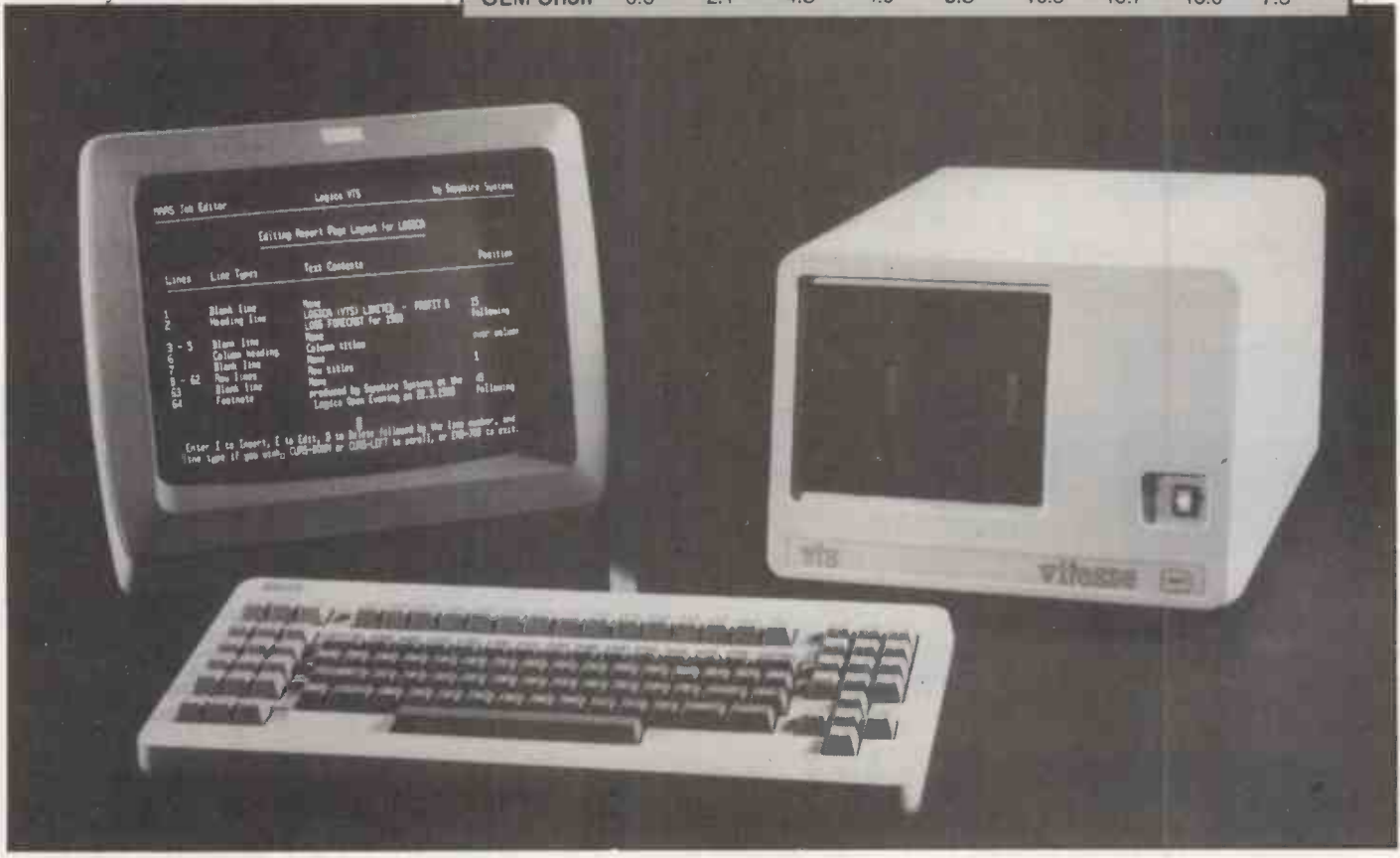
The system disc supplied by Logica has only two files on it, CPM.Sys and a file called CPM.H86, which turns out to be a hex version of CPM.Sys. It serves no function, and I am baffled as to why Logica has included it and bothered to document its presence. It would be more helpful to have the rest of the standard CP/M utilities on the same disc, but for some reason they are supplied separately.

The keyboard is uncramped, with

Benchmarks

Running the standard bechnmarks on the Logica under Microsoft Basic-86 revision 5.22 revealed a relatively slow machine, considering it uses an Intel 8086 microprocessor like the speedy OEM Orion.

	1	2	3	4	5	6	7	8	Average
Logica VTS	1.8	6.2	13.0	13.5	15.5	28.9	44.9	35.0	19.85
Zenith Z-110	1.5	5.1	10.6	11.0	12.8	24.3	25.5	28.5	14.9
IBM PC	1.2	4.8	11.7	12.2	13.4	23.3	37.4	36.9	17.6
OEM Orion	0.6	2.1	4.8	4.9	5.8	10.5	16.7	13.0	7.3



height adjusters on the underside. The separate key clusters are well spaced out, and two shades of amber are used to differentiate the QWERTY keys from the function and numeric keys. Yet in practice the keyboard is less promising than it looks. Some crucial keys are in odd places: the Control key is on the right-hand side, the Backspace is on the left-hand side, and marked Erase Char, and there is a key called Back Tab where you would expect to find a Backslash.

The top row of the QWERTY keys present a confused appearance, their tops being engraved with three characters rather than the usual two. On some of the keys the additional character is generated by holding down the Special key, but on others the connection between the key top and generated character appears to be arbitrary. The useful feature of Caps Lock is provided to hold alpha characters in upper case without shifting the other keys. It is a common enough feature on computer keyboards, and is usually implemented on a single On-Latch/Off key. On the Vitesse you have to hold down Special and "." to set alpha lock and Special and "." to release it.

Some of the keys carry mnemonics that are valid in the context of CP/M: Clear Cmd sends Control-Z to cancel the command line, Retyp Cmd sends Control-Re, Scrll On/Off sends Control-S. But many others are inscribed with names like Col Retrn, Mode Lock and Erase Word that bear no relation to the operating system or the software provided.

The handily placed array of 12 function keys are unimplemented, beeping at you if you if you try to use them, and the cursor keys send out control codes that are echoed on the screen to no very good effect. This last point will come as no surprise to CP/M veterans but, with the IBM PC and so many other new-generation machines offering cursor keys that remain meaningful at operating-system level, would-be customers are going to need some swift sales patter to smooth the rough edges.

The large 15in. amber screen is stable, very easy to read and definitely the best feature of the hardware. It operates in two modes. One is plain and simple with 24 lines by 80 columns while the other offers a message line at the top of the screen, reducing the work area to 22 lines by 80 columns.

The message line carries information about the status of the printer, the position of the cursor and — a useful touch this — translates the current I/O byte into the mnemonics used by Stat and Pip. Thus it keeps you permanently informed about the logical-to-physical I/O linkages.

Ideally the message line would be controlled by dedicated hardware in the monitor, as with the more sophisticated serial terminals like the Cifer range, but on the Vitesse it is a software emulation. Switching it on, using the dedicated SCN Switch key, involves a warm boot of the operating system. If you hit this switch while inside an applications program to see whether the printer is ready, you will be disappointed to find yourself back at the CP/M command line.

The review system arrived with discs for Micromodeller and Mars but no documentation for these programs. Despite repeated promises that the manuals were on their way there was still no sign of them by press day. A more serious disappointment was the absence of Wordsworth, Logica's own word processor, scheduled as the main feature of this review but withdrawn by Logica at the last minute as not yet ready for exposure.

Digital Research's complete documentation for CP/M-86 was provided, along with provisional documentation for Microsoft's MBasic. This language is now effectively unsupported under CP/M due to the internecine strife between the two operating-sytem vendors.

One improvement CP/M-86 offers over CP/M-80 is the provision of a Help utility that explains how the various CP/M routines work. Logica salesman are going to have to do some more smooth talking to explain why Tod, the standard date and time utility documented within Help, is nowhere to be found on the utilities disc, Copydisk is explained there too:

Copies all information on one disc to another disc, including the CP/M system tracks if they are present on the source disc . . .

"System tracks" includes the vital loader on track 0 I mentioned earlier and that brings me to my main objection to Logica's approach.

Digital Research recognised very early on that, one valued aspect of the microcomputer, unlike the main-frame, was the user's maximum independence from the manufacturer. In this spirit, CP/M routinely comes with a set of utilities to create new versions of the system on blank discs. One of these is Sysgen, the system-generation utility. Another standard way of creating new system discs is by using Copydisk, directly transferring all the tracks, including track 0, from one disc to another.

As with Tod you will look in vain for Sysgen and Copydisk among the CP/M utilities offered with the Vitesse. Instead there is a utility called Backup, a track-to-track copier written by Logica that expressly omits transferring track 0. Logica is allowing you to create data discs and copy them, but has gone out of its way to make sure you will never be able to generate new system discs.

This is a mainframe marketing strategy designed to tie the user closely to the manufacturer. Readers of this magazine will have picked up the feel of the micro world enough to know that this is not what micros are about. I hope no amount of saleman's rodomontade will persuade them otherwise.

With such an extensive choice of dual-floppy micros available, customers can avoid this problem very simply. If they stay away from the Vitesse on this account Logica can hardly complain. The company might even be grateful — that way it can be absolutely sure nobody is copying its treasured system discs.

Let's hope Logica quickly changes its mind and falls in with the more neighbourly behaviour adopted by the majority of micro manufacturers. It would be a pity if such an amiable machine, with a large friendly screen and a fast, true 16-bit processor were given the cold shoulder on account of an old-fashion, misapplied marketing ploy.

Specification

SYSTEM
CPU: 8086 true 16-bit processor
Memory: from 64K to 516K; review model had 256K
Discs: twin 5.25in. 592K drives; literature suggests the intention to offer IMbyte drives
Interfaces: Centronics; optional RS-232C
Dimensions: 34cm. × 46cm. × 25cm.

DISPLAY
Type: 15in. orange phosphor
Display: 24 lines × 80 characters with 22 line option; seven-by-nine dot matrix, reverse video, bold, underline
Dimensions: 35cm. × 37cm. × 38cm.

KEYBOARD
Type: detached, international standard full QWERTY pad
Features: Calculator-style numeric keypad with 18 keys; 12 programmable function keys, disabled
Dimensions: 48cm. × 20cm., height adjustable

Manufacturer: Logica VTS Ltd, 86 Newman Street, London W1A 4SE. Telephone: 01-637 5171.
Price: £2,490 for 64K system

Conclusions

● The Logica Vitesse has been developed from the company's dedicated word-processor the VTS. The development is still in progress, and at the moment the system presents some rather ragged edges.
● The hardware looks good and is pleasant to use. The screen in particular is large, with very legible orange characters.
● The operating system is an incomplete version of CP/M-86, a historic piece of software that has not really seized the opportunities offered by the 16-bit environment. MS-DOS 2 and Concurrent CP/M have been available to OEMs since January. MS-DOS 2 would seem to be a natural choice, as Logica is the U.K. guardian of Microsoft's Xenix.
● Following in the leaden footsteps of Dec, Logica is apron-stringing its customers by withholding the facilities for creating system discs.

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1983
THE QUEEN'S AWARD FOR TECHNOLOGICAL ACHIEVEMENT

ELECTRON

Acorn's long awaited Electron is here. It is smaller and cheaper than the BBC Micros, but the machines have a lot in common. Neville Maude thinks it should do well.

A Welcome tape is provided which follows the BBC Micro style. It includes Polygon; Island, where the waves move; and Draw, the horizontals and verticals are fine, diagonals difficult, and curves almost impossible.

Specification

CPU: 6502A running at 2MHz
Memory: two 16K ROM/EPROM chips plus 32K of RAM from four chips
Keyboard: 56 typewriter keys in QWERTY layout
Ports: UHF TV, video, RGB monitor and cassette ports; expansion bus
Features: colour graphics and sound; number keys used as function keys; optional single-key Basic keyword entry; user-definable characters
Notable ommissions: BBC Mode 7; no joystick ports
Power supply: separate, 19V 14W
Dimension: 343mm. × 159mm. × 57mm.
Origin: assembled in Malaysia for Acorn Computers, Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN
Price: £199

Technical details

The 6502A processor runs at 2MHz when accessing ROM, but in the Electron at 1MHz from RAM. This is because the RAM is in four 64K by 1-bit chips, for cheapness, so every access needs two operations.

In modes 0,1 and 2 the RAM access of the video part of the ULA is interleaved between the 6502A access. For 40μs out of 64 the processor is out of action. In mode 3 the processor is running full speed on alternate lines. In modes 4, 5, and 6 it runs at 1MHz all the time it accesses RAM. Hence a program taking 10 seconds on the BBC in all modes can take on the Electron about 43secs in modes 0,1, and 2, about 34secs in mode 3, and 20secs in modes 4,5 and 6.

A trick is to draw graphics by shifting the Electron into its faster modes during the drawing period and then back again. The screen display will be somewhat strange during that period but become normal at the end.

The ULA register of mode is in &FE07, a write-only register, and the operating system uses &0283. So program inserts could be something like:

```
500 DEFPROCquick
510 ?&FE07 = &B0
520 ENDPROC
  (PROGRAM)
900 DEFPROCslow
910 ?&DE07 = ?&0282
920 ENDPROC
```

Of course, this does not help to speed up programs where the graphic display is used not just drawn, but It helps with those like Persian, in both manuals, where one looks at the results. Times for this are about 34secs on the BBC, 50secs with Procquick on the Electron or 105secs unaided.

THE ELECTRON is small, neat — less than half the size of its ancestral BBC Micros. The finish, including keys, is light cream and mainly plastic which contributes to its light weight.

The mains transformer, 19V 14W, is separate and has an integral three-pin plug, which is rather large, 3.5in. by 2.5in. by 2.65in., excluding prongs. This can cause problems with some switched sockets or double sockets when two plugs are being used. The advantage of having only low voltage reaching the computer is obvious, especially for children, there is also no heating problem in the main casing. The transformer appears to have a thermal overload cut-out — a good idea.

The nominal RAM is 32K, which is not immediately apparent from the instruction books. If one asks the computer now much RAM is spare, with the standard phrase

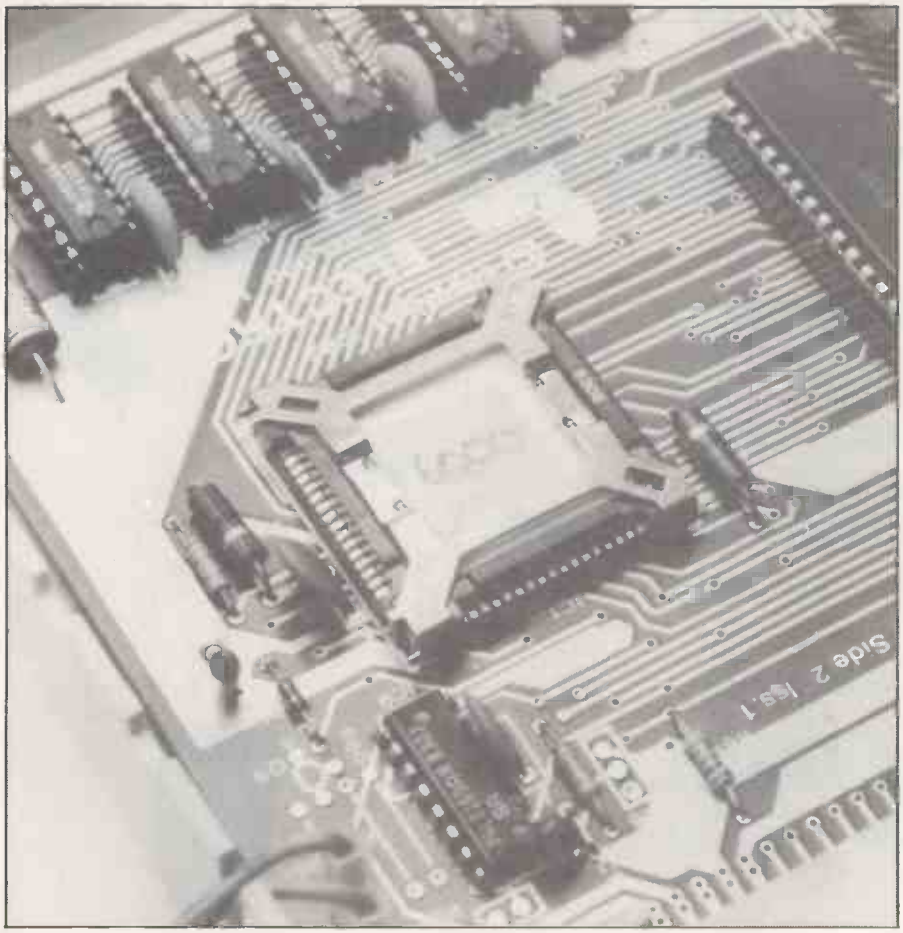
```
DIM P%:PRINT HIMEM – P%
```

the answer is 20,990. It is because the Electron does not support the teletext mode 7. The nearest is mode 6, see table, which needs about 8K as compared with mode 7 which uses 1K. Apart from this ommission the modes are the same as for the Model B, not the A — a real achievement in so low-priced a micro. The high-definition modes 0,1, and 2 need 20K as they do with Model B but this is unavoidable, for example, mode 5 permits 16 colours with 160 by 256 pixels. In general the graphics are outstandingly good though slower than the Model B.

The standard question to determine the operating system with these micros is *Help and the Electron replies with 1.0 OS, not the latest 1.2. However, it is versatile with plenty of *FX commands. Indeed, there are a couple which the Model B does not have, namely *FX226 which sets the base number for Func A to P, and *FX227 which does the same for Func Q to /.

There are four sockets on the left of the computer, not the right as shown in the manual, and these are labelled underneath the case, UHF TV, video, RGB, cassette. The video socket is for a monochrome monitor and the DIN socket for the cassette player is for 1,200 baud, not alterable to 300 baud. There is also a multi-pin connector under the body, thoughtfully shielded with plastic in case anyone puts the micro on a metal projection. Presumably this will be used in conjunction with the first add-on for the Electron which is called the Elk. It is a general-purpose module to enable sideways ROMs, printer interface, games paddle sockets and RS-232.

Mode	Characters	Pixels	Colour	Memory
0	80 × 32	640 × 256	2	20K
1	40 × 32	320 × 256	4	20K
2	20 × 32	160 × 256	16	20K
3	80 × 25	TEXT	2	16K
4	40 × 32	320 × 256	2	10K
5	20 × 32	160 × 256	4	10K
6	40 × 25	TEXT	2	8K



The ULA is a major reason for the Electron being cheaper than the BBC computers.

The ULA is a large one, about 30mm. by 30mm. with 68 connections. It controls the colour palette and takes over the CRT controller action of the 6845 in the Model B.

But the Electron has no 6845, so there can be no sidways scrolling as used in games such as Planetoid. Internal timing is also taken over by the ULA, as is sound. This is less complicated than the BBC method. To allow reasonable compatibility between the two micros there are three tone channels and one for noise. However, only one tone channel at a time can be used on the Electron and the envelope is also more simple, most people will find it still complex enough.

If tested for speed using the statutary benchmarks the Electron runs about 30 to 40 percent slower. Arithmetical computations are the slowest but, since the BBC Basic is so fast the Electron is still doing well.

If one tries to load a BBC cassette into the Electron the the title page usually comes out as monochrome hash — not always. The main program generally loads but then runs like an arthritic snail, about 2.0 to 4.3 times slower than it should. The Electron does its best, for example, it interprets mode 7 as mode 6 instead of just stopping, and since it cannot implement the double-height BBC command for titles it just prints two identical normal-height lines. The programs on the Electron Welcome tape ran perfectly on the Model B, but at present it is not known if the versions of Snapper, etc., being rewritten for the Electron will be perfectly compatible on the Model B. As a very rough rule, programs for the BBC Micros will not work on the Electron unless altered; programs for the Electron probably will work on the BBC but may not take advantage of all BBC facilities.

The Electron keyboard is a real one, not rubberised plastic, an experienced typist reported that she was perfectly happy with it. The construction is a little cheaper than that of the Model B but is still good. The number of keys has been reduced and both the user-programmable keys and the cursor keys are combined with others. A function key may be used in conjunction with 29 keys to give Basic keywords. For example, Print may be entered in full or as P or Func P, so the Electron has the best of both worlds. There are two ommissions, Tab and the shift lock, but those who never had them will presumably not miss them.

In general the Electron keyboard is easier to learn than the BBC and considerable thought has gone into making it simple.

(continued on next page)

ELECTRON

(continued from previous page)

The programmable keys run from 1 to 9 and then 0, as distinct from the BBC 0 to 9 series. The change means that the numeric and f values are the same on the same keys. Only one definition can be put in each programmable key, not three as in old BBC. Small hands will find it easier to reach keys without stretching, a useful point since most Electron users will be young.

The Electron comes with a user guide, 290 pages, in a ring binder. It is smaller than the BBC one, partly because there is less to descibe but also because it is written more simply. Apart from not having an index it is a really superb book with better organised information than in the more detailed BBC manual. Those who have trouble with the BBC could try this volume as an alternative, if available separately, since much of the information is similar.

Another book supplied is *Start Programming with the Electron*; again this is excellent, much better than most other books written to help learning to program the BBC computer. One hopes the authors will produce a companion book for the BBC, otherwise this one will help to get started with both.

A Welcome tape is provided which follows the successful pattern with small improvements from experience. Some programs, such as Patterns, are much the same. Gomuku has come in from the BBC games of strategy cassette, Island is from Acornsoft's graphics book and others are new. A two metre coaxial lead is provided for connection with a television set, production machines will also have a lead for the cassette player.

Many comparisons have been made between the Electron and the BBC micro; unavoidable as the latter is a known machine and the two have so much in common. Nevertheless, in the market place the contest will be between the Electron and micros costing less than £200 — a crowded arena. The Electron should do well as it has many advantages over the present competition. Others will arrive, in particular there are Ataris on the way; the 600XL and 800XL should come in this price range and are said to be compatible with the vast range of existing software. It is not impossible for Acorn to reduce its price should it become necessary. Acorn's decision not to release machines to software houses prior to the launch is interesting. On one hand it gives Acorn about two months lead with its 10 or so cassettes which are the first to be converted, on the other hand software sells computers.

The Electron will go out to dealers and high street chains. Acorn projects sales of 100,000 by Christmas with W H Smith stocking it and then perhaps Boots. The Electron should carry BBC Basic into many more homes and it is anticipated children will use the BBC at school and the Electron at home. Curry is quoted as saying "The BBC is happy because they see it as support for the language, making it as standard as possible."

Conclusions

● The Electron is an excellent micro for the money. It is rumoured it will sell for £199. It is a little unfair to compare it with the Model B which costs more than twice as much.

● The Electron will sell well at the cheaper end of the market place and the first add-on module should be available almost immediately after the launch.

● The Electron is not a replacement for the Model A; the Electron cannot be upgraded to a Model B, as could the A. Even when all add-ons are available, which will make the cost higher than a Model B, the result will still be an augmented Electron, not a B.

● Backing will be good; books for the Electron have been written and a users club has been announced.

● The Electron has a good keyboard, colour, graphics and Basic plus strong connections in the educational field. It can be recommended as a first computer on which to learn, or as a step up from still cheaper types such as the ZX-81.

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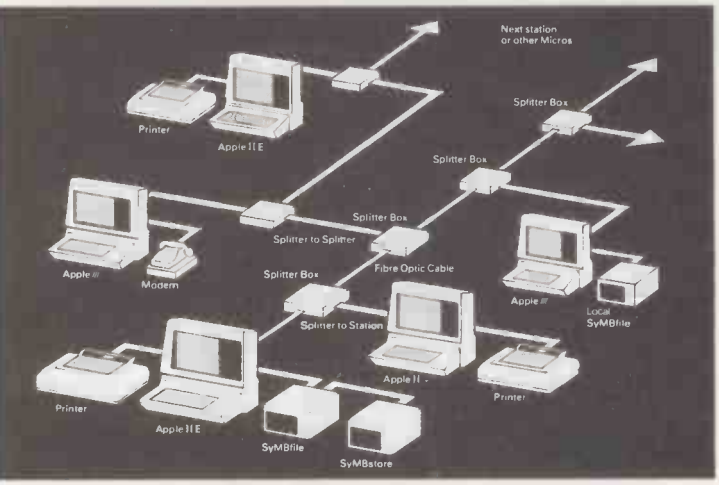

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Inside the Advance

An IBM look-alike for the price of a BBC — sounds too good to be true. Ian Stobie went along to check it out.

A 16-BIT machine built around the advanced 8086 processor with 128K of RAM and a modern business standard keyboard for £350 — less than the cost of a BBC Model B. An IBM compatible disc-based system with twin drives with WordStar, Mailmerge and CalcStar thrown in, for £1,200. These two systems from the North London-based company Advance Technology U.K. certainly have remarkable specifications for their price.

Both models, the Advance 86 Model A and the Advance 86 Model B, are scheduled to be launched in September. I had a look at pre-production versions and talked to some of the people behind the systems. What I actually saw was the electronics of the systems without production casing, and pre-production mock-ups of the casing the systems will be delivered in. Advance say September is when it hopes to be actually delivering systems to computer shops.

Externally the Advance looks like a modern business computer. The Model A comes in two units, a system box and a separate detached keyboard on the end of a cable. The Model B comes in a third box containing two disc drives and other goodies. This clips on top of the Model A system unit. So really there is no separate Model B, but rather an expansion unit which converts the Model A into a Model B. Model A users can convert to the disc-based system for £852.

The reason there are two models is to enable the Advance to address two distinct market slots. The model A is aimed at the kind of people who are buying the Commodore 64 and BBC computers.

The disc-based Model B is aimed at the same kind of people as the IBM PC itself, or people who are buying IBM look-alikes, or even eight-bit business systems like the Osborne which have some application software thrown in.

The Advance keyboard would certainly impress most home micro users. It is deliberately very like the IBM PC in layout, but to my mind there are certain improvements. The left Shift key has been moved to a more normal location next to the Z key, the Return key enlarged, the numeric keypad moved slightly to the right to separate it from the main keyboard.

The system box contains the main board with its 8086 processor and 128K of RAM. The box is large and flat and, in the mock up at least, is chocolate coloured. Looking at the electronics which goes in it, it could have been much smaller, but since the idea is to have the Model B expansion unit sit on top it makes sense to have both boxes the same size. When not in use the keyboard can be stored away inside the system unit, so the Advance will not take up too much space on a desktop.

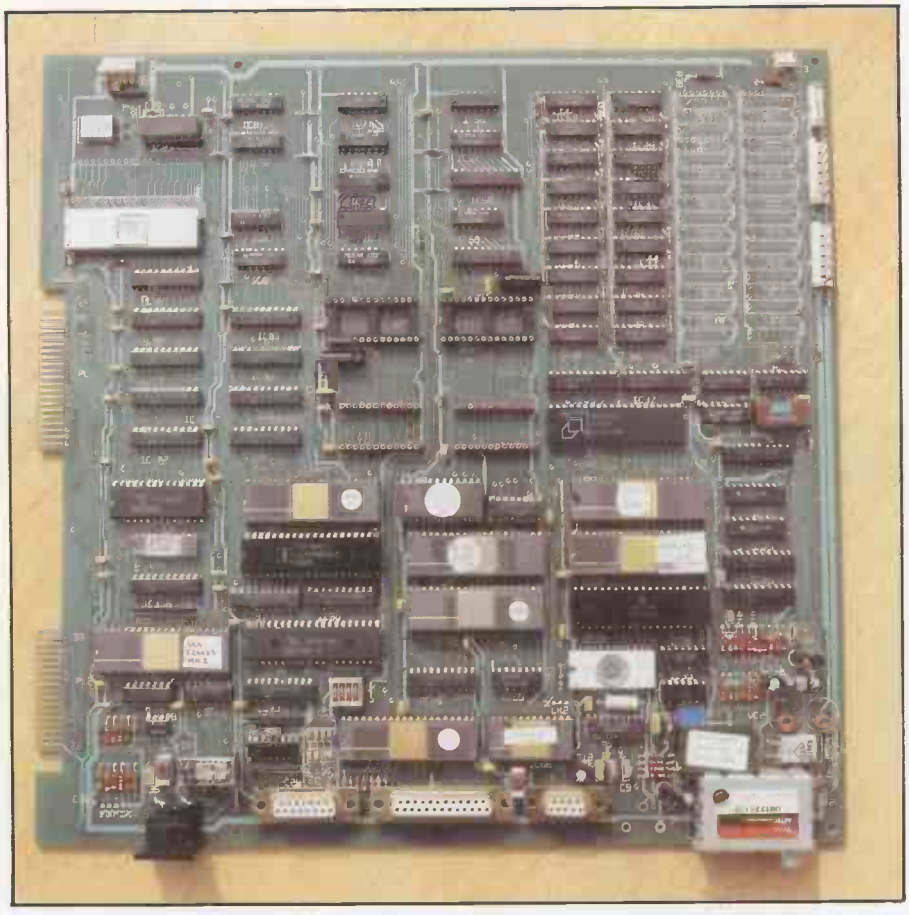
Even the entry level Advance Model A at £347.82, comes with 128K of RAM and this can be expanded on board to 256K. By home micro standards this is enormous. A further 16K of RAM is set aside for the display. The system can put out 25 lines of text in either 40- or 80-column widths, or do high-resolution grahics in up to 16 colours. No display device comes with the system but three different outputs are provided, for domestic TV, RGB monitor or composite synch. monitor. A cassette port is provided so programs and data can be stored using an ordinary domestic cassette recorder. The system comes with a joystick port and a Centronics-type parallel-printer port fitted as standard. The printer port in particular is worth having as connecting a printer to systems like the Commodore 64 or Atari can involve appreciable extra cost.

There is no separate Model B, an expansion unit converts the Model A into a Model B.

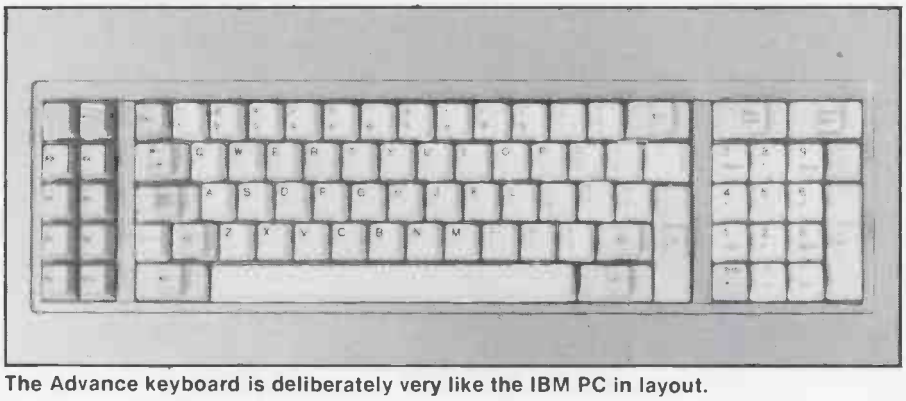
The Model A will run cassette-based commercial software; Advance say they will be marketing a range of titles. In the United States though not in Europe an entry level cassette-based version of the IBM PC has been available, so there is some American software which should run on the 86 Model A. Advance say that with 128K of memory available it is possible for software suppliers to easily adapt many disc-based packages for distribution on tape; this obviously applies to programs which do not make disc accesses when running but are simply quite large.

The Advance's third unit, the Model B expansion unit, clips on top of the main unit. It is quite simple to fix and no external cables are involved. Once clipped together the two boxes are meant to be treated as one. The expansion unit contains another circuit board and two Shugart 5.25in. floppy drives, providing 640K of disc storage. The Advance's 8086 processor is capable of directly addressing 1Mbyte of memory, and with the Model B expansion unit RAM memory can be expanded up to 768K.

The Advance 86 Model B comes with the MS-DOS operating system, Microsoft GW Basic, an assembler, and three popular Micropro packages — WordStar, Mailmerge, and the CalcStar spreadsheet program. WordStar is the new version 3



The main board has an 8086 processor and 128K of RAM.



The Advance keyboard is deliberately very like the IBM PC in layout.

which has better documentation, horizontal scrolling — and it is in colour.

The man behind the Advance is Jack Dangoor, who is responsible for the overall design of the system and is managing director of Advance Technology U.K. Ltd. "Everybody thought I was absolutely loony when I said I was going to make an IBM look-alike, faster than the IBM with an enormous amount of memory — for the same price as the BBC." Jack Dangoor is no stranger to the consumer end of the electronic market; he has been in electronic watches for a number of years.

Advance Technology is a completely new company set up with private capital with the sole task of selling the Advance computer. It has taken a year and a half to develop and manufacture the system. The Advance core team is very small, consisting of Jack Dangoor and just three other people. "All manufacturing is contracted out. Advance only sells, nothing else. Once the order is taken it is passed on to the relevant manufacturer who delivers. There are four manufacturers, three are in the U.K. and one is in Japan." Each of these manufacturers is responsible for producing the complete system through to final assembly.

"At least 90 percent of sales will be abroad. Already sole distributers are being appointed on a country-by-country basis. Already there is a distributor for Japan." Jack Dangoor sees the system's IBM compatibility as its key selling point. "You can take a disc for the IBM and just bung it in and it works. As you know there is more software for the IBM now than for anything else. In fact, you can even add a card for the IBM into the card cage and that will work."

He does not anticipate any copyright problems over his system with IBM. "It has a different processor, it has a different memory architecture, it has a different ROM. It just happens to work the same way. The thing Advance has in ROM is purchased from Microsoft, the same as IBM did. All IBM proprietary work, which is also in ROM, was not copied"

According to Jack Dangoor, the Advance, with its 8086, is a good deal faster than the 8088-based IBM PC. "It is approximately 40 percent faster on average than the IBM. If you run certain games for the IBM, because the Advance is faster, it is more challenging." The Advance has an obvious price advantage. A working Model B system, with disc drives, Micropro software and a cheap monochrome monitor would work out at about £1,250. Jack Dangoor reckons the IBM equivalent would be about £3,400. He is confident that although people might be willing to pay an extra 30 percent for the IBM name, they will not pay that much. He thinks this kind of price difference for both the A and B models is crucial.

Jack Dangoor thinks that most British manufacturers tend to bring out machines and then sell them, for as much as they can get — the wrong strategy for long term success.

"I've been in electronic watches for eight years. If people think that computers are cut throat now they haven't lived. There were two ways with electronic watches. There were the people who made a watch for £100, and then gradually reduced to 95, 90, slowly, slowly, slowly; this to my mind is a typical British computer manufacturer. Then there were the other people: they brought out a watch for £10, and kept it at 10. And in the end they were the ones that won out."

He anticipates eventual competition even at the Advance's price level, but is not worried by the prospect. "The Advance just happens to be the first, and as you know that is everything in this business."

Conclusions

- **Both systems seem remarkably good value.**
- **Software for the cassette-based Advance 86 Model A system may be less abundant than for competing systems, like the Commodore 64 and the BBC micro.**
- **The 86 Model B is designed to run IBM PC disc-based software, which is very abundant. The software included in the 86 Model B price, especially WordStar and CalcStar, has sold widely and can be recommended.**
- **The Advance, especially the Model B, stands or falls on the claims made for it as an IBM compatible machine. It should be emphasised that we were unable to use the machine to check how far this compatibility goes.**

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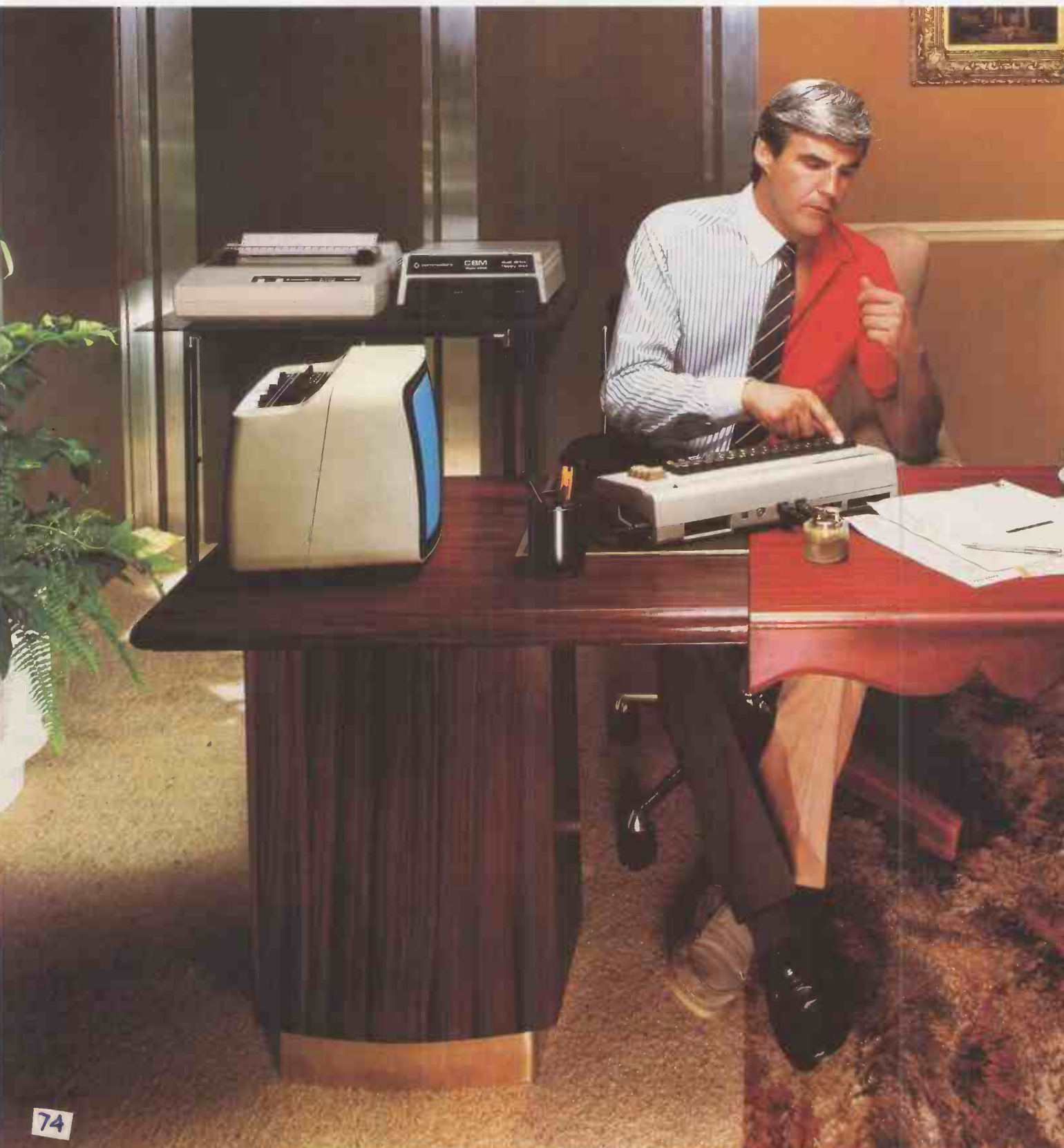

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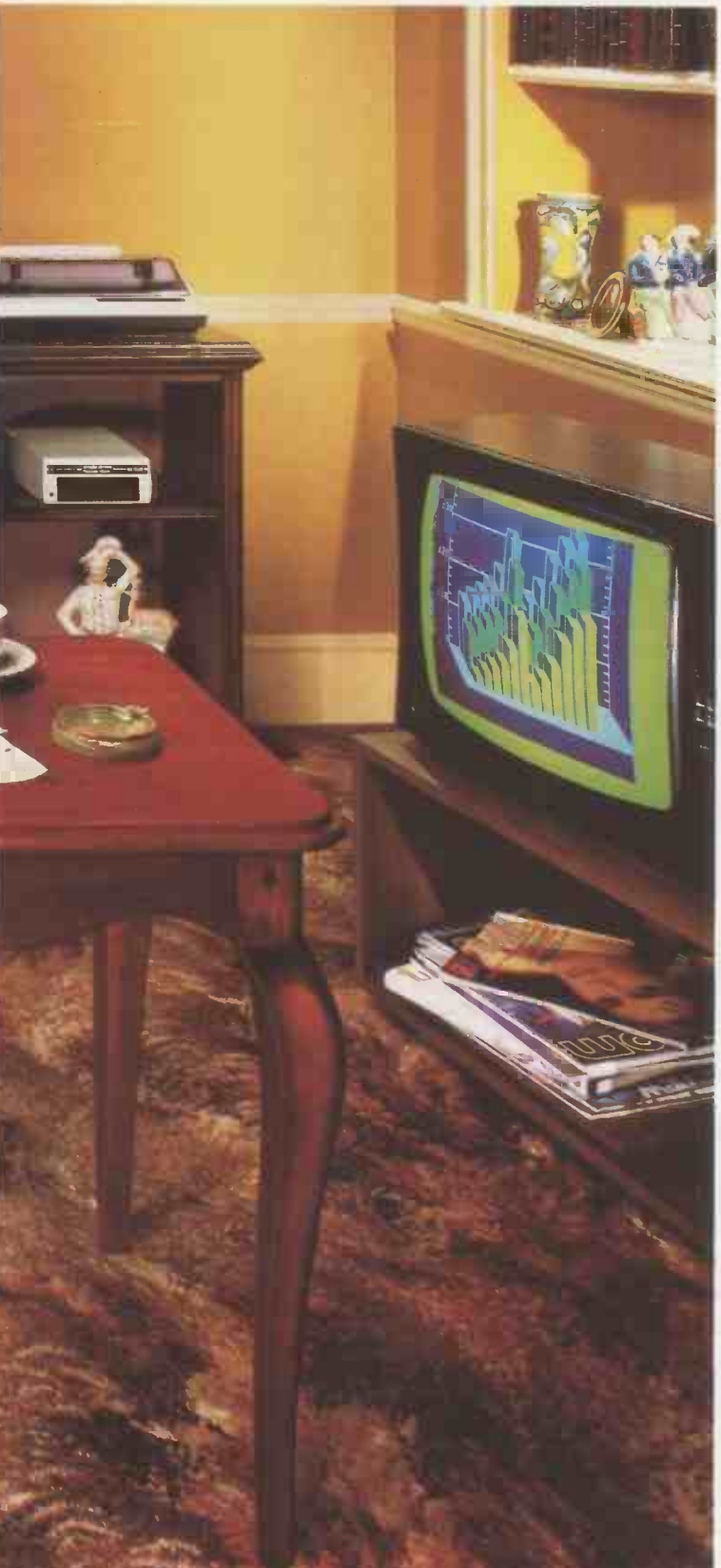

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CP/M's past

For all its popularity, CP/M could hardly be described as elegant. John and Timothy Lee look at what makes it so annoying to use, and find out how many of its faults have been eliminated in the new version, CP/M Plus.

MICROS have now been with us for a decade, during which the CP/M operating system has become the *de facto* standard operating system for eight-bit micros. It was originally written by Gary Kildall, a consultant to Intel, for use on his own Intel development system.

CP/M — the name is said to stand for Control Program for Microcomputers — was then developed and marketed by Digital Research for the Intel 8080 processor, and subsequently for the Zilog Z-80 and Intel 8085-based machines. By 1975 a growing number of microcomputer manufacturers had adapted CP/M to run on their hardware, and a large base of users began to form.

One important feature which made CP/M catch on was the provision of the program ASM. It provided the ability to write machine-code programs using mnemonics, rather than having to hand-code them in hexadecimal. Furthermore, such programs would run on any CP/M machine, making it possible for people to write programs like Microsoft Basic.

With the large CP/M market, programs could be sold at ridiculously low prices compared with the price of software for mainframes. In the early days a revolutionary word-processing program called The Electric Pencil held a position of dominance, though in recent years this spot has been taken by WordStar.

The availability of CP/M and its dependent software led to the widespread use of the Intel 8080 and Zilog Z-80 central processors. The superior speed of the Z-80, which runs at up to 4MHz, together with its much larger instruction set, made it more popular than the original 8080 which can only manage 2MHz. Z-80s are now available running at 6MHz, and even 8MHz. The Intel 8085 which is a code-compatible enhanced version of the 8080 runs at 5MHz and faster. Zilog's forthcoming Z800, a code-compatible enhanced version of the Z-80, will run at up to 25MHz — see Ray Coles' article in the August *Practical Computing*.

The battle for dominance of the 16-bit microcomputer market is still on. CP/M-86 and MS-DOS are strong contenders for computers based on the Intel 8088 and 8086, CPUs while several variations of Unix and CP/M-68 are in contention for the Motorola 68000-based machines. Concurrent CP/M, with time sharing of the CPU between two or more tasks, may prove valuable where the CPU is sufficiently fast and powerful. In this article, CP/M without qualification will refer to the 8080 version of CP/M, release 2.2, now sometimes called CP/M-80. The new CP/M operating system CP/M Plus is the long-awaited CP/M-3.

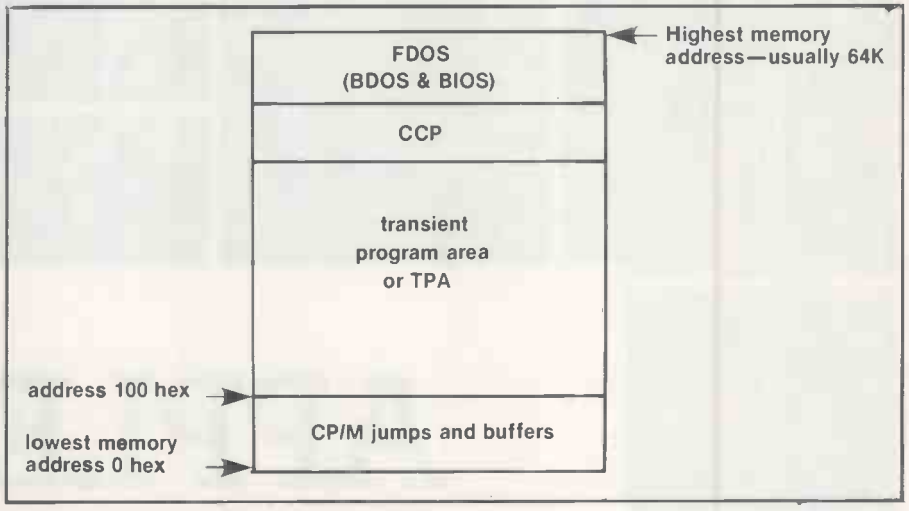

Figure 1. CP/M 2.2 architecture and memory map.

CP/M does not allow transient programs like Microsoft Basic or WordStar to access more than 64K of memory. At the time CP/M was originally written, this limit appeared astronomically large and unimportant. Now it is the common size. In fact you cannot even get 64K of usable memory since CP/M itself occupies about 7K, leaving only 57K if you are lucky. If your computer has a memory-mapped disc board, or a memory-mapped video board, then even less memory will available be for your program.

Because CP/M is unable to handle more than 64K of memory, there is not enough memory for CP/M to buffer previously used disc sectors. If such buffering were available, sections of data on the disc that are frequently used would be held in buffer memory and would give almost instantaneous program loading. Programs that make extensive use of overlays — WordStar is one — or those word-processors and data-base programs that manipulate large files would run much faster. Some manufacturers have simulated a disc drive using RAM to get round this deficiency. Such devices are variously known as RAM discs, virtual discs, silicon discs or semidiscs, examples being Warpdrive, Semidisk, M-Drive, RAM Disk and Interstellar Drive.

CP/M Plus can be configured in two different ways. The simplest form uses up to 64K of memory, like previous releases of CP/M, and it is called non-banked. However, CP/M Plus also supports multiple banks of memory and this version is called banked.

Configured in banked mode, CP/M puts the TPA user memory in bank 1 and moves most of CP/M to bank 0. Only the top 4K of the users bank of 64K is needed by CP/M, and this 4K must not be bank-switching — that is, the top 4K must appear in all banks. This leaves a larger TPA of 60K. In the banked version, the CCP is kept permanently in memory in bank 0, so it takes practically no time to return to CP/M command level.

To display the names of the files present on the logged-in disc CP/M uses the Dir intrinsic command. This is fine, but the command is slow. Dir works by reading through the file-directory space as stored on disc, starting at the beginning and continuing entry by entry until the end. Each time a non-deleted file is found, the name of the file is printed.

Equally important, each time a program opens a file, or looks for a file, or a new file extent — that is a new 16K section of a disc file — CP/M has to search sequentially through all of the

and present

Gary Kildall, president and founder of Digital Research, is the primary architect of CPM.

directory entries to determine whether the file exists. This is painfully slow and is simply not necessary. Techniques like hashing the directory would reduce the number of disc accesses needed to find a file.

Directory handling has been improved considerably in CP/M Plus as directories are now hashed. When CP/M Plus is asked to create a file, an algorithm calculates into which entry of the directory the file should go. If this entry is empty, the file name is put there, otherwise the algorithm produces another entry to try, and so on until an empty entry is found. If an empty entry cannot be found, then the directory is full.

When CP/M Plus accesses a file, it calculates in which entry in the directory the file name is likely to be, and looks there. The file name will usually be there, but if another file name is found, CP/M Plus tries the next entry where the file name might have been put, etc. If CP/M Plus finds an empty entry before the file name is found then the file does not exist. Thus CP/M Plus usually only looks at one or two entries in the directory to find a file and does not search linearly through all the directory entries as CP/M 2.2 did. This results in files being searched for, opened or created much faster. Since files have a directory entry for every 16K of data, this results generally in faster disc access times.

There is little provision for redirection of output. If your CP/M has the IObyte implemented, then you can use Stat to change the console device to any one of three physical devices. But on many copies of CP/M the IObyte is not implemented. You may want to run a program and redirect the output which would normally go to the screen to a disc file, or to a printer. CP/M allows the user to type Control-P for all messages which are sent to the console to be copied to the printer. Unfortunately this does not work when running some proprietary programs like Microsoft Basic.

CP/M does not allow you to send console output to a disc file instead of a terminal. It is only possible to copy output to the printer, and it is not possible to copy console output to a disc file, so it is not possible to create a file containing a sample run of a program.

Similarly CP/M provides only poor facilities for redirection of input. The transient command Submit allows CP/M commands to be read from a file rather than from the keyboard, and Xsub allows command lines to be passed to applications programs. However, these commands only support the passing of command lines. They do not allow single characters to be read from a file rather than typing them from the keyboard. Thus any program that has character commands rather than command lines which have Return at the end of the lines — WordStar for example — cannot be driven using the facilities provided. It should be possible to read input data from a disc file instead of typing it from the keyboard, and redirection facilities of this type exist on all mainframes.

True redirection of input and output is now available on CP/M Plus using the new transient commands Get and Put. Input can now be taken from, or output sent to disc files.

Input from the keyboard is not buffered by CP/M. During a slow disc operation the CPU is not listening to the keyboard, and anything you type during this period will be lost. A good operating system should check periodically to see whether characters have been typed on the keyboard, and store them in a buffer until the program that is running asks for input data. This form of keyboard buffering would prevent characters being lost when disc access occurs on a word processor.

Early versions of CP/M were designed exclusively for 8in. IBM single-density format discs. The basic units of the IBM format were the track and the sector. Discs had 77 tracks and each track had 26 sectors. Each sector contained 128 bytes of data. CP/M was, and still is, organised around sectors. Files are read or written in 128-byte sectors.

Most disc boards now read or write more than 128 bytes at a time. For example, IBM double-density puts 256 bytes in each sector, and North Star double density puts 512 bytes in each sector. Meanwhile CP/M still works by reading or writing 128-byte chunks of data that CP/M still calls sectors. Thus one, two or four CP/M sectors equal one disc sector. CP/M would run more efficiently if it could be set to work in the appropriate multiples of 128 bytes.

The way CP/M reads discs is wasteful. When a request is made to read a sector from disc, CP/M moves the disc head to the correct track and watches the data passing under it until the required sector is seen. The data is then read into memory. The next file to be read will probably be for the next sector, and it is likely that this sector will be on the same track as the previous sector.

CP/M would run faster if it read and buffered the whole track as soon as the track is first used. Subsequent accesses for this track would then read the data from buffer memory rather than from the disc, and thus would be very quick indeed. Track buffering is not implemented in CP/M although some manufacturers have developed special versions of Bios that buffer a track, for example Turbodos by Software 2000 Inc.

In the banked configuration of CP/M Plus any spare space in bank 0 can be used by CP/M for disc buffering, as can up to another 14 banks of 60K. The total amount of disc buffering available is thus over 850K if sufficient memory is available. Both the banked and the non-banked versions allow a sector count to be set. CP/M always then communicates with the disc system in the multiples of sector-count CP/M sectors. Thus CP/M can be made to work in units of the disc system, or even in tracks.

One of CP/M's annoying and unnecessary features is the need to press control-C to log in a new disc each time you change discs. Cromemco found how to avoid doing this many years ago with its CDOS operating system. If you change

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discs and do not press control-C then the first time you try writing to the changed disc, CP/M will stop with a BDOS error.

Copying a whole disc is tedious and slow, using Pip to copy the files, and Sysgen to copy the operating system for the reserved tracks on the disc. It would be more convenient, and much quicker, to have a utility program to copy an entire disc track by track.

With CP/M Plus it is no longer necessary to type Control-C every time a disc is changed. If it tries to write on a disc CP/M Plus detects that the disc has changed and no longer gives BDOS error R/O. Instead it logs the new disc in and does the file write. This improvement should remove one major source of frustration of using CP/M.

CP/M Plus will also search all discs for a program before giving up with an error message. The order in which the discs are searched can be set by the user. Failing to shut the disc door is not fatal.

Even better, an application program can put CP/M Plus in a mode where CP/M Plus never reports an error, but sends a Return code back to the program, indicating that the desired function has not been achieved. Using this facility application programs can be rewritten to put an intelligent error message on the screen, stating the source of the problem and indicating what remedial action should be taken.

CP/M's console command processor, CCP, only looks on the currently logged-in disc for files. It would be more friendly if all discs were checked, starting with the logged-in disc. If the CCP cannot find the file on any disc then a message to this effect should be printed rather than just the file-name and a questionmark.

It is annoying if you type a command line with a spelling mistake and press Return. The CCP does not let you edit the erroneous line to take out the spelling mistake — the whold line has to be retyped instead.

There is a considerable delay when returning to the system from a transient program. For example, when you type System to get out of Microsoft Basic to return to CP/M, there is a considerable delay before the CP/M system prompt A> appears. This is because the transient program may overwrite the CCP, and on returning to CP/M the CCP must be read from disc, and reloaded into the appropriate part of memory — see figure 1.

The transient program ASM, which contributed much to the early success of CP/M, is now very dated. It still works perfectly well, but only accepts the 80 instructions in the 8080 instruction set, thus preventing use of the extra 80 commands in the Z-80 instruction set.

In CP/M Plus the old ASM program has been replaced by a macro assembler, which can also assemble Z-80 code. The 1Obyte redirection facilities have been

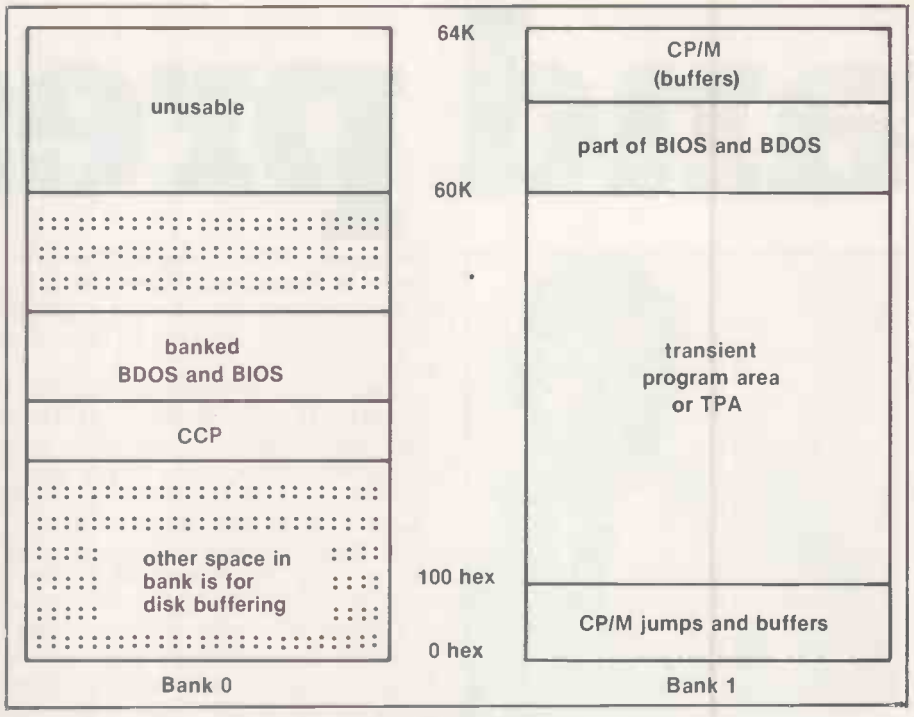

Figure 2. Memory map for banked CP/M Plus.

taken out of Stat and made into a new easy-to-use program. A Help system is also supplied for CP/M. The database used by the Help program can be customised using programs provided.

You can also add help on completely new topics, such as applications programs that you use, or instructions for backing up discs, etc. Pip now has the ability to archive files. Used this way, Pip copies all files that have not previously been archived, and also marks the file as archived. It makes the task of backing up of big hard discs onto floppies slightly more tolerable.

New machines will probably use CP/M Plus rather than CP/M 2.2, as the banked version provides far faster file handling. Installing CP/M Plus will be difficult: Digital Research does not plan to sell CP/M Plus to end-users but dealers will be able to configure and sell versions for their machines.

Those micros that can have lots of memory — for example, all S-100 machines — will benefit greatly from the change from CP/M 2.2 to CP/M Plus. On many micros the discs are the biggest bottleneck, and CP/M Plus dramatically improves disc throughput.

For those who cannot wait until a version of CP/M Plus is available for their machine, a dramatic improvement in computer performance can be achieved by buffering some of the disc in memory. It can be done from CP/M 2.2 with software that is in the public domain and published in *Lifelines* from Lifeboat Associates.

Alternatively you can purchase Warpdrive from Compupro, Semidisk from Semidisk Systems Inc., M-Drive/H from Compupro for S-100 systems, RAM disc for the Sage, or Pion's Interstellar Drive for a wide variety of machines, including S-100 systems, IBM, Tandy and Apple. They all provide the extra memory and the software to make it work, usually on a configuration disc.

Effectively these add-ons work by kidding the system into believing that a 256K or 512K memory board is really a disc drive. You can copy files from a floppy on to it and use them. If you alter the disc file, then you must copy the new file back on to a real floppy disc before switching off.

A cheaper and more subtle approach is to use extra memory as a cache, where only the frequently used disc files or parts of files are buffered. This works with quite a small amount of memory, from 4K upwards. Obviously more memory makes it work better. When the buffer is full, the least recently used part is the first to be discarded. There are two suppliers of this type of system, both British. Ghost is from Micrology, 4 Deanery Road, Godalming, Surrey GU7 2PQ, and Microcache, is supplied by Microcosm Research, 26 Danbury Street, London N1 8JU.

Cifer U.K. is a beta test site for CP/M Plus and is already selling machines with the new operating system. Sirton is also selling CP/M Plus in the U.K. Other dealers will probably follow shortly.

It seems likely that CP/M Plus will add extra life to the eight-bit micros based on the Z-80. At present the 16-bit machines offer the promise of much more power, but good 16-bit software is still lacking. Mark Twain said, "Rumours of my death are greatly exaggeratted" — and the same is true for the Z-80. In many applications CP/M Plus will increase the throughput, giving more delivered power.

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Dragon games

Ian Stobie was not very impressed with the selection of games he tried for this machine.

Backgammon

BETWEEN THE casing of the cassette and the display on the computer screen Backgammon seems to change its name to Microdeal Pengammon, probably for some inscrutable copyright reason. All the same it is the traditional game of Backgammon.

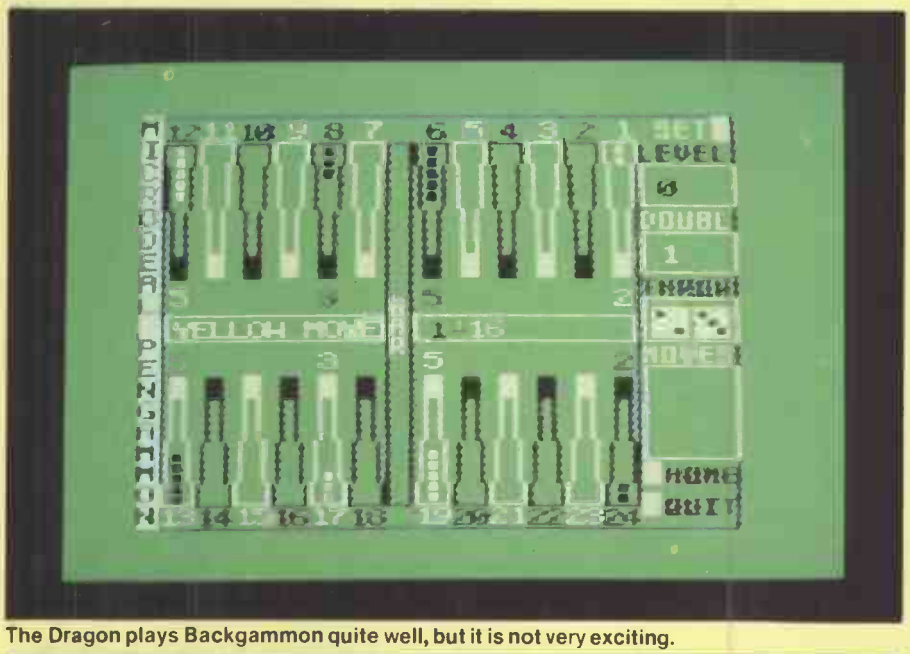
The program allows the computer to play against you or against itself; alternatively you can use it instead of a board to play with another human, although I cannot see many people wanting to given the Dragon's typical — literally — scintillating display.

The screen displays red and yellow pieces on a green background. Moves are made by typing in the source and destination square numbers, although you can use Microdeal's light pen if you have one. You need to know the rules of Backgammon as neither the screen display nor the packaging help you, and you have no option but to play the doubling game. If the Dragon offers to double the stake and you refuse you have lost.

The game has nine levels of play. You can cheat by changing the machine's level of play during the game or you can get the machine to make your moves for you. The machine seemed to play quite well at its top level, but to be honest I did not find playing Backgammon against a machine sufficiently exciting to provide it with much of a challenge.

Specification

Supplier: Microdeal
Price: £8
Use of graphics: 6/20
Playability: 12/20
Overall rating: 9/20



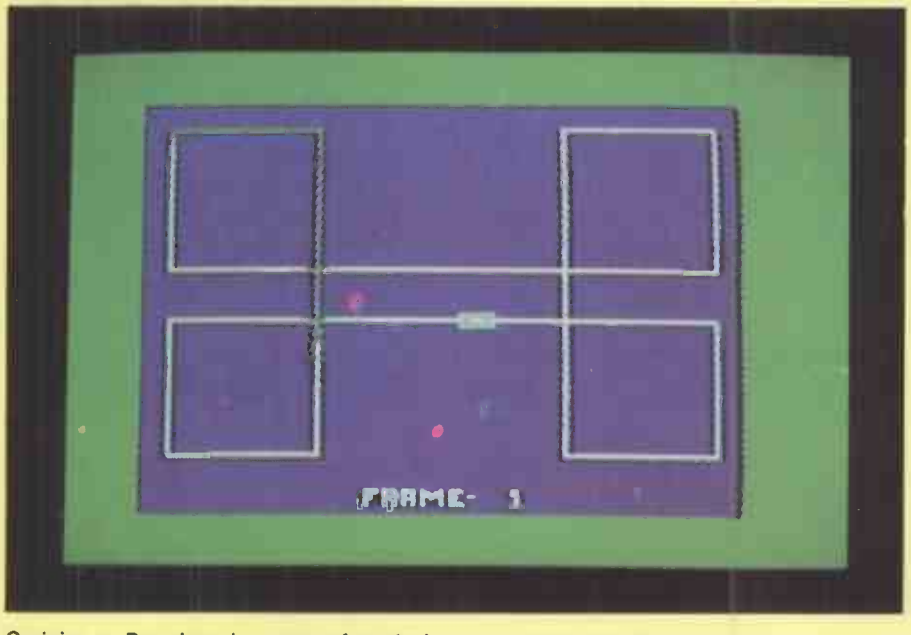
The Dragon plays Backgammon quite well, but it is not very exciting.

Cruising on Broadway

CRUISING on Broadway is one of the few games to make the transition across from the Spectrum to the Dragon, and is quite a playable game although it is very simple. It has no discernable connection with anything as realistic as Broadway, or for that matter with cruising.

You are a green blob and you are chased by a yellow blob through a simple maze. Success promotes you to higher and progressively more complex mazes until you are eventually eaten. However, your name will live on in the high scoring hall of fame if you can survive sufficiently long.

Cruising has simple graphics and sound effects to match, but it is quite compelling and exciting. In fact, the Sunshine logo which comes up as you load the game is one of the best examples I have seen of what can be done with Dragon graphics, although the screens you play on are far less elaborate.



Cruising on Broadway is a game of survival, you can never actually win.

Given the generally poor standard of the 30 or so Dragon games I looked at Cruising must rank as one of the better games available for the machine.

Specification

Supplier: Sunshine
Price: £6.95
Use of graphics: 8/20
Playability: 12/20
Overall rating: 10/20

Gridrunner

SO MUCH goes on in this game it is difficult to describe. It is like a cross between Space Invaders and Centipedes. Your little orange ship is being chased by linked chains of droids across the high energy lattice, the grid. You draw power from the first seven rows of the grid, which you zoom around while firing at the droids. Meanwhile the deadly X/Y zappers try and get you from the side of the grid.

Gridrunner is a top selling game on the Vic-20 and Atari. The Microdeal Dragon version is credited to the same author, Jeff Minter, but it is not as good. It seems slower, the graphics are not as good, and generally it is less exciting.

Much of the problem can be attributed to a less effective use of sound; the game needs lots of noises to generate a sense of excitement. In this version you do not get a noise when you fire. Still, while not initially very compelling Gridrunner is a good game if you persevere.

Specification

Supplier: Salamander
Price: £7.95
Use of graphics: 6/20
Playability: 13/20
Overall rating: 10/20

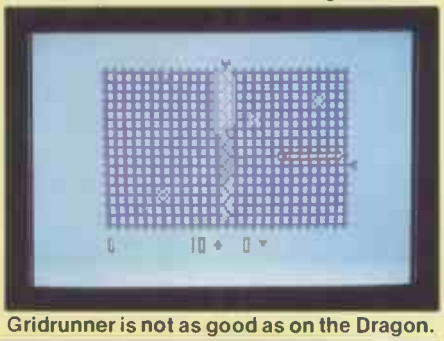
Dragon Trek

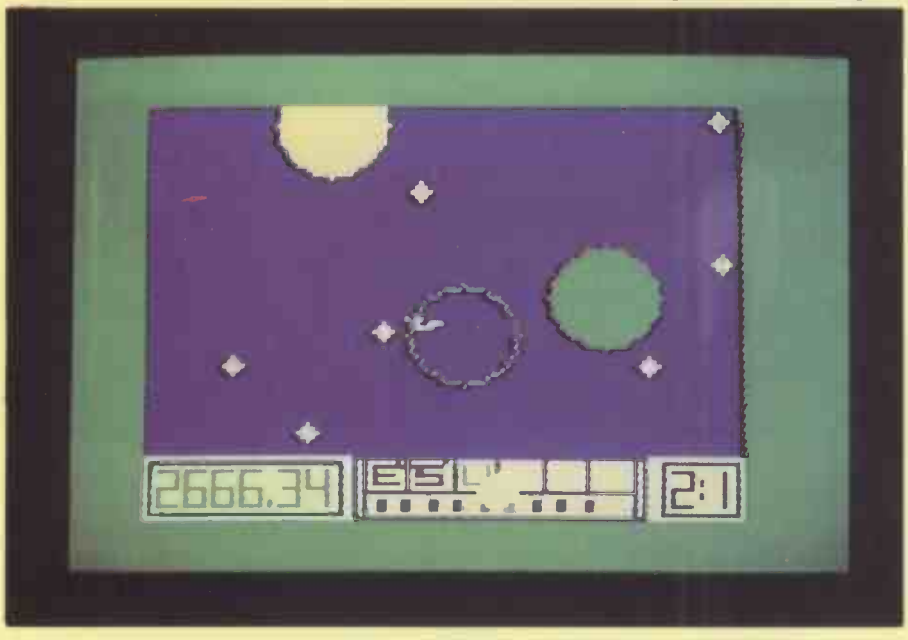
THERE ARE several versions of the classic computer game, Star Trek, available for the Dragon and Dragon Trek from Salamander was the best of the three I looked at. It goes beyond the typical text mode display and has reasonable graphics. The game takes place in real time so you cannot take too long over your decisions.

You start by setting the difficulty level, 0-9, and length of game. Your task is to take command of the USS Enterprise and patrol the galaxy, eliminating deadly Klingoms to save the Federation. Your ship, armed with three types of phasor and with photon torpedos, is protected by shields. The problem is to correctly use your limited amount of energy. This is used up at an alarming rate whenever your shields are hit by a Klingon, when you fire back, or when you warp or use your impulse jets to move.

This is quite an enjoyable game, but it is still not a patch on the best, truly real-time versions of Star Trek for other machines, for instance, Star Raiders on the Atari.

Galactic Ambushic is an arcade game.


Gridrunner is not as good as on the Dragon.



Dragon Trek is just one version of Star Trek available for the Dragon.

Specification

Supplier: Salamander
Price: £9.95
Use of graphics: 9/20
Playability: 13/20
Overall rating: 11/20

Galactic Ambush

GALACTIC AMBUSH is a Galaxians-type arcade game. Aliens steadily advance from the top of the screen, occasionally leaving formation to come at you with missiles blazing. You shoot back.

Visually the game is quite good by Dragon standards — the best thing is the three-dimensional moving star field against which the action takes place. But even at the fast speed the game is rather too easy to play. I doubt if it will provide much of a challenge to the average mad gamester for very long.

Specification

Supplier: Microdeal
Price: £8
Use of graphics: 12/20
Playability: 6/20
Overall rating: 9/20

Wormtube

WORMTUBE IS a kind of crude Defender, but it is quite enjoyable. You fly your ship through a steadily narrowing tube, scoring more points the futher you get along it. Gold nuggets appear in your path, which you have to avoid or shoot apart. You get extra points for gobbling up the fragments of shot-up nuggets.

Up to four people can play Wormtube taking turns with one joystick. The graphics are quite simple but adequate, and the game is made more exciting by the noises which rise in tone as your score increases. This game reminds you that it is not always the most complicated effects that work best. One of the best things about the original arcade Space Invaders, for instance, was the steady insistent noise the ever-more determined invaders made as they came at you.

Specification

Supplier: Hornet
Price: £8
Use of graphics 6/20
Playability: 13/20
Overall rating: 10/20

Practical Computing big game hunt

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Machine:.....
RAM required:.....
Accessories required:.....
Price:.....for cassette/disc/ROM

* * *

Type of game:.....
.....Frogger, Scramble, Pacman type, etc.
Number of players:.....to.....
Object of game:.....
.....
Use of colour/sound:.....
.....
Comments:.....
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Your highest score:.....
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Post completed forms to: BIG GAME HUNT, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS to arrive by Friday September 30, 1983.

Oh, so easy WP

Jack Schofield found Atariwriter convenient, easy to use, and relatively cheap.

POWERFUL WORD PROCESSORS are no stranger to the Atari computers: Letter Perfect, Text Wizard and the Atari word processor have been out for three or four years. But the new ROM-based Atariwriter represents a breakthrough in terms of convenience and ease of use, especially for the 16K 400 owner who will be able to use it even with a disc system.

It is also, while virtually as powerful, cheaper than some of its rivals. It costs about a third less than the Atari WP and is half the price of the Letter Perfect ROM, though it is somewhat more expensive than the product it most resembles — Computer Concepts' Wordwise ROM for the BBC micro.

Atariwriter was developed by Atari partly from the Atari WP, in conjunction with Datasoft who produce Text Wizard. It has something in common with both parents, but is most like Text Wizard in its insert mode. Like Wordwise, Atariwriter operates permanently in insert mode so there is no overwriting. As you type text into the middle of a paragraph existing text is pushed down the screen a word at a time. This creates some odd effects at line endings but is eminently practical.

As with all Atari's main-line programs the documentation and packaging are outstanding. Atariwriter comes with a slim manual which includes tutorial and reference sections, plus a handy quick-reference card. Interestingly the documentation is better than the massive volume and tape provided with the Atari word processor.

To run you just plug it in. The program has two main screens with legible white text on a darkish blue background, darker than the usual Atari screen. First is the menu screen with eight options: Create, Delete, Edit file, Format disc, Index of disc files, Load, Print and Save file. Options are selected by typing the first letter of each word which is shown in inverse type.

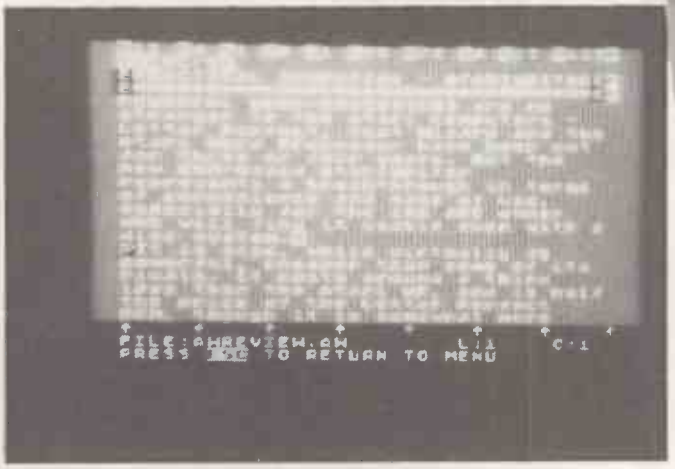
The second screen provides a 21-line by 36-character space for text entry, which is less than the Atari's standard 40-by-24 format. The top line initially contains the default parameters for printing. These can be changed or added to later.

Anyone can use the program without knowing anything about word processing, just by typing C and then entering text. The more sophisticated user will learn to use the other functions like block moves and Search and Replace. These are invoked using combinations with Control, Ctrl, and the Atari's three programmable function keys marked Option, Select and Start.

The initial menu screen is self explanatory and provides some access to Atari DOS functions. Index rapidly alphabetises the list of files, and its scrolling is stopped and started with the space bar. Any function which destroys text or files requires an "Are you sure — Y/N", confirmation. You can always get back to the menu screen by pressing Esc for Escape.

The text-entry screen provides a

Atariwriters main menu.



Typical Atariwriter screen.

The manual includes tutorial and reference sections.

reasonable range of cursor movements for editing. The basics are handled by the standard Atari full-screen editor with four direction keys, which with Ctrl move you one step at a time in any direction. There is full scrolling up and down, though up-scrolling is a bit jerky. You can go up or down one screenful at a time by Option ↑ and Option ↓.

Four other movements are exactly the same as in Text Wizard. Ctrl A moves the cursor to the start of the line, and Ctrl Z moves it to the end. Select T takes it to the top of the text, Select B to the bottom. There are no word, sentence or paragraph movements.

Deletions are equally simple, by character and by line, using the Delete Back Space key, DBS for short. Select DBS deletes to the end of the file. A 30-line buffer holds the last thing you deleted, so it can be recovered by pressing Start Insert.

The buffer also provides for block moves and block duplication. Each block has to be defined by marking its start and end with a Ctrl X. Again, block deletes require a Y answer to an "Are you sure?" Search and Replace can be individual on the same Y/N basis, or global. The maximum length of a search string is 25 characters — more than generous.

It is always possible to find out how much space remains for text by pressing option F. At this point using a 48K Atari 800, for example, 12,941 bytes — or characters — remain free, so this report will consist of a single continuous file. Atariwriter warns you when there are only 1,500 bytes left. The Atari WP has no limit but you must produce text as a series of saved pages. The memory limits of Letter Perfect and Text Wizard are 36,714 and 30,505 bytes respectively, compared with Atariwriter's initial 26,332 without DOS.

Texts can be merged so it is possible to, say, load a text from disc into the middle of an existing file. Also print files can be Chained, a way of handling long articles.

After the text has been entered the next step is formatting for printing. Here Atariwriter is at its weakest because it is limited by the Atari's 40-column screen. One option would be to scroll the screen horizontally to provide a sort of 80-column screen, which is what the Atari word processor does, just like WordStar on the Osborne and Magic Wand on the Apple II. There are 80-column boards for the Atari, which Atariwriter does not mention. Software can also provide 80 columns, though of course the text would not be legible on a TV set.

What Atariwriter does instead is provide a print preview facility, Option P, where the text is set out as it will be printed and the screen forms a window which can be scrolled over it. Thus it is possible to check line and page endings and margins, though it is not very convenient. Many would prefer the Atari word processor preview option also adopted by Wordwise on the BBC, where the text is displayed as it will be printed even though it is illegible.

It does not show how expanded or condensed text will be printed, nor proportional spacing if the printer is capable of it. Also although Atariwriter will print double columns, these are previewed one under the other not side by side.

Being limited to a 36-character screen width for text entry only becomes a real problem when trying to set out tables using the Tab key. If the table is for condensed printing across the maximum 132-character width you really have to construct the table on paper, then type it in afterwards.

The print parameters can be set in half-lines for the bottom margin, top margin, paragraph spacing, line spacing and page length. Widths can be set in characters for left and right margins for two columns, and for paragraph indent. Justification can be on or off. All of these can be varied within a file. Lines can be ranged left, right, or centred. Ctrl 0 allows decimal codes to be sent to non-Atari printers, such as the Epson MX-80 used to print this text. Headers and footers can be handled simply with @ providing page numbers. Ctrl E can be used to force the start of a new page.

The package is on disc and cassette.

The final printing out is simply a matter of selecting a printer from the list of four Atari models — select number 3 for a non-Atari printer, and following the screen instructions. You can start and stop at any page and print multiple copies.

There is no Mailmerge capability, as there is with Letter Perfect in conjunction with Data Perfect, but there is a forms capability. If you put an Option Insert character in the text the printer stops at it and waits for an entry — up to 35 characters — from the keyboard. The catch is that the text is not displayed on the screen during printing, and the rest of the line to be filled is probably in the printer buffer. The system is usable if you are careful.

There are a few other facilities missing from Atariwriter — and all the other Atari word processors mentioned. None let you interrupt and resume printing — Atariwriter allows a pause at the end of a page. None will print one file while editing another, or display a second file. None does automatic file back-up. None allows the use of macros to insert key phrases with a single key-stroke, or the use of wild cards in a Search and Replace operation. None provides for soft hyphenation to help with the even spacing of lines. While Atariwriter and its rivals have many qualities, they are not going to replace WordStar and its ilk for the serious writer, though of course it does not aim to.

	Atariwriter	Atari WP	Text Wizard	Letter Perfect
Menu driven	Yes, one	Yes, many	No	Yes
Text insert mode	Yes	No	Yes	No
Global search/replace	Yes	Yes	No	No
Horizontal scrolling	Only in preview	Yes	No	No
Print prevlew	Via window	Yes	No	No
Double-column printing	Yes	Yes	Yes	No
Prints half-lines	Yes	No	Yes	No
Can edit programs	Yes	No	Yes	No
Mail merge	No	No	Extra	Extra
Pause for text entry from keyboard	Yes	No	No	No
Disc interface	Atari	Atari	Atari	LJK
Medium	ROM	Disc	Disc	Disc or ROM
Producer	Atari/ Datasoft	Atari	Datasoft	LJK
Price	£65	£99.99	£68.95	£109.95, disc £149.95, ROM

This table is not a comprehensive comparison of products, but shows how Atariwriter combines most of the best features of its rivals.

Conclusions

● Atariwriter is a powerful word processor, well documented and extremely easy to use. It is easier to learn than Atari's Star Raider game, which is supplied on the same kind of ROM cartridge.

● It is suitable for most everyday writing tasks, and coped admirably with the writing of this article. It is not comparable in power to the best CP/M word processors, but provides word processing at a fraction of the price.

● It runs on any Atari micro and can happily be used with discs even on a 16K 400 system.

● At around £65 it is good value and can be recommended.

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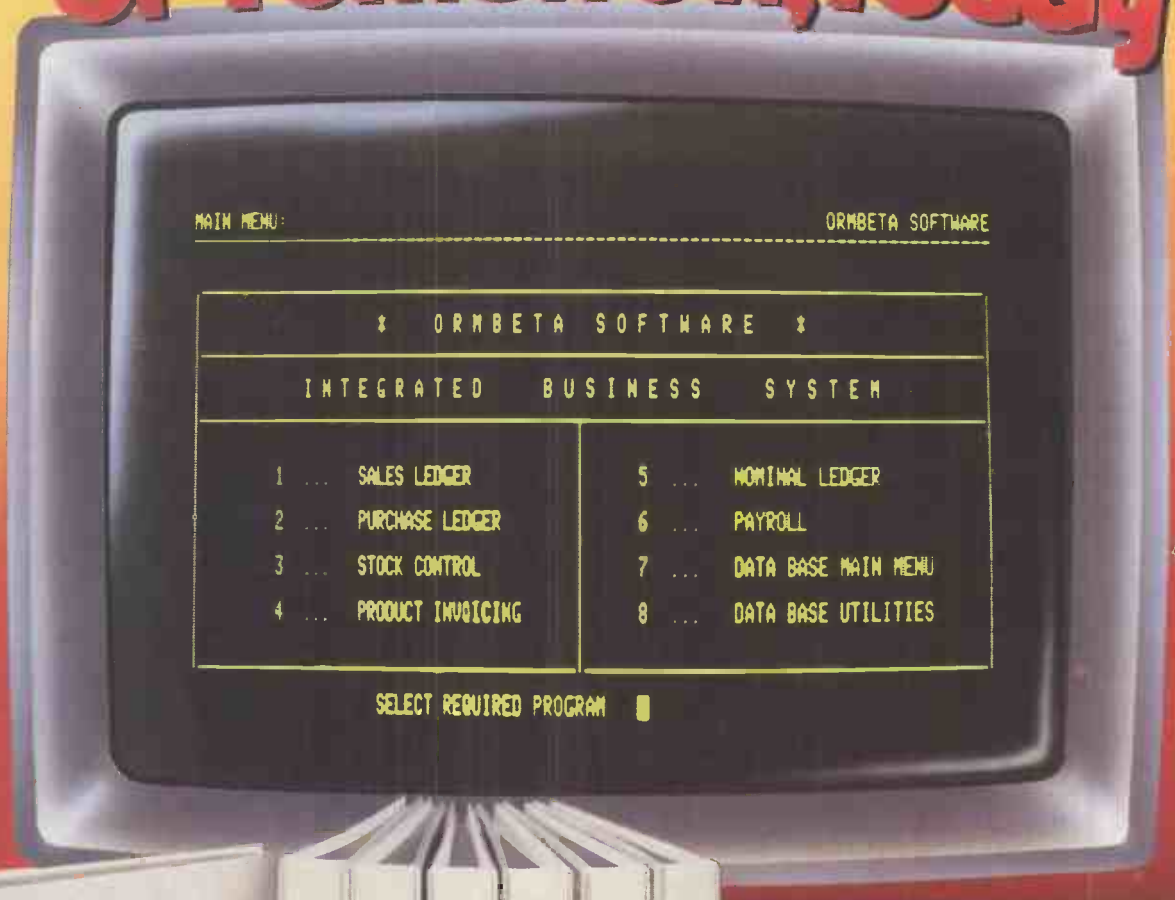

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The state of the graphics art

The computer has had a revolutionary effect on games, business and the film industry, to mention but a few — but it is still early days.

IT IS ONLY a few years ago, 1976 to be precise, that computer graphics meant — for most people — Snoopy printed out in a pattern of Xs. To watch the old Teletype print out a naked lady was really awesome.

The following year the Pet micro brought block graphics to thousands. Pictures could be drawn on a screen, not in letters but in little squares, lines and other useful shapes. Then the revolutionary Apple II, in spite of a curious lack of lower case letters, brought user-definable shapes and bit-addressable graphics to anyone with a lot of effort and £2,000 to spare — in colour, too.

Today for under £100 it is possible to buy a colour micro that is capable of drawing, within limits, almost anything the programmer sets his mind to. Screens, whether TV sets or monitors, are the universal method of displaying output. The teleprinter is worth its weight in scrap metal as more and more dot-matrix printers gain the ability to print complicated graphics which may be dumped straight from the screen.

These developments have had a powerful effect on the computer games business. The old Pet version of Star Trek, played in black and white with two axes and a handful of alphabet, pales into insignificance when compared to today's high-speed all-colour all-action arcade games.

The effect on business computing has been quieter but no less revolutionary. It is still possible to use a computer to spew out columns and columns of incomprehensible figures. However, many project managers have found that a graphic flow chart has more impact. Salesmen and accountants have found that an appropriate graph, bar chart or exploded pie diagram can make the point quicker and more forcefully. Sales are going up, or down; the company's share of the market looks like this.

Graphic representations of figures are no longer confined to slide shows and audio-visual displays. They are commonplace in company reports and the financial pages of the best newspapers. This is partly because with inflation and the chaos of the international currency markets, few people have any grasp of what figures mean any more. The important thing is the trend. Graphics provide wonderful opportunities for massaging figures into attractive shapes — there are lies, damn lies and graphics.

Cynicism aside, business graphics can have a real value, and numerous software packages exist to provide any user with the facilities to produce them simply. VisiCalc, for example, links to VisiPlot and VisiTrend. The current fashion is for spreadsheet and calculation programs to include graphics as part of the package. Lotus 1-2-3, Context MBA and TK! Solver are examples. Graphics are an essential part of integrated operating systems such as Apple's Lisa. Companies like Hewlett Packard, Rikadenki and many more have developed the plotters which will draw suitable graphics with multicoloured precision.

Microcomputer graphics has come a long way in the last five years. Nonetheless there is still a long way to go. Displaying graphics remains a problem, in that TVs and most monitors cannot cope with real high-resolution graphics of 1,024 by 1,024 picture-points or pixels. Indeed, many micros are used with TV sets that are incapable of displaying even the limited resolution they are capable of generating.

However, even higher display capabilities should shortly become common on personal computers, thanks to the remarkable new NEC μPD 7220 graphics chip. This was runner-up in a recent Amerian hardware-innovation-of-the-year competition, where the winner was the IBM Personal Computer. Two of these chips are used in NEC's Advanced Personal Computer to provide graphics resolution of 1,024 by 1,024 pixels, though the screen only provides a 640 by 475 pixel window onto this. Nonetheless, the display still requires 384K of dedicated video RAM. Even in these days of decreasing RAM prices, this is far beyond the reach of the home micro user and hard for many businesses to justify.

A real high-resolution colour display needs about a megabyte of RAM, but with 256K-bit RAM chips on the way, even this will become widely available in time. Another factor limiting the advance of computer graphics is the lack of standardisation between machines. A comparison of screen displays on small micros reveals every standard from excellent, as on the Acorn BBC Micro, to the truly appalling, such as the Dragon. Business micros ought to be more homogenous, but in fact are not; even half-a-dozen IBM PC look-alikes turn out to offer different screen resolutions. Such variations limit software portability because almost every graphics routine has to be rewritten to suit each micro

The solution, suggested at the American ACM Siggraph conference in 1977, is for a core graphics system. The idea is similar to the idea behind CP/M, where all the machine-dependent parts of the operating system are collected together in the BIOS, Basic input/output system. This, in theory at least, is the only part that needs to be rewritten for CP/M to run on different microcomputers. CP/M of course treats the screen display like a primitive Teletype terminal, which is why it currently does not lead to too many problems with the graphics display.

The Siggraph idea was to gather the machine-dependent graphics routines into a similar framework called the CGS or core graphics system. Applications programs would then present a common face to the CGS, which would translate their requirements to suit the particular machine in use. Thus programs could be more standardised and software portability greatly increased. Digital Research will shortly implement the idea in its GKS graphics kernal — addition to CP/M.

Such approaches represent a small step on the right road, but the computer graphics business is by no means settled yet. Systems like the Xerox Star, ICL Perq and Apple Lisa are still making pioneering advances in business graphics and CAD/CAM — computer-aided design and manufacturing applications. The moving graphics of arcade games such as Atari's Pole Position remain a terrible indictment of the graphics capabilities of most home micros. Beyond these there are computer graphics systems which require vast amounts of mainframe processing power, whether for films like Walt Disney's *Tron* or for more serious applications such as modelling or flight simulation for pilot training.

Computer graphics may have come a long way in a mere five years, but the changes over the next five should be equally dramatic.

Taking your TV for granted

Do you plug your micro into the first cheap display screen available? A little more information could help you get better results, says Chris Naylor.

MOST OF US can hardly remember a time when we did not have television to watch at home. Now computer users surely look back in vague awe to those times when output did not go to a screen.

The TV screen has become so much a part of our lives that the way it works seems almost to be beneath our attention.

In some ways the attitude is justified. After all, we just want to switch on and watch. Given a small, cheap micro we now want a cheap display screen. The domestic TV is the obvious first choice, but will it give good results? Perhaps a different model would work a bit better, or maybe a special-purpose monitor. The arrival of personal computers has been so sudden that your usual source of such information, the man in the local shop, will not know the answers either.

The cathode-ray tube or CRT is at the heart of every screen. The tube itself is made of glass, and is evacuated. At the thin end there is a heated element called the cathode, which is negatively charged and emits large numbers of electrons. Left to their own devices these electrons float off in all directions. However, further up the tube is a positively-charged series of plates, which make up the anode. Because electrons are negatively charged they are drawn towards it.

By the time the electrons get to the anode they are going so fast that they cannot stop, so they go charging on and hit the wide end of the tube. The wide end of the tube is coated with a phosphorescent material which glows when the electrons hit it, so when the tube is switched on the wide end glows with a sort of blurred light.

But not everyone wants a tube which glows evenly all the time, so there is another electrode, called the grid, in front of the cathode at the thin end of the tube. When this grid is lying idle it has no effect, but if you place a negative charge on the grid the electrons will not get a sight of the positively charged anodes further up the tube and so will have no incentive to go there. The result is that as the negative charge on the grid is increased, the flow of electrons diminishes. The glow from the bombarding electrons on the wide end of the tube diminishes too, and eventually ceases altogether when the charge on the grid is large enough.

A glowing tube whose brightness can be varied would be fine to light the room but not much good as a display medium. What is needed is a little more control, so first take a ring of electromagnets and place them around the neck of the tube to form an electromagnetic lens. Typically there are three of them and they bring the electron stream to a sharp focus as a dot at the centre of the phosphorescent screen. Electrostatic lenses are also possible. The focus control on the CRT adjusts the electron lens, and the brightness control adjusts the grid voltage.

To make the dot do something a little more interesting there are four plates arranged in pairs around the neck of the tube. If one plate is charged negatively and the opposite plate positively the electron beam deflects towards the positive plate. As there are two sets of plates at right-angles to each other the glowing dot can be moved to any point on the screen.

There is just one more thing to worry about and that is the phosphorescent coating on the screen. A phosphor carries on glowing even after electrons have stopped bombarding it. Some phosphors glow longer than others, though in general the glow does not really last long at all. There are three well known phosphors which can be used to coat the tube: fluorescein, which glows yellow-green; quinine sulphate, which glows blue; and chlorophyll, which glows red. By using any one of them or a mixture you can make the moving dot glow in just about any colour you want.

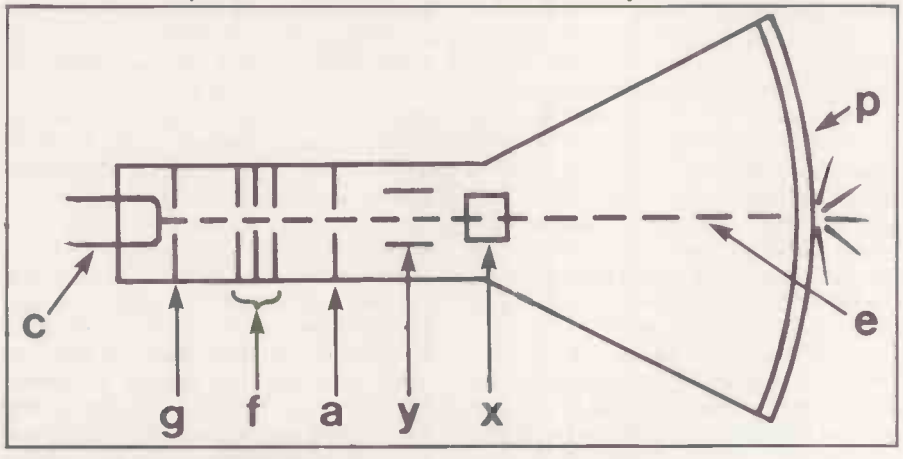

Figure 1. The cathode-ray tube.
c — cathode. Negatively charged and emits an electron stream.
g — grid. By increasing the charge on the grid the electron stream can be reduced, so it acts as the brightness control.
f — focusing anodes forming an electrostatic lens to focus the electron beam to a fine point on the screen; the focus control, if there is one, alters the charge on these anodes.
a — accelerating anode. Positively charged to draw the beam at high speed towards the screen.
X — X plates. Carry an electrostatic charge which deflects the beam from side to side.
Y — Y plates. Carry a similar charge but work up and down, at right angles to the X plates.
e — electron stream.
p — phosphorescent coating. Glows when struck by electrons; the colour of the glow depends on the type of phosphor used.
Some CRTs use electromagnetic fields rather than electrostatic deflection plates to control the electron beam, but the basic principles are the same.

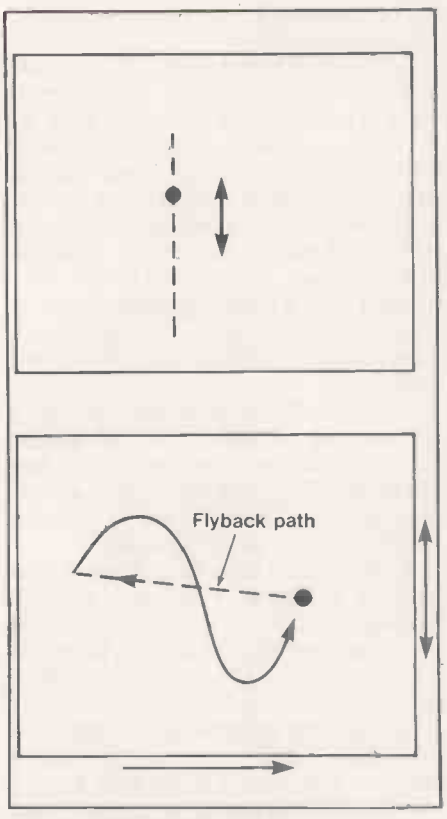

Figure 2. The oscilloscope screen.
Using only one input to control the Y plates only allows the dot to be driven up and down, which is not very useful. Using the atuomatic tlmebase on the scope, the dot can be steadily driven in X as well as Y to show the entlre waveform plotted against time. If the interval between flybacks is the same as the time taken for one complete cycle of Y input then a complete waveform can be viewed.

With a device like the CRT available, why not stay with it? It's simple and fairly cheap. It can draw its dot anywhere on the screen, so surely it can handle the output from a computer. You just have to put a couple of digital-to-analogue converters on your computer to provide the X and Y inputs and you can drive the dot anywhere on the screen you like. This is what a vector scope does: it can draw anything, anywhere just as fast as the computer can send the X,Y data.

The snag is that the glow from the dot does not last very long, so you have to write a program to drive the CRT in X,Y and then put that program in a loop so that it keeps on driving the CRT in X,Y. If it does so fast enough, the eye will be deceived into thinking that it is viewing a stable, permanent image.

The speed at which the image must be redrawn depends on the flicker-fusion rate of the human eye, which is typically around 12 cycles per second. For a computer that is not very fast at all, but you do have to keep on doing it. Faster still is better, and to be on the safe side you might try doubling the rate to 25 cycles per second. Certainly, below 12 cycles per second the image will start to flicker in a fashion beloved of stroboscopic lighting specialists. A rate around the flicker-fusion rate can be very unpleasant, and can even cause fits.

As you are using your computer to drive the screen you cannot use it to do anything else — it is tied up displaying things. The answer is to have two computers. One drives the vector scope and the other carries out any other work, occasionally passing new plotting data through to its partner. In fact, if you buy a vector-plotting screen it will have, in effect, a second computer inside it to hold the plotting data that your computer gives it and to drive a CRT over and over again with that plotting data. With a good internal computer a vector scope can produce a very high-quality image, albeit at a very high price.

Oscilloscopes are built round a CRT which can receive only a Y input. That is, it can move the dot up and down the screen but not from side to side. Movement in the X direction is achieved automatically by the scope itself, and is usually called the timebase.

Suppose that you wanted to look at an image of a 1,000Hz audio tone. You place this signal on the Y input of the scope and the dot moves up and down 1,000 times per second, which is much too fast to detect by eye. However, if you slowly move the dot in the X direction at the same time the dot marks out the curve of the 1,000th wave being input. If the dot moves right across the screen 1,000 times each second, yhou would see one complete cycle of the input tone on the screen.

From a computer person's point of view, the oscilloscope illustrates two important points: the automatic generation of an X input to sweep across the screen, and a very rapid flyback to the

(continued on next page)

Screen test in Apple Basic.

```
10  REM :PRACTICAL COMPUTING SCREEN TEST
11 W = 1:CH = 40:CV = 20: REM :CH IS NO. OF CHARACTERS HORIZONTAL, CV IS C
     HARACTERS VERTICALLY
15  REM :CHECK FULL OUTPUT
16  HOME :A$ = "CHECK FULL OUTPUT": GOSUB 1000
20  TEXT : HOME : INVERSE
30  FOR I = W TO CH * CV
40  PRINT  SPC( W);
50  NEXT
55  GOSUB 1000
60  REM :CHECK SCREEN SHAPE
65  HOME :A$ = "CHECK SCREEN SHAPE ": GOSUB 1000
70  HGR
80 V = 159:H = 279: REM :H IS HORIZONTAL AND V IS VERTICAL
85 R = V / 4
90  HCOLOR= 3
100  HPLOT 0,0 TO H,0 TO H,V TO 0,V TO 0,0
101  HPLOT H / 2,V / 2: FOR I = 0 TO 6.3 STEP .04: HPLOT H / 2 + R *  COS
     (I),V / 2 + R *  SIN (I): NEXT : REM :THIS DRAWS A CIRLE IN THE CENTR
     E OF THE SCREEN RADIUS R
105  GOSUB 1000
110  REM :TEST LOW FREQUENCY RESPONSE
115  HOME :A$ = "CHECK LOW FREQUENCY RESPONSE": GOSUB 1000
120  TEXT : HOME
130  NORMAL : PRINT  SPC( 20);
140  FOR I = W TO CV / 2
150  INVERSE
160  PRINT  SPC( CH);
170  NORMAL
180  PRINT  SPC( CH);
190  NEXT : PRINT
195  GOSUB 1000
200  REM :TEST HIGH FREQUENCY RESPONSE
205  HOME :A$ = "CHECK HIGH FREQUENCY RESPONSE": GOSUB 1000
210  HGR
220  FOR I = W TO H - W STEP 2
240  HCOLOR= 3
250  HPLOT I,0 TO I,V
260  HCOLOR= W
270  HPLOT I + W,0 TO I + W,V
280  NEXT
285  GOSUB 1000
290  GOTO 15
1000  VTAB 22: PRINT A$: PRINT "PRESS ANY KEY TO CONTINUE ";: GET A$: RETURN
```

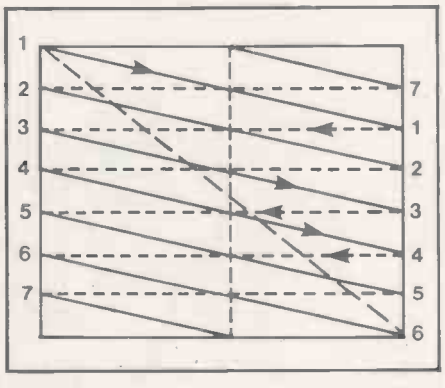

Figure 3. Interlaced scanning.
An interlaced scanning pattern for a seven-line system. Solid lines are drawn on the screen and scanned from left to right. Dotted lines are not drawn on the screen and represent flyback paths. In the first scan the odd-numbered lines are drawn; in the second scan the even-numbered lines are drawn. The diagonal flyback from the end of line 6 to the beginning of line 1 and the vertical flyback from halfway through line 7 are field flybacks. The horizontal flybacks are line flybacks. In the 625-line U.K. system 312.5 are covered in the first 1/50th of a second and the remaining 312.5 covered in the next 1/50th of a second.

(continued from previous page)
starting point so that the process can begin all over again. Using these methods it becomes possible to draw a two-dimensional picture on the screen using only one input rather than having to drive the screen in both X and Y.

At this point we come to television. The devices I have talked about so far can only draw things on the screen that can be represented as line drawings. But remember the grid and the way that it controls the brightness of the dot. If one input is fastened to the grid, the brightness of the dot can be varied at will. The dot is moved rapidly in both the X and Y directions so that it covers the entire screen in a very short time, a technique known as raster scanning. British TVs draw 625 lines 25 times per second so that a whole screen picture is drawn at twice the flicker-fusion rate. To make the picture appear even more stable the scan is interlaced: it is drawn in two passes, each lasting 1/50th of a second. In the first pass all of the odd-numbered lines are drawn, and in the second pass all of the even-numbered lines are drawn — see figure 3.

To synchronise an incoming TV signal with the TV set the signal includes some control pulses which set up the correct line synchronisation, or horizontal scanning and flyback, and frame synchronisation, or vertical scanning and flyback. In between these control pulses, in periods lasting just 1/15,625th of a second, comes the picture signal proper in the form of a burst of activity during which a varying voltage controls the grid on the CRT to vary the brightness of the spot at any given instant — see figure 4.

It is this video input which drives the set. The voltage level controls the brightness of the spot: a high voltage extinguishes the spot to give black on the screen, and a low voltage makes it bright, giving white. In the early days of TV the system worked the other way around.

In a perfect world every TV set would display a perfect picture, but in reality there are all sorts of disturbances in the incoming signal. Such unwanted information in the signal is called noise. The most common type of noise consists of high-voltage spikes which should not be there. With the old system they showed as a white spot, and early TV sets were plagued with a snowy appearance due to noise. The black spots produced by the more modern system are much less noticeable.

In normal TV reception the video signal is used to modulate an ultra-high-frequency carrier wave which is then broadcast. This UHF signal is picked up by an aerial and demodulated in the set to recover the original video signal.

If you want to drive an ordinary TV set from a computer you need a UHF modulator inside the computer to make the signal look like the normal broadcast TV signal. Since the computer's output does not have to be broadcast, it is clearly a waste of time to modulate the signal and then demodulate it again. Specialised monitors and some TV sets have a video input which will accept an unmodulated signal.

A computer drives the screen via a specialised collection of chips. The

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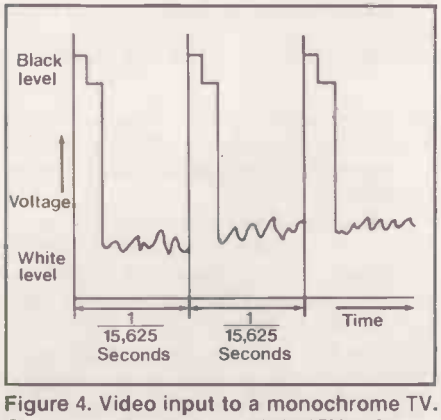

Figure 4. Video input to a monochrome TV. One line is drawn every 1/15,625Hz of a second. The first part of the video signal is a high-voltage line-synchronisation pulse, followed by a slightly lower voltage corresponding to a black tone, during which the flyback occurs. The signal proper then follows. A synchronisation pulse initiates the next line flyback and another line is drawn. A similar method is used at the end of each frame scan to initiate a frame flyback.

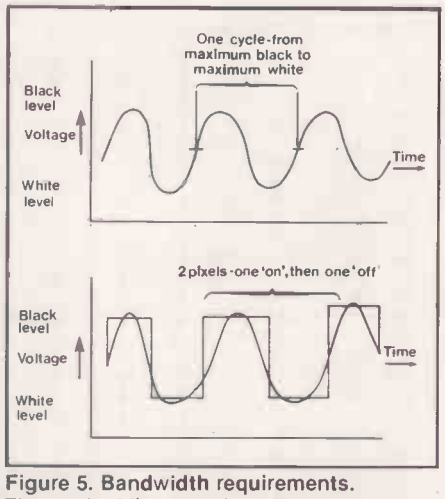

Figure 5. Bandwidth requirements. The vertical lines on the broadcast test cards are actually sine waves. To display 336 black-and-white vertical bars in each line scan of 1/15,626Hz of a second requires a bandwidth of 336 x 15,625 Hz, or 5.25 MHz. If your computer tried to send 336 black and white dots to each line it would almost certainly generate a square waveform. It could be approximated by a single sine wave of 5.25MHz, but not very well. The sharp edges of the square wave need higher frequencies to fill in the corners accurately. If the square wave has a frequency f, it will also generate sine waves at 2f, 4f and so on. It will expect, in this example, a bandwidth of 10.5MHz if you try to generate a screen picture 672 pixels wide.

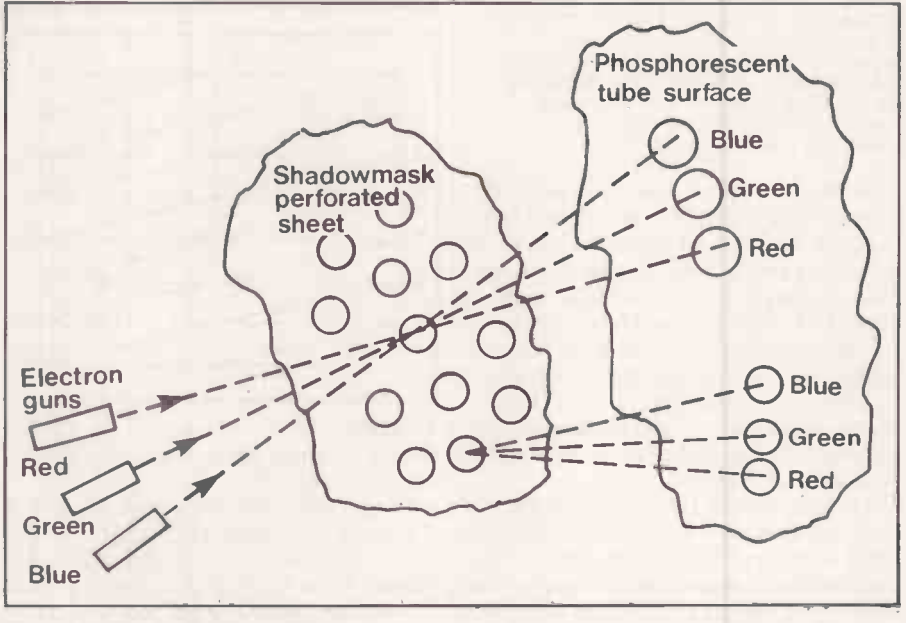

Figure 6. The shadow mask tube. The shadow mask colour tube has three guns all angled inwards. All three electron beams meet at a single point so that they can be focused and deflected as one by arranging the controlling electromagnetic fields to act at this point also. Directly before the phsophorescent tube surface is the shadow mask, a sheet with thousands of tiny perforations. All three beams pass through each hole in the mask, and so for each hole there are three dots of phosphor on the surface of the tube — one red, one green, and one blue — arranged exactly so that the beam from each gun hits exactly the dot that belongs to it. By controlling the output from each gun an impression of any colour can be formed at any point on the surface of the tube. Unlike the monochrome tube the beam cannot really be directed to any point on the surface, but only to those points corresponding to holes in the mask. On black matrix screens each individual dot of phosphor is surrounded by an opaque black ring which improves the colour definition. The main exception to this general arrangement is the Trinitron tube which uses a system of vertical slots in the mask rather than individual holes. The Trinitron method is said to give a brighter picture.

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(continued from page 96)

standard signal formats for driving TV sets are so well known that there really is no reason for the video generator to produce a bad signal. Yet you will not always get a perfect picture: for instance, if the line and frame synchronisation is wrong you will get a complete mess. The problem is too clear-cut to be likely to arise, but you can still find your picture is less than perfect without being a complete disaster.

In a monochrome set bandwidth and resolution dictate how much detail you can see. The Apple II in Hires mode will draw 279 dots on one line horizontally, say a succession of bright pixels and dark pixels — 139 bright pixels in all. This pattern is roughly equivalent to a wave going up and down 139 times. It has to do so within the 1/15,625Hz of a second it takes the line to cross the screen, so the frequency of the signal is 2.17MHz. Any set should be able to cope with a bandwidth like this.

Broadcast test cards have a series of vertical gratings from which you can judge the bandwidth of the set. The highest frequency, corresponding to the finest grating. If your set can resolve the lines on the finest grating then its bandwidth is 5.25MHz at least.

There is an important difference between TV test cards and a row of computer generated dots. The gratings are not real, vertical bars but are actually sine waves — they do not start and stop with a sharp edge. The computer's pixels do have sharp edges, and this raises the bandwidth requirements. The Apple Hires dot is a square wave which requires a whole series of higher-frequency sine waves to represent it accurately.

To fill in the corners with a frequency twice that of the basic signal raises the bandwidth to 4.34 MHz for good graphics — see figure 5. Doubling the frequency again brings the bandwidth to 8.69 MHz, and at this point, the bandwidth requirements start to exceed the capabilities of most domestic TV sets. The broadcast frequency allocations allow only 8MHz per channel, so that is all a TV set normally has to cope with. Purpose-made monitors can have bandwidths of, say, 24MHz, which is easily enough for anything the Apple might produce.

Working out your bandwidth requirements from your micro's high-resolution graphics mode can give some useful insights into what you really need from your screen. You can then go on to look at the advertised bandwidth of monitors or, in the case of a TV set, tune in to a test card to see the likely bandwidth it will accept.

The next group of things which can go wrong hinge on the nebulous concept of quality. A TV picture is a very boring thing technically. Broadcasters know that most people have mediocre TV sets and they transmit easily displayed signals to match them. Computers are different; they can send anything to the screen, and the demands they make on it are that much higher.

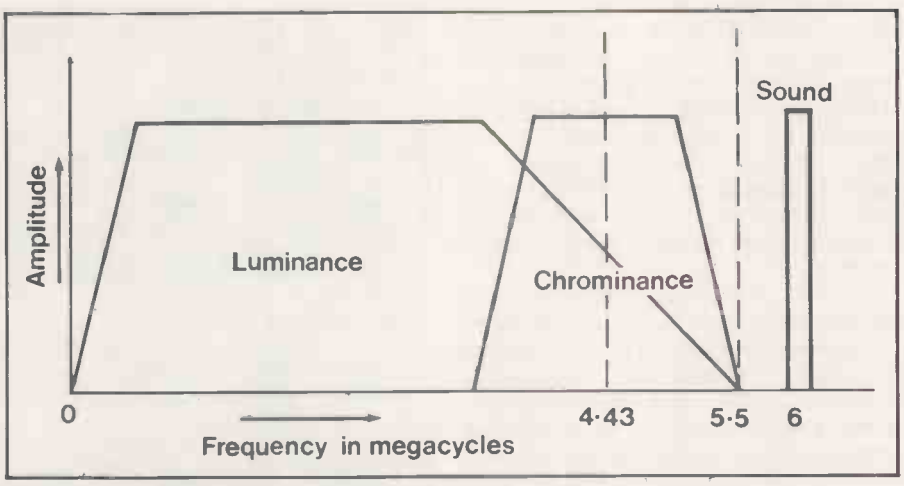

Figure 7. Allocation of bandwidth in broadcast TV.
In a colour broadcast the luminance or brightness information is transmitted in the lower frequencies. Above it is a band centred on 4.43MHz which contains the chrominance or colour information, followed by a very narrow band centred on 6MHz which contains the sound information. Because of the way a TV picture is transmitted the overlap of luminance and chrominance is not usually serious. In the overlap area the luminance signal tends to occur in clumps, and so does the chrominance signal, and these clumps tend to be in different places within the overlap area. But your computer may not be quite so well behaved as this. If it generates luminance signals over about 4MHz they are likely to be interpreted as colour information, and at 6MHz they may be interpreted as sound. A screen width of over 500 pixels or thereabouts may give problems with some colour TV sets if the input is to the aerial socket. Using an RGB input bypasses the problem because the signal does not then have to be decoded by the set.

Switch on your computer and display some text, tuning the TV monitor to give the best possible display. Now display the same data using inverse characters and see what happens. Ideally it should be as clear and neat as before, but it may not be. The shape of the text may change, smearing slightly to the right, and if you display half a line of inverse characters the second half of the line may appear blacker than the rest of the screen, as if the bright inverse patch had cast a shadow.

TV sets are not usually called upon to display solid patches of maximum brightness, and your set's power supply may not be quite up to the job. The result is that after showing a block of maximum brightness the voltages in the set start to sag producing a reduced level of brightness immediately afterwards. Inverse text written all over the screen is most taxing of all. If anything will make the screen sag that will.

You may also notice little black dots all over the place. The modern system of having a high voltage on the video signal for black and a low voltage for white is fine for suppressing the effect of noisy spikes as long as the basic background is dark. If the screen has a white background the noise really shows badly because now you can see the black noise dots. If you want to use inverse a lot you should try to find a monitor that works the opposite way round.

Most people use a colour TV set for viewing nowadays, and they often use the same set with their computer. A colour TV tube is exactly like a black-and-white one, except that it has three of everything. In a way, it even has three screens to give red green and blue phosphorescence.

Any problems with colour sets almost always arise from the methods used to code the colour signals. Figure 7 shows how the British PAL system of colour transmission works. Within the 8MHz bandwidth allocated to a single broadcast channel, the bottom half of the bandwidth is taken up by the luminance or brightness information, with around 4MHz devoted to the chrominance or colour information and a very narrow band to carry the sound signal. Black-and-white sets only pick up the luminance information, so colour signals can be used by everybody, whatever type of set that they have.

The luminance information must not exceed about 4MHz — if it does, it may be misinterpreted by a colour set as chrominance information. Next time you watch TV look out for high-frequency luminance information which is misinterpreted in this way. The fine detail of tweed clothing often causes problems, so people rarely wear tweeds on TV. Bright objects are also problematical. The reflection from a gold candlestick, for instance, can produce a very high-frequency edge in the picture which is mistaken for colour information to produce a sudden, vivid splodge of colour. If the object is moving to the left the problem may be even worse as it causes a Doppler effect which pushes the frequency even higher.

What bandwidth do you really need? Push 8MHz into a colour TV and the

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picture will really break up. It may even be so bad that it invades the bandwidth normally reserved for sound and your Hires graphics finish up coming out of the loudspeaker. If your computer is causing this cross-colour effect then there is not much you can do about it. All that can be said is that the computer manufacturer ought to have designed the TV output better.

If you would be happy with a monochrome picture try switching the set to monochrome and the disturbance may go away. All sets have colour-killer circuits so that if a black-and-white picture is being received it is not spoilt by colour fringing at the sharp edges of objects, where a high-frequency luminance signal exists. The colour-killer circuits are normally switched in when the set detects an absence of the chrominance information which normally occupies the higher frequencies. But any high frequencies generated by your computer in the luminance band may fool the colour-killer circuits into thinking there is some colour there. In that case your picture bursts into a glorious display of unwanted colour as everything is turned on for you.

The other problem which can arise with colour comes from the different broadcast standards around the world. All British TV sets use the Pal standard. In France they use Secam, and in the U.S. they use NTSC. So make sure you buy a computer with a Pal output otherwise it will not work with your British TV.

If you wanted to set up a small business you could go out and buy in a lot of black-and-white portable TV sets that nobody else wanted, remove the loudspeaker and the aerial socket, add a video input socket and sell the end-product as a perfectly adequate computer monitor. I am not suggesting that this is what monitor manufacturers actually do, but a monitor is really just like a monochrome TV. How good a picture it gives depends on how well it has been designed and built. When buying a monitor you must, if possible, see it in action before signing the cheque.

In theory a monitor will be better than a TV set for displaying computer output. The whole thing should be better engineered to start with and can make use of the fact that it never has to handle a TV signal. The bandwidth can be very high — up to 24MHz in some cases — and because the screen does not have the dot-matrix pattern of the colour tube it will be capable of revealing this greater detail.

Do your bandwidth sums again: 24MHz gives a frequency of 1,536 per line, so the set could resolve a basic 3,072 pixels. But remember that it will still be working at 625 lines vertically, so you will have nearly four times the resolution in the horizontal direction as in the vertical direction.

At 14MHz you can resolve about 1,500 pixels, around 20 pixels for each character on an 80-column output. Divide by two to fill in the corners on square waveforms and you have 10 pixels per character. Because the monitor uses a video input, rather than relying on an add-on UHF modulator, the picture quality will be better than a TV anyway so it only remains to test the monitor to make sure that it is not doing anything horrible.

To test a screen connect your computer to it, using video/RGB input if possible. If you have to use an aerial socket use shielded coaxial cable because the UHF modulated signal is very susceptible to losses. Keep the cable as short as possible.

Display a screen of solid white. For instance on the Apple's 40-by-20 text screen enter:

```
FOR 1 = 1 TO 40 * 20: PRINT SPC(1);;NEXT
```

to check that the picture is rectangular at full output. Then switching to high-resolution graphics enter:

```
V = 159:H = 279: REM: V IS VERTICAL
PIXELS, H IS HORIZONTAL
HGR
HPLOT 0,0 TO H,0 TO H,V TO 0,V TO 0,0
```

This is to draw a thin, white border on an overall black background and allows you to check that the screen shape remains good at low output. Go back to text again and enter:

```
NORMAL: PRINT SPC(20);
FOR I = 1 TO 10
INVERSE
PRINT SPC(40);
NORMAL
PRINT SPC(40);
NEXT
```

This draws a series of solid bars of white alternating with black, each extending halfway across the screen. At the middle of the screen, where a white block ends, look for a darker than usual black band following it. Is it darker than the black band preceding white on the next line down? If it is, it shows that the low-frequency response of the set — the extent to which the power sags after displaying a solid patch of white — is not as good as it should be. On a normal TV the same effect is sometimes introduced deliberately because it can appear to sharpen the image up a little.

Now go back to high resolution again. Enter:

```
FOR I = 1 TO H – 1 STEP 2
HCOLOUR = white
HPLOT I,0 TO I,V
HCOLOUR = black
HPLOT I + 1,0 to I + 1,V
NEXT
```

to draw a series of vertical black-and-white bars over the surface of the screen. If there are H pixels per line, the high-frequency response is H/2 cycles per line or H*7,812Hz.

If the set performs these tests without trouble then it is a fairly safe buy. If you want to examine it further using broadcast test cards you will find one transmitted on Channel 4.

Guide to buying a TV or monitor

1. Work out your bandwidth requirement. If it exceeds 4MHz to draw a row of 500 pixels in high-resolution graphics then you cannot safely use a normal colour TV unless it has an RGB input. You can use a black-and-white set, or you can buy a high-resolution colour monitor. An 80-column output will normally require too high a bandwidth for a colour TV.
2. If you decide to use a normal TV try to get one with an RGB input rather than using a UHF modulator to feed into the aerial socket.
3. Always ask to see a test card displayed on a set — you should be able to resolve the finest of the vertical bars on the card, corresponding to 5.25MHz bandwidth.
4. If possible, try out the set you are thinking of with the computer you intend using. Test it with high-resolution graphics and 80-column output if you have it. Also try it with inverse text and draw blocks of maximum brightness. Look for distortion in the shape of the picture.
5. If you can, buy a set with Prestel or Ceefax on it. Displays on these channels are very similar to what your computer may send to the set; if it cannot cope with teletext it will probably not do very well with computer output.
6. If you feel you can live without colour, then a black-and-white portable makes a very good buy and you will not be plagued by cross-colour effects. However, the power supply may be rather light, causing distortion on inverse text.
7. The safest and most expensive choice is a purpose-built monitor with 14MHz bandwidth or more. The colour of the screen phosphor for a mono monitor is a matter for personal taste.
8. The next safest choice is a black-and-white portable. Look at a test card on it and check its behaviour with inverse display. Try to get one with a video input on it.
9. A colour set with RGB input on it and one of the information channels is ideal. It should not give any problems unless you want very high resolution, but try it with your computer anyway.
10. The most difficult item is a cheap colour TV with only the aerial socket as input. A high-resolution display or an 80-column card is very likely to send it haywire. If you are thinking of buying one check it out very, very carefully first.

Health warning

Having read this article, you may feel tempted to try messing around inside your TV set. DON'T DO IT! If you were not sure how to do it before then you do not have enough knowledge to poke around inside a TV set. A TV contains a live chassis, and the tube usually works at tens of thousands of volts. It is easily the most potentially dangerous device in the home.

Multi-million dollar industry

John Lewell assesses the computer graphics business.

IT STARTS with a distant view of the galaxy, then enters the solar system, approaches Earth, descends through the atmosphere and ends up exploring the retina of an insect's eye. It is the ultimate zoom, a computer-graphics device beloved of a number of film makers.

The computer-graphics industry itself is becoming so huge that you have to step back a long way before you can fit it all in the picture. It is estimated by Frost and Sullivan that the industry will be worth $14.5 billion a year by 1990.

The scientific uses of computer graphics are many and wondrous, and without the new imaging techniques much scientific research would grind to a standstill. Computer graphics are used for plotting the paths of particles in high energy physics; for designing new drugs; in genetic engineering; for cartography; for enhancing the images sent back by space probes; for representing bone structures prior to surgery; for designing semiconductor chips; for modeling abstract theories; and for showing the effects of stresses on man-made objects.

Computer-aided design comes into a separate category, as it is specifically concerned with product design. CAD systems are used by engineers, industrial designers, architects, aerospace and car manufacturers, and by printed-circuit board designers.

CAD/CAM, the extension of computer-aided design, carries the process through to computer-aided manufacturing. With it a product may be manufactured automatically as soon as the design has been completed by linking the CAD system and the numerical-control machinery that is used in milling and molding processes.

All the specifications for the new product are held in a database while a three-dimensional model of the product is constructed by the designer on an electronic graphics display. When everything is ready and the computer has made all the analytical tests, modified information is passed to numerical control where lathes, mills, drills and molds are automatically set to the new specification. Presto! Your industrial robots have made a new ashtray, or space shuttle or a better mousetrap.

The category loosely labelled "business and presentation graphics" is the area of most interest to personal-computer users, and it is the one on which we shall be concentrating. Few companies in the business-graphics area are more than 10 years old, most of them are more like 10 months old. Office graphics is very much the younger sister to scientific and CAD applications.

Within this enormous category you can find some very strange bedfellows. An animated ABC Television logo and an analytical paper graph showing the sales performance of General Motors have little in common other than the fact that both images were generated on a computer. Business and presentation graphics may exist in electronic form, on video tapes and discs, and in computer memories. Or they may be placed onto hard copies — photographic film, paper, or plastic.

Each of the three main computer-graphics categories contains a multitude of different stories but the third one, business and presentation graphics, is the most varied of all. The entire range of computing power from the massive Cray I down to the Sinclair ZX-81 can be applied in this category.

As microcomputers become more powerful they begin to play a larger role in all aspects of business and presentation graphics. Whereas research scientists and motor-car designers continue to rely on their mainframes and super-minis, the business user is finding that his other graphics needs can sometimes be met by less expensive systems. The most effective graphics hardware is currently to be found in the mid-range of computers, though you will be wise to keep one eye on those micros. The future may well belong to pint-sized processors.

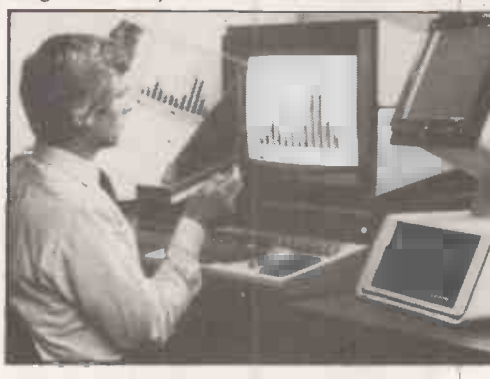
Moving closer to the subject, you can see the industry in greater detail. Looked at in terms of products rather an activities, there are three main types of graphics display: the direct-view storage tube or DVST, the stroke-refresh display, and the raster-refresh display. You are more likely to encounter the stroke-refresh type in engineering and architectural design applications, and the raster-refresh type in business and presentation graphics.

The DVST was developed in the late 1960s mainly in an effort to bring down the cost of graphics displays. It forms an image using an electron beam that moves more slowly than in other devices. The image is stored temporarily on a mesh in which the phosphor is embedded. For simple applications, the DVST is still very popular since it does not require the expensive additional ciruitry known as a refresh buffer.

Line-drawing displays date from the mid-1960s. They show line drawings by instructing the electron beam to connect end-points which have been digitised into the computer memory. The display processor and display-buffer memory then assemble the picture by repeatedly passing instructions to the electron gun which writes the picture on the screen.

Raster-graphics technology is closer to the operation of a normal TV set. Picture information is stored in the buffer in terms of picture elements or pixels. The horizontal scan lines of the display are now composed of these individual picture elements, the whole raster being a matrix of pixels. This technology burst into prominence in the mid-1970s and is destined to become the major type of display. It appeared late on the scene because far more computing power is required to calculate the intensity and colour values of millions of pixels than to calculate just the end-point positions of vectors in a line-drawing display.

To judge the resolution of a raster display you can simply count the number of pixels; a matrix of 512 by 512 is considered average. However, when a picture is split up into discrete square elements there is a loss of resolution especially in representing diagonal lines, which tend to look like



Polaroid's VideoPrinter Model 8 colour film recorder.

staircases. A software technique called anti-aliasing has been developed to smooth out the jagged lines. In it the intensity values of pixels that are adjacent to areas of solid colour are adjusted to create the illusion of smooth edges.

The main difference between vector and raster displays is the ability of the raster display to show solid areas of colour, something which is essential in business graphics. Industrial designers, too, are becoming increasingly interested in raster systems because they can simulate the actual appearance of a product by solids modelling. Another plus for the raster approach is that the screen never flickers, however much visual information is crammed on to it. Vector displays suffer from this complaint because the refresh time can easily be exceeded by the time taken to write the whole image. On the other hand, raster systems rarely match the resolution of good vector systems.

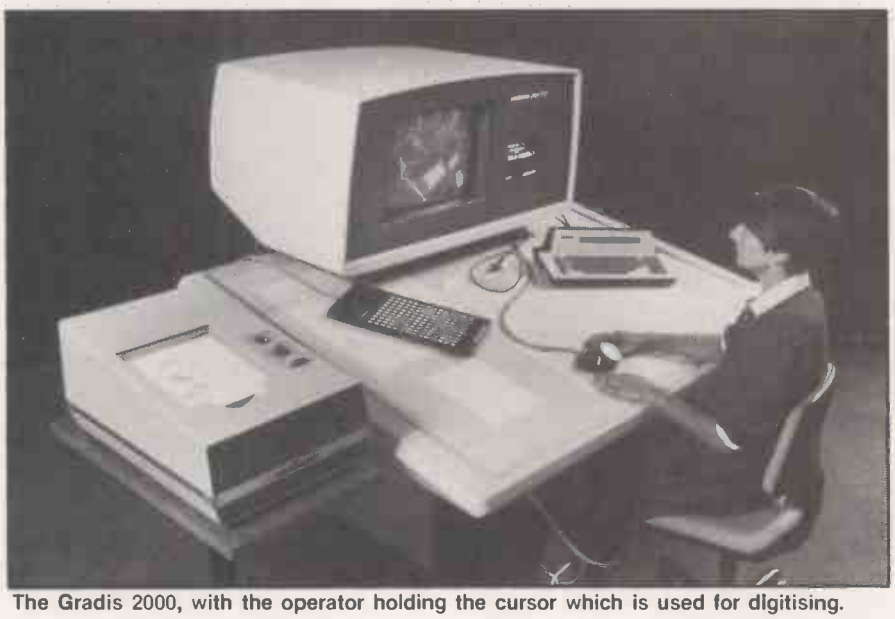
"Interactive" is a word which one often finds associated with computer graphics. The idea of a human being interacting with a computer-driven display was inherent to the very first step taken by Ivan Sutherland's Sketchpad program in 1963. Since then, the technology has been refined to a point where even voice recognition has a role to play, though most interaction is still through touch devices. They are used both for inputting and controlling the lines, dots and shapes that comprise the picture.

Interactiveness comes at many levels. It is possible to address an electronic image in machine code via an alphanumeric keyboard, but no one should really describe that as being truly interactive. What is portentously called the "human/machine interface" is dependent on having a number of convenient input devices so that artists, designers and other ordinary mortals can make pictures with the computer. Among the devices available to input or control picture information are: data tablets and stylus, touch-sensitive screens, light-pens, keyboards, joysticks, tracker balls, control dials, function switches, hand cursors and mice.

A mouse is a small hand-held locator device that can roll across a flat surface while keeping track of its own position. Two sets of tiny wheels set at right-angles in the base of the mouse register changes in movement in two dimensions. The instrument is used for locating positions of points that are to be entered into the computer memory. This process is known as digitising.

Other digitising devices for inputting pictures include the hand cursor and the stylus and tablet. The hand cursor, like the stylus, works in conjunction with a sensitive tablet. It has "cross-hairs" to indicate the point-positions. Function switches are often included on a hand-cursor to give various instructions, such as Pick or Select.

Manufacturers have really gone to town with data tablets. Sonic tablets, for instance, measure the stylus position using



The Gradis 2000, with the operator holding the cursor which is used for digitising.

strip microphones along two adjacent edges. The microphones pick up sound waves from the tip of the stylus, which emits a small electrical spark. Far more accurate — and quieter — is the tablet that has a grid of wires embedded in its surface. The co-ordinates of a point are then picked up by the stylus as variations in voltage. Yet another method is to use special material for the surface of the tablet through which electrical pulses can travel at right angles to each other. The pulses are emitted at regular intervals and so the stylus position can always be calculated.

A graphics tablet is a simulation of an artist's drawing board. Instead of seeing the image on the board you see it on a screen. Combine the tablet with a stylus which simulates a brush or a pen, and you really begin to feel like an artist. Whenever the stylus touches the tablet, a pressure-sensitive switch in the tip signals the location. A cursor may appear on the screen or, depending on the program, a pixel may be illuminated. Move the stylus and you get a row of pixels where before you had a blank screen.

Touch sensitive screens are used in some systems to give the operator a more direct contact with the electronic image. No screen cursor is then needed. There are both low-resolution and high-resolution touch screens, having 10, 50 or even 500 resolvable positions vertically and horizontally. Like the tablet, they work on several principles, including both light-wave and sound detection.

Light-pens detect light on the screen by means of a photocell located either in the pen itself or at the end of a fibre-optic pipe. They are more useful as positioning devices in line-drawing systems than as mere pointing devices in raster displays. To position images they require a tracking program in the computer software.

Keyboards are familiar to all typists and programmers. The chord keyboard, however, is a five-button device that is played like a midget's piano. You can generate 31 different instructions on it if you are clever — but beginners should stick to the normal alphanumeric keyboard.

Joysticks and tracker balls are used for scrolling or panning the screen image. A joystick is also convenient for tumbling a wire-frame or a three-dimensional model in space. Control dials and function switches help you give instructions quickly and efficiently without having to type in more precise details on the keyboard.

The trouble with computer graphics is that people still want to carry images around with them. They like to look at them on the bus or scrutinise them in the boardroom, or project them on to a screen.

Far from decreasing the amount of printed material computers are actually increasing the quantities of paper and photographic products we consume.

Electromechanical output devices convert electronic images into hard copy. Both printers and plotters come into this category. Plotters draw while printers imprint — yet ink-jet printers imprint without even touching the paper.

The cost of electromechanical output devices range from a couple of hundred pounds for a single-pen plotter up to several hundred thousand for a sophisticated film recorder. Most of the devices have potential applications in making presentation and audio-visual graphics.

In film animation you do not have to use a film recorder: you can use a pen plotter instead. The computer-generated sequences for the American TV series "Music in Time" were created by taping an animation peg-bar on to the paper in a mechanical-arm plotter. The computer drawings, all in exact register, were later photographed and coloured by an optical camera.

Electrostatic printers are sophisticated photocopying machines, and Xerox is the leader of the pack in this field. For computer graphics they are both fast and economical, using either a matrix-writing technique or a photoconductive plate at the heart of the system. In matrix writing an

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Multi-million dollar industry

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invisible image is placed on to the paper by a electrostatic charge applied by a matrix of needles. Liquid toner is then wiped on to the paper, and clings to the charged areas. In an alternative method, the image from an internal cathode-ray tube is transformed by a photoconductive plate into an electric charge on the paper.

Laser printers work in a similar way to the second electrostatic method, except that a laser beam is used instead of a CRT electron beam. These machines are very fast: the Xerox 6500 CGP prints 180 colour copies per hour, and Xerox has a machine that can produce 7,000 black-and-white charts per hour. Both electrostatic and laser can print in full colour on to a variety of media by applying carbon particles in seven colours: cyan, magenta, yellow, red, green, blue and black.

Impact and non-impact plotters tend to be relatively low-resolution devices which are well suited to providing hard-copies of raster images. Impact plotters work like sophisticated typewriters in that they use ribbons and hammers for printing. Non-impact printers work on a variety of ink-jet principles, spraying coloured inks on to paper without any physical contact between the surface being printed on and the jets. Non-impact printers are also ideal for putting images on to fragile materials.

Photographic recorders produce slides or prints from individual frames, either directly from a CRT or by collecting and reassembling the picture information. When a CRT is photographed directly the scan lines will appear in the photograph. A photographic recorder, introduced a controlled amount of blur into the picture so that the lines disappear. Sophisticated electronics are needed to match the red, green and blue CRT output with the response of photographic films.

Film recorders are similar to photographic recorders — but are around 100 times more expensive. Film recorders of this type use a special internal black-and-white single-line raster-scan CRT to display the image. Its scan is closely co-ordinated with the film transport so that the film moves a fraction of an inch after each scan line to build up an image. Colour is introduced by using a filter assembly. A powerful minicomputer analyses the image into primary colours and intensity values.

Once you have established what kind of hard copy you require, the next step is to specify the operating mode. In on-line plotting, the machine is connected to the host computer by cable. The method is fast and convenient — and expensive too because of the computer time involved. Off-line plotting makes copies from data supplied from storage media such as tapes or discs. It can be used with a central hard-copy facility, when operators can be specially trained in this aspect of graphics.

System companies take equipment from original equipment manufacturers, design and build additional hardware, and put the whole system together as a package for specific applications and markets. They may also write or commission special software to run on their systems. Unfortunately many end-users simply do not take the trouble to shop around. If they deal with IBM for, say, data processing systems, they wait until an IBM salesman brings around a new graphics product. The alternatives are to spend weeks sifting through mountains of information, attending lengthy demonstrations, or employing a consultant.

The best approach is to hire a generalist consultant. He can suggest specialist consultants who will work with you to purchase and commission a system. Remember that computer graphics is more than just a slide-making system.

The systems of scientific and technical graphics, and for CAD/CAM need not concern us. The business and presentation graphics category contains a myriad of systems companies.

Analytical systems help us to understand the output of the computer in graphic form; presentation systems produce custom-made graphics for business presentations. Plenty of overlap exists between the two types, but the distinction is important. There is a big difference in manipulating a billion pieces of data when you make a business graph, from merely generating a computer image because you like the look of it.

Business graphics are divided into analytical and presentation systems. The products themselves can be further divided into hardware and software solutions. Hardware solutions involve purpose-built display hardware. Stand-alone systems which are usually minicomputer based are available in this category and can often be hooked into a larger data base.

The software solution is becoming increasingly popular as CPUs become more powerful. It involves the generation of graphics displays by running sophisticated software through a general-purpose computer.

Business users are demanding high resolution, ease of operation, speed, and an ability to hook into a corporate data base. A state-of-the-art device with these features will also give good performance per dollar.

When you increase the resolution of a display, for example, you immediately meet with the law of diminishing returns. As you double the number of pixels on each axis you are quadrupling their total number. Displays also feature a number of pixel layers — or planes — in the z-axis, the depth of the picture, and while this is not directly related to resolution it effects the number of colours that the display can handle.

A new feature that has been introduced by Raster Technologies, a Massachusetts company, is a graphics display system that allows you to put the image on to either a 512-line monitor or a 1024-line monitor. With its Model One/40 you can also select the full display on the higher-resolution screen or window into the image memory in the 512 mode. The product can be described as state-of-the-art because it meets the requirements of high performance, versatility and relatively low cost.

Good software is the key to good computer graphics. The quality of the end-product — the picture or graph — is entirely shaped by the ability of the software to help you deliver an appropriate image.

Graphics software packages are a major growth area of the industry. They are available for mainframes, minis and micros. But people in the mid-range of quite expensive stand-alone mini-based systems may well find themselves in a sort of no-man's land within a few years.

Mainframe software is so powerful that once you have seen the results you will fnd it hard to settle for anything else. Neither is it strictly true, as some stand-alone suppliers claim, that graphics packages tie up mainframe resources at the expense of other applications. At the lower end of the market, as micros become more powerful very sophisticated software is being written for them.

The big breakthrough in software packages has been the improvement in

Business graphics systems

Apple Business Graphics
Turns data into graphs. Telephone Apple, Hemel Hempstead (0442) 60244.

Apple Lisa
Hard disc-based personal micro with powerful integrated graphing capabilities provided by LisaGraph. Telephone Apple, Hemel Hempstead (0442) 60244.

Bit-Stik
Built around a graphics joystick with X, Y and Z directions, links to an Apple II. Telephone Robocom, 01-263 3388.

Boxer
A three-dimensional solid-modelling facility which works in conjunction with DOGS, a geometric-modelling Drawing Office Graphics System, originally developed at the University of Leeds. Telephone Pafec, Nottingham (0602) 292291.

BFS Business Graphics
In effect a word processor for business graphics, it interfaces to most popular printers and plotters and runs on the IBM PC. Imported from Cambridge, Massachusetts by Pete & Pam Computers. Telephone: Rossendale (0706) 227011.

Context MBA
Powerful spreadsheet with limited text entry, database and graphics facilities integrated together. Available for the IBM PC and Hewlett Packard Series 200

Model 16. Telephone The Software Rental Bank, Leighton Buzzard (0525) 373440, or Hewlett Packard (0344) 773100.

Dataplot
Business graphics package which can interface to the Supercalc spreadsheet and to Graphtext, a word-slide generating package. Runs under CP/M and MP/M. Contact Grafox, Oxford (0865) 242597.

dGraph
Versatile business graphics package which entails minimum programming and interfaces with Ashton Tate's dBase II. Telephone Fox & Geller, 01-580 5816.

Dicomed
Computer-based high-resolution colour-slide design system aimed at audio-visual producers, Dicomed copes with text, electronic drawing, digitising and freehand drawing. Eidographics then produces the final slides from your floppy discs. Contact Eidographics Ltd, 47 Marylebone Lane, London W1. Telephone: 01-486 9479.

Graforth
All-singing all-dancing graphics package written in Forth, includes a built-in music synthesizer. Telephone SBD Software, 01-948 0461.

Graphics Toolkit
Business graphics package for the ACT Sirius, interfaces with Supercalc. Telephone ACT, 021-501 2284.

Graph It
Simple graph-drawing package for Atari micros. Telephone Atari, Slough (0753) 33344.

Graphkit
Graph plotting, curve fitting and statistical analysis package for Commodore Pets. Telephone Commodore Information Centre, Slough (0753) 79292.

Graph'n'Calc
Graph-drawing program with its own modest spreadsheet, for the IBM PC. Imported from Santa Cruz, California by Pete & Pam. Telephone: Rossendale (0706) 227011.

Lotus 1-2-3
Spreadsheet with a powerful graphic extension built in. Telephone Planning Consultancy, 01-839 3143.

Peachtree Graphics Language
Interactive graphics programming language which runs under CP/M and MP/M, and interfaces to Peachcalc/Magicalc and Peachtext/Magic Wand. Telephone Peachtree, Maidenhead (0628) 32711.

Perq
Amazing mouse-driven graphics system for draughting and CAD/CAM applications. Telephone ICL, Infopoint, 01-788 7272.

P L Graphics
Digitising and drawing system based on the BBC Model B and suitable for schools and small businesses. Telephone B S Dollamore, Burton-on-Trent (0283) 217905.

StarGraphics II
35mm. colour-slide design system based on the Apple II micro. Myriad produce the final slides from your discs. Contact Myriad, 106 Hampstead Road, London NW1, Telephone: 01-380 0191.

Sub-Logic Graphics Package
For displaying three dimensional scenes on a two dimensional display. Telephone Pete & Pam, Rossendale (0706) 227011.

Utopia Graphics Table System
Provides 64 colours, 40 brush shades and pen-controlled editing.

Vectrix VX Series
CAD/CAM and business graphics system which includes NEC chips and an Intel 8088, and links to various personal computers including the IBM PC, Sirius, Osborne and Hewlett Packard and Apple. The VX-384 can display up to 512 colours from a palette of 16.8 million. Imported from Greensboro, North Carolina by Sintrom Electronics. Telephone: Reading (0734) 875464.

VisiTrend/Plot
Converts data from VisiCalc and other Visi products into business graphics. Telephone Rapid Recall, (0494) 38525.

user-friendliness. This is a marketing breakthrough because the people who really need graphics are rarely skilled in computing. Yet the most sucessful cases of business graphics implementation have been where hundreds and even thousands of company employees have been trained to operate a system. No longer is computer graphics an arcane and mysterious art. The new techniques are available to everyone.

First-rate graphics software is now almost affordable by everyone. VisiPlot, to run on an Apple computer, is priced at around £177. At these rates, the use of computer graphics will become almost universal in small businesses and perhaps even in the home.

Word processors can be converted into graphics workstations with the addition of appropriate software. Writing a software package, however, requires highly-skilled programmers. The business graphics packages offered by Apple Computers took 200 man-years to develop — and woman-years no doubt.

The academic interest in artificial intelligence is influencing new approaches to computer graphics. Eventually even the most advanced scientific thought reaches the businessman in one form or another. One phenomenon of particular interest to students of artificial intelligence is pattern recognition. We do not fully understand why or how we instantly recognise, say, the face of a friend in a crowd of people, when everyone in the crowd has two eyes, two ears and a nose in approximately the same places. It prompts the question, can patterns be generated and developed to help the businessman recognise the friendly face of his sales statistics?

Over the past decade we have survived a blitz of multi-image shows which have helped pave the way for an appreciation of pattern recognition as a business tool. Today's incredible growth of computer graphics is both a symptom and a cause of this new development of human skills.

Business graphics

Our world's economy, depicted in colourful business graphics, looks pretty unhealthy. Today you can see all those complex statistics at a glance, arranged for you by the computer in graphic format. Gone is the time when economists could pretend to be deaf when asked which way the wind was blowing. But if charts and graphs show us a sorry picture of the world recession at least the world of business graphics is booming, at a rate of around 70 percent a year.

Graphics Software, Inc., an Oregon-based business graphics company, makes a startling claim, "Mainframe quality graphics can now be replicated on your mini/microcomputer." The claim will bear scrutiny providing you read it carefully. The company is not suggesting that an Apple II can perform the same service as a big mainframe complete with Tell-a-Graf software. Rather, it is saying that its product, GSS Plot, will lift micro graphics to a new level of flexibility. The software will run on most mini and microcomputers, and it is fully device Independent in regard to CRTs and plotters.

This particular software package has been designed specifically for applications software developers. GSS Plot contains all the necessary computer instructions to prepare presentation quality line graphs, bar charts, scatter charts and other types of display. For example, a user need call only four related sub-routines and supply 13 parameters in order to generate a complex pie chart. Without the GSS Plot subroutines you would have to write a 100 lines of code and make all the necessary tests before being able to generate similar graphics.

Since CP/M has become the favoured operating system of most personal-computer manufacturers, GSS has signed a deal with the CP/M originators, Digital Research Inc., and now offers GSS Plot in CP/M compatible form. This co-operation could have a significant impact on the future of business graphics,

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Multi-million dollar industry

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enabling micro users to add a true graphics capability to their machines. Tom Clarkson, president of GSS, says that the agreement, "will significantly assist our ability to make standardised graphics software available to micro and minicomputer users."

Another company to watch in this field is Graphic Communications Inc., of Waltham, Massachusetts. Its President, Randall E Wise, is a strong believer in what he calls the software solution. He says, "There are hardware solutions to stand-alone graphics and there are software solutions to stand-alone graphics. We have chosen the software solution, currently operating on the HP-8587. That concept works on an IBM Personal Computer as an application. And powerful 16-bit computers are coming along with very good software, which can very nearly duplicate the capabilities that other stand-alone systems are offering with their hardware solutions".

Special hardware is always more expensive than general-purpose software. Randall Wise suggests that the companies who are offering expensive hardware for business graphics will find themselves fighting a losing battle on prices. "I don't know how they are going to react to the new software that will duplicate their capability for a few thousand dollars."

Business graphics are often required in slide or overhead transparency format. Polaroid instant film technology has made a big impact on this market with several manufacturers incorporating instant film cameras in their systems. Polaroid has several products, in particular, the Videoprinters Models 4 and 8. "We can now bridge the gap between electronics and film," says James Hartnett, Marketing Manager of Polaroid's Professional Film Products Division. "Previously, film had not been appropriately matched in phosphor response to proper exposures of red, green, or blue levels. In the Model 8 it is possible to optimise the two — and get the best result."

The Model 8 Videoprinter is a microprocessor-controlled display-driven device, producing 8in. by 10in. instant colour overhead transparencies. "It is very state-of-the-art in digital input and information gathering," says Hartnett. The Model 4 is intended for 4 by 5 formats and smaller, including the new instant-process 35mm. film that Polaroid is launching later in 1982.

One of the first micro-based graphics systems came from Cromemco, a company that is better known for its CAD/CAM hardware. The Z-2H graphics system is based on the Z-80 chip, and has recently been upgraded to include the Motorola 68000. This allows the display of a 1,000 by 1,000 matrix, putting it just into the high-resolution bracket. Cromemco has supported its system with two software packages, Slidemaster and Fontmaster. With Slidemaster and a graphics tablet a user can choose from 75 design functions that are displayed on both screen and tablet menus. The package is intended for presentation graphics, and includes a carousel mode that allows you to call up an image sequence as though you were controlling a slide projector. Fontmaster lets you design your own lettering or special characters such as scientific notation.

Excellent software for both the Apple II and III has been developed by Business and Professional Software of Cambridge, Massachusetts. Recent packages from this company, marketed by Apple themselves, go beyond the presentation graphics of its earlier software. The two-diskette package, now called Apple Business Graphics, allows you to create colour graphic representations of data using English language commands. For instance, sales projection data can be retrieved from a VisiCalc program and automatically displayed as bar, line or pie charts.

Like the Cromemco system, the Apple Business Graphics package can make the computer function like a slide projector. It requires the addition of a new product called Screen Director, two diskettes that come with a Kodak hand-held projector controller, which plugs into the game-slot on the Apple. David Solomont, President of BPS, says, "Apple Business Graphics allows the user to create and store graphic images. Screen Director retrieves and displays them on video monitors for presentation." It also lets you create hard copies of a whole tray of images on many brands of dot matrix printer, including the IDS Paper Tigers, Anadex 9000s, Epson MX line and Apple Silentype. The IDS Prism will produce hard copy in colour.

With the low cost of Apple software and the relatively high cost of colour slide-making systems an attractive solution is to make use of a hard-copy bureau service. Comshare has tried out its Target Image Maker on the Apple. Users of the system would be able to create charts on their in-house computer and then download them to a Comshare facility for production of the slides. At this point the Post Office takes over, the postman brings you the slides in the mail. Perhaps this deflates some of the high-tech magic that surrounds the creation of electronic images, but it is also the thinking behind the Cornerstone/Clear Light Stargraphics operation.

The Apple Business Graphics package makes the computer function like a slide projector.

If business graphics becomes as simple and as inexpensive as many experts predict, we shall be knee-deep in graphs and charts before the decade is over. Manufacturers are already treating the subject as though images will be manipulated with the ease of words in word-processing. Another name will have to be found for this technique, since image processing means something quite different — image enhancement.

Hinting at the shape of the office of the future, Hewlett-Packard can now proudly show off its Merged Text and Graphics system. This will actually produce illustrated business correspondence, among other applications. Perhaps we shall eventually be able to dispense with words altogether and communicate with each other entirely in pictures. This, of course, will only deepen the world recession. The left side of our brains will be redundant, while the right side will be on strike — demanding extra pay for extra work.

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● Circle No. 167

Geometrical

THE STANDARD METHOD of plotting lines on computer-graphics sytems is very similar to the way a pen and paper is used.

The main difference is that the computer is a comparatively simple machine and can normally only draw straight lines. To draw a circle, for example, the computer has to divide the curve up into short straight-line segments which it then plots individually.

Even drawing lines requires a lot of software. Anything less straightforward calls for a library of routines. Often the programmer must start from scratch using only a basic line-plotting routine supplied with the system.

The listing provides a library of useful plotting routines written in Basic which should run on any machine. Only one routine needs to be written to interface the library with most line-plotting systems, and usually it only needs to be a line or two in length.

The interface routine is at line 1000 and is used by all the other plotting routines in the library. It moves the cursor from the current position to a new position specified with a pair of X,Y co-ordinates in the parameters. A third parameter is used to specify the mode in which the cursor is to be moved. If it is zero the cursor is simply moved to the new position. If it is non-zero a line is also drawn from the old to the new position. The value of the parameter may be used to specify the colour and/or intensity of the line to be drawn.

In the library it is assumed that only one colour is available for the line drawing. You could use a global variable to specify the colour to be used for plotting if your system allows it. The routine at line 1000 must then use this variable to plot the correct colour.

All the routines, apart from the basic plotting routine and the conversion routines, need to be supplied with a starting position offset X0 and Y0 from which plotting will commence. The variables T0 to T9 may be corrupted by the library routines and thus should not be used to hold global values.

None of the routines in the library contain line-number references using Goto or Gosub statements, apart from line 1000 for the basic line-plotting routine. You can easily relocate the code to different line numbers, if you wish, without changing the code itself, provided the Plot routine is on line 1000.

The library should be stored as a single file. When a new program which uses some of the library routines is to be written, the library itself should first be loaded. Unused routines may be deleted and the program typed in on the keyboard. The program and library routines may then be renumbered as required before being saved as another file.

Interface routine

Plot, line 1000. Plots from current position to new position. The only routine in the library which needs to be written for a specific system. Most of the other routines in the library call this routine. Input parameters are:

X — X co-ordinate of new position
Y — Y co-ordinate of new position
M — mode of plot; 0 to move without drawing line, 1 to draw line to new position

Line-plotting routines

Draw, line 1100. Draws a line between two positions. Useful when the two end co-ordinates of the line are known and the current position of the cursor is at neither of them. Input parameters are:

X0 — starting X co-ordinate
Y0 — starting Y co-ordinate
L1 — finishing X co-ordinate
L2 — finishing Y co-ordinate

Line, line 1200. Draws a line from a position. Should be used when the starting co-ordinates and the relative position of the finishing co-ordinates are known. Input parameters are:

X0 — starting X co-ordinate
Y0 — starting y co-ordinate
L1 — increment in X direction for final position
L2 — increment in Y direction for final position

Radius, line 1300. Draws radius of a circle. Useful when the angle and the length of the lines are known rather than the X,Y co-ordinates of the end of the line. Input parameters are:

X0 — starting X co-ordinate

Geometrical plotting.

```
1000 REM "PLOT",X,Y,M
1010 REM
1020 REM (C) J.P.BOWEN, OCTOBER 1982
1030 REM
1040 REM ************************
1050 REM * Machine dependent code *
1060 REM ************************
1070 REM
1080 REM
1090 RETURN
1100 REM "DRAW",X0,Y0,L1,L2
1110 M=0
1120 X=X0
1130 Y=Y0
1140 GOSUB 1000
1150 M=1
1160 X=L1
1170 Y=L2
1180 GOSUB 1000
1190 RETURN
1200 REM "LINE",X0,Y0,L1,L2
1210 M=0
1220 X=X0
1230 Y=Y0
1240 GOSUB 1000
1250 M=1
1260 X=X0+L1
1270 Y=Y0+L2
1280 GOSUB 1000
1290 RETURN
1300 REM "RADIUS",X0,Y0,L,A
1310 T0=A*PI/180
1320 M=0
1330 X=X0
1340 Y=Y0
1350 GOSUB 1000
1360 M=1
1370 X=X0+L*COS(T0)
1380 Y=Y0+L*SIN(T0)
1390 GOSUB 1000
1400 RETURN
1410 REM "FIGURE",X0,Y0,L1,L2,N1,N2,
     X(?),Y(?)
1420 M=0
1430 X=X0+L1*X(N1)
1440 Y=Y0+L2*Y(N1)
1450 GOSUB 1000
1460 M=1
1470 FOR T0=N1+1 TO N2
1480 X=X0+L1*X(T0)
1490 Y=Y0+L2*Y(T0)
1500 GOSUB 1000
1510 NEXT T0
1520 RETURN
1530 REM "POLYGON",X0,Y0,L,A,N,N1
1540 T0=A*PI/180
1550 T1=2*PI/N1
1560 M=0
1570 X=X0
1580 Y=Y0
1590 GOSUB 1000
1600 M=1
1610 FOR T2=1 TO N
1620 X=X+L*COS(T0)
1630 Y=Y+L*SIN(T0)
1640 T0=T0+T1
1650 GOSUB 1000
1660 NEXT T2
1670 IF N<N1 THEN RETURN
1680 X=X0
1690 Y=Y0
1700 GOSUB 1000
1710 RETURN
1720 REM "SQUARE",X0,Y0,L,A
1730 L1=L
1740 L2=L
1750 N=4
1760 REM "RECTANGLE",X0,Y0,L1,L2,A,N
1770 T0=A*PI/180
1780 T1=COS(T0)
1790 T2=SIN(T0)
1800 M=0
1810 X=X0
1820 Y=Y0
1830 GOSUB 1000
1840 M=1
1850 IF N<1 THEN RETURN
1860 X=X+L1*T1
1870 Y=Y+L1*T2
1880 GOSUB 1000
1890 IF N<2 THEN RETURN
1900 X=X-L2*T2
1910 Y=Y+L2*T1
1920 GOSUB 1000
1930 IF N<3 THEN RETURN
1940 X=X0-L2*T2
1950 Y=Y0+L2*T1
1960 GOSUB 1000
1970 IF N<4 THEN RETURN
1980 X=X0
1990 Y=Y0
2000 GOSUB 1000
2010 RETURN
2020 REM "TRIANGLE",X0,Y0,L1,L2,A,N
2030 T0=A*PI/180
2040 T1=COS(T0)
2050 T2=SIN(T0)
2060 M=0
2070 X=X0
```

plotting

Jonathan Bowen presents a library of versatile Basic procedures which add a graphics-handling capability to your micro.

Y0 — starting Y co-ordinate
L — length of radius
A — angle of radius

Geometrical plotting

Figure, line 1410. Draws an irregular figure. The co-ordinates of the vertices of the figure are passed as arrays in the parameters X and Y which must be set up before the routine is called. For example:

```
100 N1 = 1
110 INPUT N2
120 DIM X(N2), Y(N2)
130 FOR I = N1 to N2
140 INPUT X(I), Y(I)
150 NEXT I
160 X0 = 0
170 Y0 = 0
180 L1 = 1
190 L2 = 1
200 GOSUB 2100: REM "FIGURE"
```

The parameters N1 and N2 specify the range of the arrays to be used; in this example the entire array is used. The parameters X0, Y0, L1 and L2 may be used to offset and scale the figure. Input parameters are:

X0 — offset in the X direction
Y0 — offset in the Y direction
L1 — scaling factor in the X direction
L2 — scaling factor in the Y direction
N1 — first array subscript to be used
N2 — last array subscript to be used
X — array containing X co-ordinates
Y — array containing Y co-ordinates

Polygon, line 1530. Draws a regular polygon. As well as the number of sides of the polygon, the number of sides to be drawn is also specified. The polygon may be drawn at any angle to the horizontal. Input parameters:

X0 — starting X co-ordinate
Y0 — starting Y co-ordinate
L — length of side
A — angle of first side; normally zero
N — number of sides to be drawn; normally equal to N for a complete polygon
N1 — number of sides; must be three or more

Square, line 1720. Draws a square. Drops through to the rectangle routine with the correct parameters to draw a square. Input parameters are:

X0 — starting X co-ordinate
Y0 — starting Y co-ordinate
L — length of sides of square
A — angle of first side; normally zero for horizontal square

Rectangle, line 1760.Draws a rectangle. The size of the base and height, number of sides to be drawn and angle to the horizontal must be specified. Input parameters:

X0 — starting X co-ordinate
Y0 — starting Y co-ordinate
L1 — length of base of rectangle
L2 — height of rectangle
A — angle of first side; normally zero for horizontal rectangle
N — number of sides to be drawn; normally four for complete rectangle

Triangle, line 2020. Draws an isosceles triangle. The figure is drawn clockwise so that if only two sides are drawn then they are symmetrical. The angle from the horizontal may be varied. Input parameters are:

X0 — starting X co-ordinate
Y0 — starting Y co-ordinate
L1 — length of base of triangle
L2 — height of triange
A — angle of base
N — number of sides to be drawn; normally three for complete triangle

Circular curve plotting

Arc, line 2240. Draws a circular arc. The centre of arc and the radius must be specified, together with the starting and finishing angles from the horizontal. The number of straight-line segments needed to make up the arc is calculated automatically and then the Segment Arc routine is used. The segment number calculation assumes a plotting area of a few hundred pixels in each direciton. If this is not the case on a particular system, then the division factor — 3 in this case — may need to be altered to obtain satisfactory results. For example:

X0 — X co-ordinate of centre of arc
Y0 — Y co-ordinate of centre of arc
L — length of arc radius
A1 — starting angle
A2 — finishing angle

Segment Arc, line 2260. Draws a segmented arc of a circle. The parameters are as for the Arc subroutine

(continued on next page)

```
2080 Y=Y0
2090 GOSUB 1000
2100 M=1
2110 IF N<1 THEN RETURN
2120 X=X0+L1*T1/2-L2*T2
2130 Y=Y0+L1*T2/2+L2*T1
2140 GOSUB 1000
2150 IF N<2 THEN RETURN
2160 X=X0+L1*T1
2170 Y=Y0+L1*T2
2180 GOSUB 1000
2190 IF N<3 THEN RETURN
2200 X=X0
2210 Y=Y0
2220 GOSUB 1000
2230 RETURN
2240 REM "ARC",X0,Y0,L,A1,A2
2250 N=20+INT(L*ABS(A2-A1)/1080)
2260 REM "SEGMENT ARC",X0,Y0,L,A1,A2,N
2270 T0=A1*PI/180
2280 T1=A2*PI/180
2290 T2=(T1-T0)/N
2300 M=0
2310 X=X0+L*COS(T0)
2320 Y=Y0+L*SIN(T0)
2330 GOSUB 1000
2340 M=1
2350 FOR T3=2 TO N
2360 T0=T0+T2
2370 X=X0+L*COS(T0)
2380 Y=Y0+L*SIN(T0)
2390 GOSUB 1000
2400 NEXT T3
2410 X=X0+L*COS(T1)
2420 Y=Y0+L*SIN(T1)
2430 GOSUB 1000
2440 RETURN
2450 REM "CIRCLE",X0,Y0,L
2460 N=20+INT(L/3)
2470 REM "SEGMENT CIRCLE",X0,Y0,L,N
2480 T0=2*PI/N
2490 M=0
2500 X=X0+L
2510 Y=Y0
2520 GOSUB 1000
2530 M=1
2540 T1=0
2550 FOR T2=2 TO N
2560 T1=T1+T0
2570 X=X0+L*COS(T1)
2580 Y=Y0+L*SIN(T1)
2590 GOSUB 1000
2600 NEXT T2
2610 X=X0+L
2620 Y=Y0
2630 GOSUB 1000
2640 RETURN
2650 REM "DOT",X0,Y0
2660 X=X0
2670 Y=Y0
2680 M=0
2690 GOSUB 1000
2700 M=1
2710 GOSUB 1000
2720 RETURN
2730 REM "DOT GRID",X0,Y0,L1,L2,N1,N2
2740 T0=L1/(N1-1)
2750 T1=L2/(N2-1)
2760 Y=Y0
2770 FOR T2=1 TO N2
2780 X=X0
2790 FOR T3=1 TO N1
2800 M=0
2810 GOSUB 1000
2820 M=1
2830 GOSUB 1000
2840 X=X+T0
2850 NEXT T3
2860 Y=Y+T1
2870 NEXT T2
2880 RETURN
2890 REM "DOT LINE",X0,Y0,L,A,N
2900 T0=A*PI/180
2910 T1=L*COS(T0)/(N-1)
2920 T2=L*SIN(T0)/(N-1)
2930 X=X0
2940 Y=Y0
2950 FOR T3=1 TO N
2960 M=0
2970 GOSUB 1000
2980 M=1
2990 GOSUB 1000
3000 X=X+T1
3010 Y=Y+T2
3020 NEXT T3
3030 RETURN
3040 REM "DOTS",X0,Y0,L1,L2,N
3050 FOR T0=1 TO N
3060 X=X0+L1*RND(1)
3070 Y=Y0+L2*RND(1)
3080 M=0
3090 GOSUB 1000
3100 M=1
3110 GOSUB 1000
3120 NEXT T0
3130 RETURN
3140 REM "ARROW",X0,Y0,L,L1,A,A1,N
3150 T0=A*PI/180
3160 T1=A1*PI/180
3170 T2=X0+L*COS(T0)
3180 T3=Y0+L*SIN(T0)
```

(listing continued on next page)

(continued from previous page)
except that the number of straight-line segments in the arc must also be given:

X0 — X co-ordinate of centre of arc
Y0 — Y co-ordinate of centre of arc
L — length of arc radius
A1 — starting angle
A2 — finishing angle
N — number of segments in arc; must be 2 or more

Circle, line 2450. Draws a circle. the parameters are as for the Arc routine except that the starting and finishing angles need not be specified. The number of straight-line segments is calculated automatically before the Segment Circle routine is used. As with the Arc routine, the segment-number calculation assumes a plotting area of a few hundred pixels in each direction. If this is not the case, then the division factor — 1,080 in the library routine shown — may need to be adjusted to obtain satisfactory results. Input parameters are:

X0 — X co-ordinte of centre of circle
Y0 — Y co-ordinate of centre of circle
L — length of circle radius

Segment Circle, line 2470. Draws a segmented circle. The parameters are as for the Circle subroutine except that the number of straight-line segments to be used must also be given:

X0 — X co-ordinate of centre of circle
Y0 — Y co-ordinate of centre of circle
L — length of circle radius
N — number of straight-line segments

Dot-plotting routines

Dot, line 2650. Draws a dot. A similar calling sequence is used by the rest of the routines in this section. Input parameters:

X0 — X co-ordinate of dot
Y0 — Y co-ordinte of dot

Dot Grid, line 2730. Draws a rectangular grid of dots. The size and the number of dots in each direction must be specified. Input parameters are:

X0 — X co-ordinate of bottom left-hand corner of grid
Y0 — Y co-ordinate of bottom left-hand corner of grid
L1 — length of rectangle in X direction
L2 — length of rectangle in Y direction
N1 — number of dots in X direction; must be two or more
N2 - number of dots in Y-direction; must be two or more

Dot Line, line 2890. Draws a line of dots. The parameters are as for the Radius subroutine except that the number of dots to be plotted must also be specified:

X — X co-ordinate of start of line
Y — Y co-ordinate of start of line
L — length of line
A — angle of line
N — number of dots in the line; must be two or more

Dots, line 3040. Plots random dots in a rectangle. The number of dots must be given. The routine assumes that the function RND (1) returns a random number between 0 and 1. If not, it will need to be adjusted accordingly. Input parameters are:

X0 — X co-ordinate of bottom left-hand corner of rectange
Y0 — Y co-ordinte of bottom right-hand corner of rectange
L1 — length of rectangle in X direction
L2 — length of rectange in Y direction
N — number of dots to be plotted

General-purpose plotting

Arrow, line 3140. Draws an arrow. The length and angle of the shaft and head must be specified. The head may be either open or closed. Input parameters are:

X0 — starting X co-ordinate
Y0 — starting Y co-ordinate
L — length of shaft
L1 — length of head
A — angle of shaft
A1 — angle of head from shaft
N — 0 for open head; 1 for closed head

Dashes, line 3390. Draws a dashed line. The parameters are as for the Radius subroutine except that the number of dashes and the ratio of dash to space between the dashes must also be given:

X0 — X co-ordinate of start of line
Y0 — Y co-ordinate of start of line
L — length of line
A — angle of line
N — number of dashes
N1 — ratio of dash to space between dashes

Grid, line 3660. Draws a rectangular grid. Parameters are as for the Dot Grid routine, this time the grid is drawn with solid lines.
X0 — X co-ordinate of bottom left-hand corner of grid
Y0 — Y co-ordinate of bottom left-hand corner of grid
L1 — length of grid in X direction
L2 — length of grid in Y direction
N1 — number of divisions in X direction
N2 — number of divisions in Y direction

Hatch, line 3890. Hatches in a rectangle. The number of lines used and the angle of the hatching are specified as parameters. For horizontal lines the angle is specified as zero; 90 degrees gives vertical lines.

X0 — X co-ordinate of bottom left-hand corner of rectangle
Y0 — Y co-ordinate of bottom left-hand corner of rectangle
L1 — length of rectangle in X direction
L2 — length of rectangle in Y direction
A — angle of hatching; between 0 and 180 degrees
N — number of hatching lines

(listing continued from previous page)

```
3190 M=0
3200 X=X0
3210 Y=Y0
3220 GOSUB 1000
3230 M=1
3240 X=T2
3250 Y=T3
3260 GOSUB 1000
3270 X=T2-L1*COS(T1-T0)
3280 Y=T3+L1*SIN(T1-T0)
3290 GOSUB 1000
3300 IF N=0 THEN M=0
3310 X=T2-L1*COS(T1+T0)
3320 Y=T3-L1*SIN(T1+T0)
3330 GOSUB 1000
3340 M=1
3350 X=T2
3360 Y=T3
3370 GOSUB 1000
3380 RETURN
3390 REM "DASHES",X0,Y0,L,A,N,N1
3400 T0=A*PI/180
3410 T1=COS(T0)
3420 T2=SIN(T0)
3430 T3=L/(N*(N1+1)-1)
3440 T4=T3*T1
3450 T5=T3*T2
3460 T6=N1*T4
3470 T7=N1*T5
3480 M=0
3490 X=X0
3500 Y=Y0
3510 GOSUB 1000
3520 FOR I=1 TO N
3530 M=1
3540 X=X+T6
3550 Y=Y+T7
3560 GOSUB 1000
3570 M=0
3580 X=X+T4
3590 Y=Y+T5
3600 GOSUB 1000
3610 NEXT I
3620 X=X0+L*T1
3630 Y=Y0+L*T2
3640 GOSUB 1000
3650 RETURN
3660 REM "GRID",X0,Y0,L1,L2,N1,N2
3670 T0=L1/N1
3680 X=X0
3690 FOR T1=0 TO N1
3700 M=0
3710 Y=Y0
3720 GOSUB 1000
3730 M=1
3740 Y=Y0+L2
3750 GOSUB 1000
3760 X=X+T0
3770 NEXT T1
3780 T0=L2/N2
3790 FOR T1=0 TO N2
3800 M=0
3810 X=X0+L1
3820 GOSUB 1000
3830 M=1
3840 X=X0
3850 GOSUB 1000
3860 Y=Y-T0
3870 NEXT T1
3880 RETURN
3890 REM "HATCH",X0,Y0,L1,L2,A,N
3900 T0=N+1
3910 T1=A
3920 IF (T1<0) OR (T1)=180) THEN T1=0
3930 IF T1<>90 THEN T2=ABS(TAN(T1*PI/180))
3940 T3=L1/T0
3950 IF (T1<>0) AND (T1<>90) THEN T3=
     (L1+L2/T2)/T0
3960 IF T1<90 THEN T3=-T3
3970 IF T1<>90 THEN T4=(L1*T2+L2)/T0
3980 T5=0
3990 IF T1<>90 THEN T5=INT(L2/T4)
4000 T6=X0
4010 IF T1<90 THEN T6=X0+L1
4020 T7=X0
4030 IF T1>=90 THEN T7=X0+L1
4040 T8=Y0+L2
4050 FOR T2=1 TO N
4060 T9=T0-T2
4070 X=T6
4080 IF T2>T5 THEN X=T7-T9*T3
4090 Y=T8
4100 IF T2<=T5 THEN Y=Y0+T2*T4
4110 M=0
4120 GOSUB 1000
4130 X=T7
4140 IF T9>T5 THEN X=T6+T2*T3
4150 Y=Y0
4160 IF T9<=T5 THEN Y=T8-T9*T4
4170 M=1
4180 GOSUB 1000
4190 NEXT T2
4200 RETURN
4210 REM "PI",PI
4220 PI=4*ATN(1)
4230 RETURN
4240 REM "RADIAN",A
4250 A=A*PI/180
4260 RETURN
4270 REM "DEGREE",A
4280 A=A*180/PI
4290 RETURN
```

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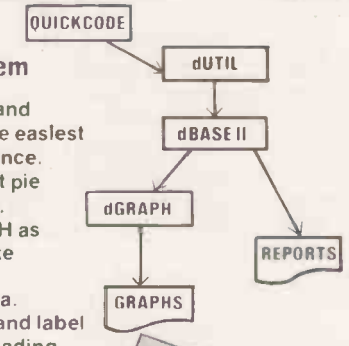

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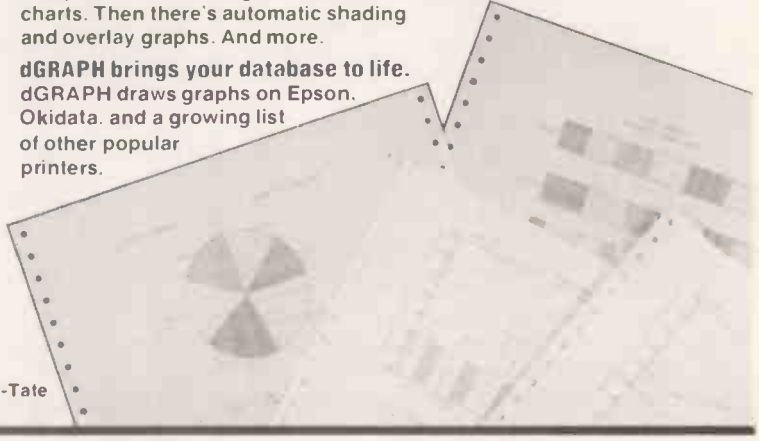

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Colouring blocks

Many shapes are difficult to fill using the BBC Micro's triangle-drawing facility. John Dallman explores the possibilities offered by the new BBC ROM.

ONE OF THE FEW serious gaps in the graphics abilities of the BBC Micro was, until recently, the lack of a general-purpose facility for producing solid blocks of colour. While the built-in triangle-drawing facility is very useful, many shapes cannot easily be produced from triangles.

It is sometimes useful to be able to fill in a shape which has been drawn, but whose boundaries are not known in a convenient form for the triangle-filling routines. Many kinds of graphs, shapes sketched by hand on the screen using a light-pen and landscapes for games are all difficult to fill using triangles.

What was needed was an intelligent graphics routine that could be given a starting point inside any closed shape and then fill it with a specified colour. Some microcomputers already have software which will do this job.

Now Acorn Computers has announced that some extra area-filling routines have been added to the BBC operating system. At first sight, they do not seem very impressive but a closer inspection shows that they are the basic operations for a very powerful algorithm which is well adapted to small systems.

The new operating system calls fill a horizontal row of pixels with a specified colour. They are implemented as two new groups of Plot operations, and may therefore be used directly from Basic. An additional Osword enquiry call has also been added, and can be accessed from Basic through the Call statement.

The techniques based on these new routines will only work on a BBC Micro with a Series 1 operating system ROM fitted. Owners of machines with the earlier version will find new ROMs available at BBC dealers and through the Beebug user group. The recursive techniques described by listing 3 will work on any BBC machine and, with modifications, on any system that allows recursive programming.

The new Plot routines are available from Basic with the statement

PLOT K,X,Y

where K is the Plot option — 72 to 79 in this case — and X and Y are the co-ordinates of a point on the screen. When used, these routines start at the pixel specified by X and Y and search leftwards and rightwards along the same row for a pixel not in the current background colour.

The search stops when it reaches the left-most and right-most pixels that can be reached from the starting point without crossing any pixel not set to the background colour.

The system variables holding the last two positions of the graphics cursor are then set to the co-ordinates of these points, and a line is drawn between them. Table 1 shows the exact meanings of X and K and the types of line drawn for different Plot options.

Plot options 88 to 95 work in a similar way but expect to be given a starting point not set to the background colour. These commands search for the last point that is not set to the background colour, moving away from the starting point. This point and the starting point are used as the new values for the last two cursor positions and a line may be drawn between them. Table 2 gives details of the individual commands.

In listing 1 a square is drawn and then filled in using Plot 77. A line is then drawn in the background colour, and an area to the left of it is filled in with a different colour. The program uses mode 5 so that individual pixels are clearly visible on the screen.

The Step 4 statements in lines 230 and 430 are important. The area-filling routines work in terms of physical pixels on the screen when searching, not 1,280-by-1,024 set of users co-ordinates. On the BBC Micro, there are only 256 pixels on the vertical axis of the screen, so the Step 4 prevents duplication of and operation after a row has been filled.

The routines work strictly in terms of logical colours and ignore any alterations of the default colours by VDU 19 statements. If you happen to have two logical colours set to the same physical colour and are using one of them as the background colour the routines will be able to tell the difference even though none is visible on the screen.

Selecting a new background colour with the GCol statement will not change the background until the screen is cleared. However, any of these new Plot statements used between selecting a new background colour and clearing the screen will treat the newly selected value as the background colour when deciding if a given pixel is set to the background colour or not.

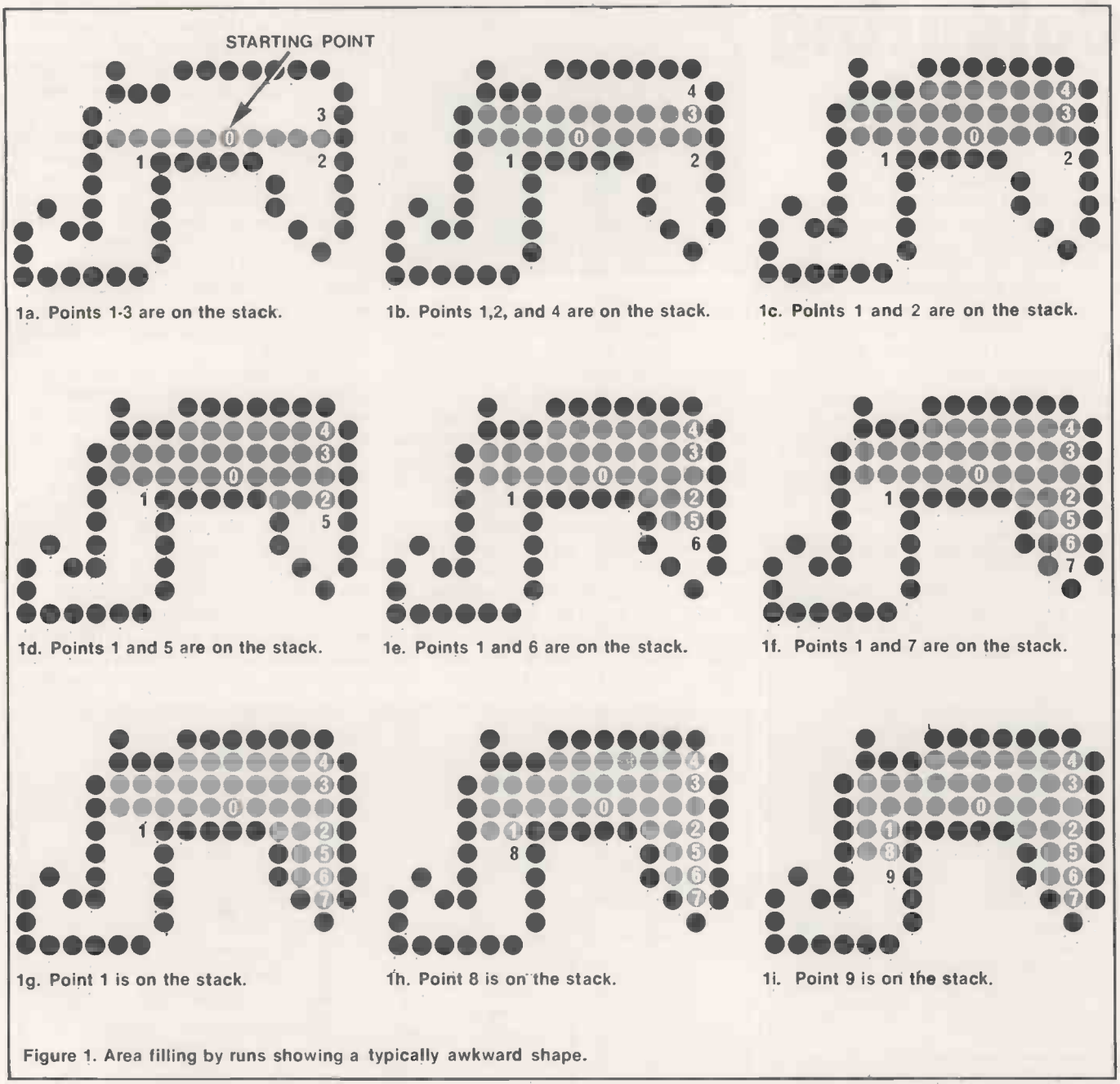
The new operating-system call has the form

OSWORD 13 (&OD)

It is used as an enquiry call, returning the

Listing 1.

```
  10 REM  Program 1 - demonstration
  20 REM  of new BBC PLOT routines
  30 REM  in MOS 1.2.
  40 REM  By J.G.Dallman, June 1983.
  50
  60 MODE 5
  70
  80 REM  Draw a shape to be filled in:
  90 REM  a square 400 * 400, centered
 100 REM  at 600,500.
 110
 120 MOVE 400,300
 130 DRAW 800,300
 140 DRAW 800,700
 150 DRAW 400,700
 160 DRAW 400,300
 170
 180 PROCpause(10)
 190
 200 REM  Fill the square in in yellow.
 210
 220 GCOL0,2
 230 FOR Y% = 300 TO 700 STEP 4
 240   PLOT 77,600,Y%
 250   NEXT
 260
 270 PROCpause(10)
 280
 290 REM  Draw a line in the back-
 300 REM  ground colour(black).
 310
 320 GCOL0,0
 330 MOVE 600,400
 340 DRAW 750,500
 350 DRAW 600,600
 360
 370 PROCpause(10)
 380
 390 REM  Fill rightwards to that line,
 400 REM  in red.
 410
 420 GCOL0,1
 430 FOR Y% = 400 TO 600 STEP 4
 440   PLOT 93,500,Y%
 450   NEXT
 460 END
 470 DEF PROCpause(secs)
 480 REM  Wait for 'secs' seconds.
 490 LOCAL t
 500 t = TIME
 510 REPEAT
 520   UNTIL TIME > t + 100*secs
 530 ENDPROC
```



1a. Points 1-3 are on the stack.

1b. Points 1,2, and 4 are on the stack.

1c. Points 1 and 2 are on the stack.

1d. Points 1 and 5 are on the stack.

1e. Points 1 and 6 are on the stack.

1f. Points 1 and 7 are on the stack.

1g. Point 1 is on the stack.

1h. Point 8 is on the stack.

1i. Point 9 is on the stack.

Figure 1. Area filling by runs showing a typically awkward shape.

last two positions of the graphics cursor in user co-ordinates as four 16-bit binary values in an eight-byte control block that may be located anywhere in user RAM. Details of the layout of this block are given in table 3. The routine is entered at &FF1 and is restored through &020C.

Listing 2 contains a procedure called Proclocate, which may be used in other programs: a compressed version of it is used in listing 4. The procedure returns the co-ordinates as four integer variables, x1%, x2%, y1% and Y2%. The values of x1% and y1% correspond to the X and Y co-ordinates of the last position of the graphics cursor: x2% and y2% do the same for the last-but-one position. When used with either of the two new groups of Plot commands, x1%,y1'% will be the co-ordinates of the right-most of the two points set, and x2%,y2% will be the left-most point.

The values returned by Osword 13 will always be rounded down to a multiple of the number of logical points, in user co-ordinates, in a pixel. They are stored within the operating-system RAM as addresses in terms of pixels, and are only converted back to user co-ordinates when requested by Osword 13. The conversion includes any resetting of the graphics origin that may have been performed by a VDU 29 call, and the returned values will always describe the pixel in which the orignally plotted point lay.

Listing 2 simply draws a line to a random position on the screen and prints the positions read back by Osword 13 on each time round the main loop. Of course, the last-x and last-y values at any time will shift to being the last-but-one-x and last-but-one-y values on the next loop of the program.

When you want to fill an area of the screen you are confronted with an area of pixels in a background colour, surrounded by a border of pixels in some other colour, possibly more than one. This border may be only one pixel wide, but may be more. It can be very irregular, with lumps forming a significant portion of the area to be filled. Figure 1 shows a typically awkward shape.

A filling algorithm must examine the pixels surrounding the filled area and fill in those that are in the background colour. The simplest technique for doing this is shown in listing 3. It embodies a simple recursive algorithm which will fill any area provided that all the pixels belonging to it share at least one edge with another member.

Such an area is known as a four-connected area, as opposed to the eight-connected type of area where two pixels

(continued on next page)

Colouring blocks

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are considered to be part of the same area if they simply touch at a corner. Figure 2 shows examples of both kinds of area. The line-drawing algorithms used on the BBC Micro make four connected areas and would allow an algorithm intended to fill eight-connected areas to leak through any diagonal line. I will confine this article to four-connected areas, but you can find more about eight-connected areas in Foley and Van Dam's quite excellent book *Fundamentals of Interactive Computer Graphics.*

When you try out program 3 on any but the smallest target areas the recursive algorithm runs out of memory even with the minimal memory used by the mode 4 graphics screen and the trivialy short main program. For small, complex areas this program can be useful, but it is not adequate for large areas with the amount of memory available in a non-professional system. The recursive procedure PROcec flood is called about 4*n + 2*m times where n is the total number of pixels within the area and m is the number of pixels within the border of the shape. Each call requires memory to hold the two parameters and the return address, so memory runs out pretty fast.

What is needed is an algorithm that is rather logically complex but uses no recursion at all. The new routines are the fundamental operations for using this algorithm, and it is surprising that Acorn did not finish the job and add a full area-filling routine. Perhaps it will be included in the Graphics Extension ROM, when it appears.

A workable version can still be implemented in Basic, and appears in Program 4. It runs in horizontal rows of pixels within the area to be filled, ending in a boundary of the area at each end. While it is not recursive, the procedure uses a stack on which the positions of the right-hand ends of all earlier unfilled runs are stored. The program uses separate stacks for the X and Y co-ordinates for the sake of simplicity.

When a run is filled, the space above and below it is searched for unfilled runs, and stacks the co-ordinates of the right-hand ends of any unfilled runs it finds. The search uses both the new groups of Plot commands. The co-ordinates of the points to be stacked are found using the new Osword call, and the routine ends when the stack is empty.

Figure 1 illustrates how the search works. Relative co-ordinate Plot calls are used with the variable dx% because neither group of calls can move the graphics cursor off the area of colour that it started in, but only up to a boundary.

Table 1. Effect of Plot options 72 to 79.

72 — X and Y are relative co-ordinates; no line is drawn.
73 — X and Y are relative co-ordinates; a line is drawn between the two points in the current graphics foreground colour and action
74 — X and Y are relative co-ordinates; a line is drawn in the logical inverse of the current foreground colour
75 — X and Y are relative co-ordinates; a line is drawn in the current graphics background colour
76 — X and Y are absolute co-ordinates; no line is drawn
77 — X and Y are absolute co-ordinates; a line is drawn in the current foreground colour and action
78 — X and Y are absolute co-ordinates; a line is drawn in the inverse of the current foreground colour.
79 — X and Y are absolute co-ordinates; a line is drawn in the current background colour.

Table 2. Effect of Plot options 88 to 95.

88 — X and Y are relative co-ordinates; no line is drawn
89 — X and Y are relative co-ordinates; a line is drawn in the current foreground graphics colour and action
90 — X and Y are relative co-ordinates; a line is drawn in the inverse of the current foreground colour
91 — X and Y are relative co-ordinates; a line is drawn in the current background colour
92 — X and Y are absolute co-ordinates; no line is drawn
93 — X and Y are absolute co-ordinates; a line is drawn in the current foreground colour and action
94 — X and Y are absolute co-ordinates; a line is drawn in the inverse of the current foreground colour
95 — X and Y are absolute co-ordinates, a line is drawn in the current background colour

Table 3. Control block for Osword 13

00,01 — x co-ordinate of last-but-one position of the grahics cursor, x2%
02,03 — y co-ordinate of last-but-one position of the graphics cursor, y2%
04,05 — x co-ordinate of the last position of the graphics cursor, x1%
06,08 — y co-ordinate of the last position of the graphics cursoe, y1%
To locate 00 in the central block the routine is entered at &FF1 and is vectored through &0206.

Listing 2.

```
   10 REM Program 2
   20 REM Demonstrates use of OSWORD 13
   30 REM by DRAWing to random locations
   40 REM on the screen, and then print-
   50 REM ing them out
   60
   70 MODE4
   71
   72 REM Alocate perameter space for
   73 REM OSWORD call.
   74
   75 DIM cords 7
   76
   80
   90 REM Set text window
   95
  100 VDU 28, 0, 4, 39, 0
  110
  120 REPEAT
  121
  122   REM Main loop of program
  130
  140   DRAW RND(1279),RND(864)
  145
  150   PROClocate
  155
  160   PRINT'" Last x              "x1%
  170   PRINT" Last y               "y1%
  180   PRINT" Last-but-one x       "x2%
  190   PRINT" Last-but-one y       "y2%
  195
  200   PRINT"Press SPACE to continue";
  201
  202   REPEAT
  203     UNTIL INKEY(-99)
  205
  210   UNTIL FALSE
  220
 5000 END
10000 DEFPROClocate
10006
10010 REM  Reads last position of the
10020 REM  graphics cursor into x1%,y1%
10030 REM  and the last-but-one position
10040 REM  into x2%,y2%.
10050
10060 A%=13
10070 X%=cords MOD 256
10080 Y%=cords DIV 256
10090
10100 CALL&FFF1
10110
10120 xyo%=cords!0
10130 xyn%=cords!4
10140
10150 x1% = xyn% MOD &10000
10160 y1% = xyn% DIV &10000
10170 x2% = xyo% MOD &10000
10180 y2% = xyo% DIV &10000
10190
10200 ENDPROC
```

Listing 3.

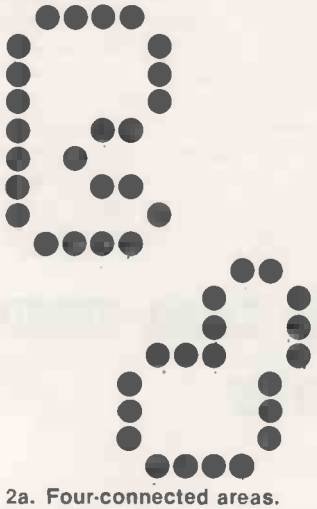
```
  10 REM  Program 3
  20 REM  Demonstration of simple
  30 REM  recursive area filling.
  40 REM
  50 REM  J.G.Dallman, June 1983.
  60 REM
  70 MODE4
  80 REM
  90 REM  Draw a small, simple shape
 100 REM  to fill.
 110
 120 MOVE 600,500
 130 DRAW 650,500
 140 DRAW 650,550
 150 DRAW 600,550
 160 DRAW 600,500
 170
 180 REM And fill it in..
 190
 200 PROCrec_flood(625,525)
 210
 220 REM Wait for user
 230
 240 PRINT'"Press SPACE to contiue"
 250
 260 REPEAT
 270   UNTIL INKEY(-99)
 280
 290 REM Draw a larger shape
 300
 310 CLS
 320
 330 MOVE 300,300
 340 DRAW 700,300
 350 DRAW 500,700
 360 DRAW 300,300
 370
 380 REM And fill it in - or try...
 390
 400 PROCrec_flood(500,500)
 410
 420 END
 430 DEF PROCrec_flood(x,y)
 440
 450 REM Have we reached the edge of
 460 REM the shape ?
 470
 480 IF POINT(x,y) > 0 THEN GOTO 600
 490
 500 REM We haven't, so fill it in
 510
 520 PLOT 69,x,y
 530
 540 REM And try the points arround it
 550
 560 PROCrec_flood(x-4,y)
 570 PROCrec_flood(x+4,y)
 580 PROCrec_flood(x,y-4)
 590 PROCrec_flood(x,y+4)
 600 ENDPROC
```

The variable dx% is set to the horizontal size of a pixel in the current screen mode by FNhorstep so that the move over the boundary can be performed reliably.

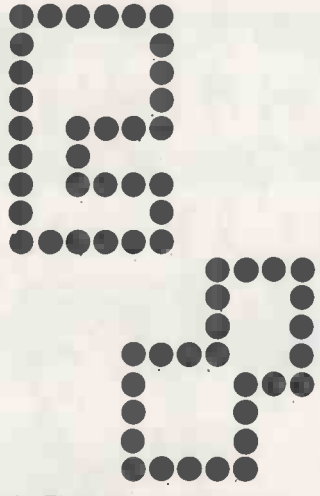
Very little stack space is used by this technique, except for areas that branch out into many small ones. A machine-code version should therefore be quite practical, even given the restricted stack space available on the Micro's 6502 microprocessor. The new Plot routines are not very fast, and an instantaneous fill seems impossible. Taking Rem lines out of the Basic version and using multi-statement lines can speed it up about 30 percent, although that is still rather slow for use within applications programs.

It is possible to extend the filling technique to fill areas of foreground colour, and to change the colour of ready-filled areas. More details can be found in A R Smith's article, Tint Fill, in *Computer Graphics*, August 1979. Acorn's routines in their current form may not allow all the possible extensions. In that case disassembly of the relevant sections of the operating-system ROM should give a good idea of how to write additional routines along the same lines.

Figure 2. Four- and eight-connected area.



2a. Four-connected areas.



2b. Eight-connected areas.

Listing 4.

```
 10 REM Program 4 -
 20 REM Demonstration of non-recurs-
 30 REM ive area filling.
 40 REM
 50 REM J.G.Dallman, June 1983.
 60 REM
 70
 80 MODE4
 90
100 REM Dimension parameter block for
110 REM PROClocate.
120
130 DIM cords 7
140
150 REM Dimension arrays for software
160 REM stacks.
170
180 DIM sx%(128),sy%(128)
190
200 SPMAX = 0
210
220
230 REM Draw a large, complex shape
240 REM to fill.
250
260 MOVE 200,200
270 DRAW 250,450
280 DRAW 500,100
290 DRAW 1000,270
300 DRAW 1100,0
310 DRAW 1200,800
320 DRAW 1100,250
330 DRAW 500,500
340 DRAW 400,400
350 DRAW 200,500
360 DRAW 200,200
370
380
390 REM Fill in the shape
400
410 PROCflood(450,300,1)
420
430
440 REM Print maxium value of software
450 REM stack pointer.
460
470 PRINT''"SPMAX = "; SPMAX
480
490 END
500
510
520 DEF PROCflood(X,Y,tint)
530
540 REM Initialise variables.
550
560 stackptr% = 0:dx% = FNhorstep
570 stacktopx% = -1:stacktopy% = -1
580
590 REM Set colour for filling.
600
610 GCOL 0,tint
620
630 REM Push starting co-ordinates
640 REM for first time round loop.
650
660 PROCpush(X,Y)
670
680
690 REM Main loop of procedure
700
710 REPEAT
720
730   REM Pop starting co-ordinates
740   REM off software stacks.
750
760   PROCpop
770
780   REM Fill across this y-co-ordinate.
790
800   PLOT77,stacktopx%,stacktopy%
810
820   REM Locate points and set up the
830   REM **base% variables.
840
850   PROClocate
860
870   x1base%=x2%:y1base%=y2%
880   xrbase%=x1%:yrbase%=y1%
890
900
910   REM screen & try to fill the line
920   REM above the current one.
930
940   IF POINT(x1base%,y1base%-4)<>-1 THEN
      PROCsearch(-4)
950   IF POINT(x1base%,y1base%+4)<>-1 THEN
      PROCsearch(4)
960
970   UNTIL stackptr%=0
980
990 REM We've run out of lines to fill
1000
1010 ENDPROC
1020
1030
1040
1050 DEF PROCsearch(dy%)
1060
1070 REM Searches for unfilled runs on
1080 REM the line above or below the
1090 REM current one.
1100
1110 LOCAL x%,y%
1120
1130 REM We have started above/below a
1140 REM point that can be lit or not -
1150 REM this handles that case.
1160
1170 IF POINT(x1base%,y1base%+dy%)=0 THEN
     PLOT76,x1base%,y1base%+dy% ELSE PLOT9
     2,x1base%,y1base%+dy%:PLOT72,dx%,0
      :1180
1190 REM Locate the point (the right
1200 REM end of a run) found above.
1210
1220 PROClocate
1230 flag%=FALSE
1240 REPEAT
1250
1260   REM Search rightward for right ends
1270   REM of runs and push them onto the
1280   REM software stacks.
1290
1300   IF x1% > xrbase% THEN flag%=TRUE:
       GOTO 1340
1310   PROCpush(x1%,y1%)
1320   PLOT92,x1%+dx%,y1%
1330   PLOT72,dx%,0
1340   PROClocate
1350   UNTIL flag%
1360
1370 REM The search has gone beyond the
1380 REM right end of the previous run.
1390
1400 REM Check if the run we're working
1410 REM on extends beyond the base run
1420 REM to the right - if so find it's
1430 REM right end and push that.
1440 IF POINT(xrbase%,yrbase%+dy%)=0 THEN
     PLOT76,xrbase%,yrbase%+dy%:PROClocate
     :PROCpush(x1%,y1%)
1450
1460 ENDPROC
1470
1480 DEF PROCpush(x%,y%)
1490
1500 REM Puts x% and y% onto the soft-
1510 REM ware stacks and into stacktopx%
1520 REM and stacktopy%.
1530
1540 REM Check we haven't stacked these
1550 REM points already.
1560
1570  IF x%=stacktopx% AND y%=stacktopy%
     THEN GOTO 1660
1580
1590 REM Perform stacking
1600
1610 sx%(stackptr%)=x%:sy%(stackptr%)=y%
1620 stacktopx%=x%
1630 stacktopy%=y%
1640 stackptr%=stackptr%+1
1641
1642 REM Check value of software stack
1643 REM pointer.
1650 IF stackptr%>SPMAX THEN SPMAX=stackptr%
1660 ENDPROC
1670
1680 DEF PROCpop
1681
1682 REM Pop software stacks and set
1683 REM new values of stacktopx% and
1684 REM stacktopy%.
1690 stackptr%=stackptr%-1
1700 stacktopx%=sx%(stackptr%)
1710 stacktopy%=sy%(stackptr%)
1720 ENDPROC
1730
1740 DEFPROClocate
1750 A%=13:X%=cords MOD 256
1760 Y%=cords DIV 256
1770 CALL&FFF1
1780 xyo=cords!0
1790 xyn=cords!4
1800 x1%=xyn MOD&10000:y1%=xyn DIV&10000
1810 x2%=xyo MOD&10000:y2%=xyo DIV&10000
1820 ENDPROC
1821
1830 DEFFNhorstep
1831
1832 REM Returns horiziontal size of
1833 REM pixel in current mode.
1834
1840 A%=135
1841 mode%=USR(&FFF4)
1842 mode%=mode% AND &FFFFFF
1843 mode%=mode% DIV&10000
1844 IF mode%=3 OR mode%>5 THEN PRINT"Wrong
     mode, dummy!!!":STOP
1850 IF mode%=0 THEN =2 ELSE IF (mode%=1 OR
     mode%=4) THEN =4 ELSE =8
```

References

Beebug Newsletter, *Acorn News*, Volume 1, Number 6, October 1982.

Fundamentals of Interactive Computer Graphics by Foley and Van Dam, Systems Programming series, 1982. Published by Addison-Wesley.

Tint Fill by A R Smith in *Computer Graphics*, August 1979.

Images of digits

Peter Kruger and Stephen Cronk of Digithurst Ltd explore the potential for high-resolution vision systems.

FOR SOME TIME the subject of image analysis has interested engineers and computer scientists. The ability to put a graphical representation of a real object into a computer and manipulate it has found countless applications from pattern recognition to CAD. Until recently most of the available vision hardware was based around either mainframes or specially designed processors; it did not have the general applications which would allow high-volume sales over which to spread development costs.

The microcomputer has a wide range of applications from office administration to process control and is proportionally lower in cost. Rather than using external hardware such as CPUs and RAM to capture the image the micro's own hardware is used as a frame store. The data becomes much more accessible to the user for the purpose of image processing.

Solid-state cameras provide the computer with digital data representing a map of pixels, which make up the image falling on the sensors of the camera's solid-state array.

Due to the low level of production solid-state cameras can be quite expensive. This is changing and solid-state sensors are being applied to a range of consumer products. Some solid-state cameras use optic RAM rather than a sensor. This enables an image to be fed straight into RAM, and the sensor itself to be read in the same way as a frame store. It provides a very rapid, low-cost method of obtaining a binary image.

The alternative to the solid-state camera is the Vidicon television camera which provides an analogue signal, which is then digitised. Unless expensive A to D converters are used this method is slower than the solid-state camera, but it does have the advantages of being both low cost and giving a grey-scale output. In general terms, where the object being analysed is slow moving and a grey-scale image is required a television camera system can be used. If a rapid access time is required and a binary image is sufficient, then a solid-state system should be used.

To carry out analysis the image data can either be sorted in external RAM, in the camera or frame store, or in the microcomputer itself. Advantages and disadvantages are present in both systems. The cost of external memory and the extra processing required is high, but may be necessary if the image analysis required is complex and takes up a large amount of RAM. If the microcomputer is large enough to hold the image and the software required, then the data becomes much more accessible to the user and the cost of additional hardware falls.

Once the image has been captured and stored it may be desirable to display it. The image may be shown as a binary or a grey scale. If a binary display is required the data must be scanned and each pixel compared to a preset threshold before deciding to display them or not. To simulate grey scale a group of screen pixels are used to represent each camera pixel. The thresholding technique is used for each pixel within the group and an image is displayed not dissimilar to newsprint. A contrast value can be used to set the threshold values for the pseudo grey-scale

Figure 1.

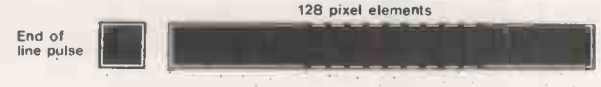
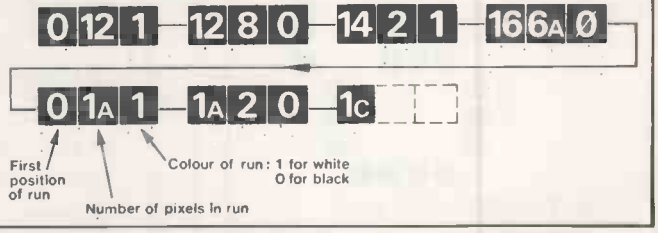


Figure 2.



The data structures hold data in unprocessed or processed forms. Figure 1 shows unprocessed data, which is held in RAM. Figure 2 shows processed data which is unprocessed data that has been encoded.

A grey-scale image.

A binary image.

display. Both routines can be written using the computer's point-plot routine making the software transportable between different micros.

Data may take one of two forms when it is read into the computer. It may either be binary image data and be bit mapped or it may be grey-scale data and be byte mapped, each byte having a value representing the brightness of the respective camera pixel. At this point it will be necessary to clean up the image. High-resolution pictures gained with a video camera which has random interlace must have the effect of the interlace removed, which is achieved using recursive processing.

This is a relatively simple yet effective way of reducing noise or any form of sporadic interference on a digitised television picture. A number of frames are captured, each being averaged with the previous using the algorithm:

NEW PIXEL = (OLD PIXEL + INCOMING PIXEL)/2

The random nature of the interference means that over a number of frames the unwanted noise will tend to cancel out. Increasing the number of frames captured and averaged in this way improves the final result but also increases the time taken to reach that result. It is usually found that acceptable results are achieved after the first three or four frames; after that the small improvement in picture quality is minimal compared to the extra time needed.

A slightly more advanced version of the technique which leads to more flexible filtering allows the user to define the proportion of the incoming image that is mixed with the previous image, using the algorithm:

NEW PIXEL = K * OLD PIXEL + (1 – K) * INCOMING PIXEL

where K is a user-specified constant weighting the new image.

Recursive processing techniques can also be used to intensify a low-level video signal such as one that is shot out of doors at night. Each captured frame is summed with the previous frame so that over a period of about 10 frames, depending on the light level, a clear image can be seen. The process requires the image to be stored in 16-bit words as it is quite likely that the values obtained may be greater than 255.

To remove any electrical noise appearing as individual pixels, or marks and small objects which appear as single pixels and therefore cannot be verified at the current resolution, the image data is cleaned. The cleaning consists of examining pixels in groups of three and eliminating any pixels whose neighbours differ radically in intensity.

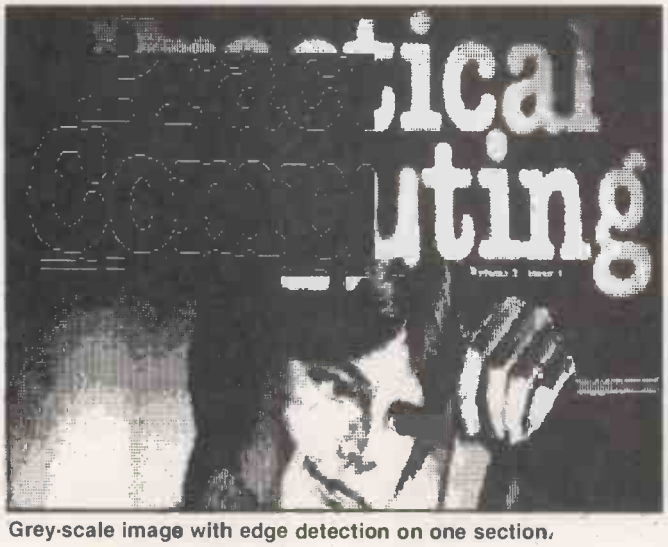
Image compaction techniques can be used to reduce the size of the image-data file to speed up data access during future processing. One method of data compaction is run-length encoding which reduces the memory required to hold an image by up to 16 times. Each pixel is examined and compared with the current threshold value. The next pixel in the current raster is also compared to the threshold value, and a run of pixels of the same thresholded value is built up. Each run is stored in a three-byte record, the first byte giving the start point of the run, the second byte the number of pixels in the run, and the third the colour of the run.

The amount of grey-scale and processed data which can be held at any one time will depend on the memory size of the computer being used. For example, a 256K Sirius will hold a 256 by 256 grey-scale image occupying 64K as well as at least one processed image at any one time. This allows the image to be processed at various thresholds without disturbing the original data.

Object/pattern recognition can be undertaken either by using values of area and perimeter or by examining the grey-scale data in greater depth. By using edge-detection methods it is possible to build up a series of co-ordinates which can be passed to a CAD software package.

With the introduction of more powerful microcomputers and with greater speed and memory mapping capabilities there is a greater potential for higher-resolution vision systems. To anyone who has spent hours inputting graphics into their programs the applications of low-cost vision systems is obvious. Images can be used as backgrounds for games programs or computer-aided learning software with images being read in and reduced to line drawings in a matter of seconds.

Solid-state cameras provide the computer with digital data.



Grey-scale image with edge detection on one section.

Inverted image with edge detection on one section.

Death to the machine

by Andrew Walker

Mandy's eyelashes flickered open, slashing the teardrop that welled in the corner of her eye. Memories of the night's storms overwhelmed her. She drew back, hating the world that had invaded her sleep and ruthlessly dragged her back to reality.

A dog barked in the avenue below. A blackbird's vivacious song rang out. Dazzling sunshine illuminated the curtains and showered the room in gold dust.

Henry sensed her waking, and he remembered the way she had quaked when the rolls of thunder and lightning had terrorised the night. Gently he touched her skin. To reassure her, he told himself.

They lay together side by side, aware of each other but not speaking, choosing instead the intimate silence of lovers. From the corner of her eye she watched him, his body bronzed in the mist of sunlight. She was afraid to move, to speak, afraid of destroying the moment.

At last he rose, silhouetted against the curtains, innocent of his own nakedness and his partner's idolatrous gaze. She studied him jealously — his flawless skin, his broad shoulders and pronounced muscles, his grace. He moved like a panther.

"Good morning Amanda," he said with a sparkling smile.

"Morning Henry," she whispered.

He carried her across the room and deposited her in the wheelchair that stood dormant in the corner. He felt no revulsion at the ugliness of her wasted limbs. Sympathy never crossed his mind.

Mandy watched him carefully. She hesitated nervously, then at last plucked up courage to speak.

"Last night . . . Henry. Thank you . . . . I know it broke all the rules. But I needed you."

Henry nodded a silent acknowledgement.

"Lights. Curtains." He gave the command as he left the room. The lights dimmed themselves and the curtains drew back, engulfing the room in light.

Mandy tucked into her breakfast with relish, scooping up the pieces of bacon with the fork in her right hand. The left was draped uselessly in her lap.

"Television 1," she ordered, and the television obligingly flickered into life. The Breakfast O'Clock News held her attention as she ate.

An explosion. The crashing and splintering of glass and wood. People running, shouting, throwing, hating. The crack of gunfire. Police armed to the teeth, charging. Panic. People screaming.

Mandy was sickened, but the screen compelled her to watch, holding her eyes the way a swaying cobra hypnotises its prey.

"A spokesman for the company, Robo-of-America, said that 10 robots were completely destroyed and several others had been severely damaged, putting the cost at 13 million dollars, 37 rioters were reported killed."

The robot newsreader spoke in cold tones, reading the idiot-tape that ran through his wrist. "The President attacked the left-wing militants who, it was said, were using people in a political game. By telling people that big business was replacing humans with robots, the communists were feeding on the fears of the working class for their own subversive ends. She added that we must all make sacrifices."

On the screen a robot was being dismembered by the rioters, while another was catapulted from a third floor window. Henry shuddered.

But Mandy was bored, numbed to the violence by its day-by-day repetition.

"Shopping," Mandy commanded. The television picture blinked out and a menu appeared, cursor flashing. Her fingers played deftly on the console installed on the right arm of her chair. She looked for things they were running out of — food, polish, toilet rolls. She compared prices and ordered items. She picked the colours that took her fancy and went window shopping for the latest fashions. New screens continually sprang into view, choices were made at leisure.

"What do you want to do today?"

Henry fired the question into the air as he worked, not looking at Mandy.

"Take me home, please. You know I want to go."

"This is your home."

"My real home," she pleaded.

Henry paused.

"You know what I think about going there. I don't like it. It's dangerous — full of thugs and hookers.

"And it's not your home — not any more. It's not the quiet suburb of your childhood. Wipe those memories away for your own sake."

"Take me," Mandy persisted. "Please."

Henry bit his lip, but replied reluctantly: "All right. You know I can never say no to you."

The Hill was home. Tree-lined boulevards, pipe-smoking artists lazing on street corners, discussing Picasso and extolling the beauty of the girls as they walked by. Sunny days, and families taking the air in their Sunday best, nodding to passing acquaintances.

It was all long gone. Buildings rotted and neglected streets flowed with garbage. The Hill groaned under man's physical graffitti.

Henry sensed the eyes on them, strangers in a strange land, anachronisms, belonging even to a different species. Faces hid behind curtains that flapped in open windows, through which the shadows of the rooms within seemed to give each building an aura of dirt and doom.

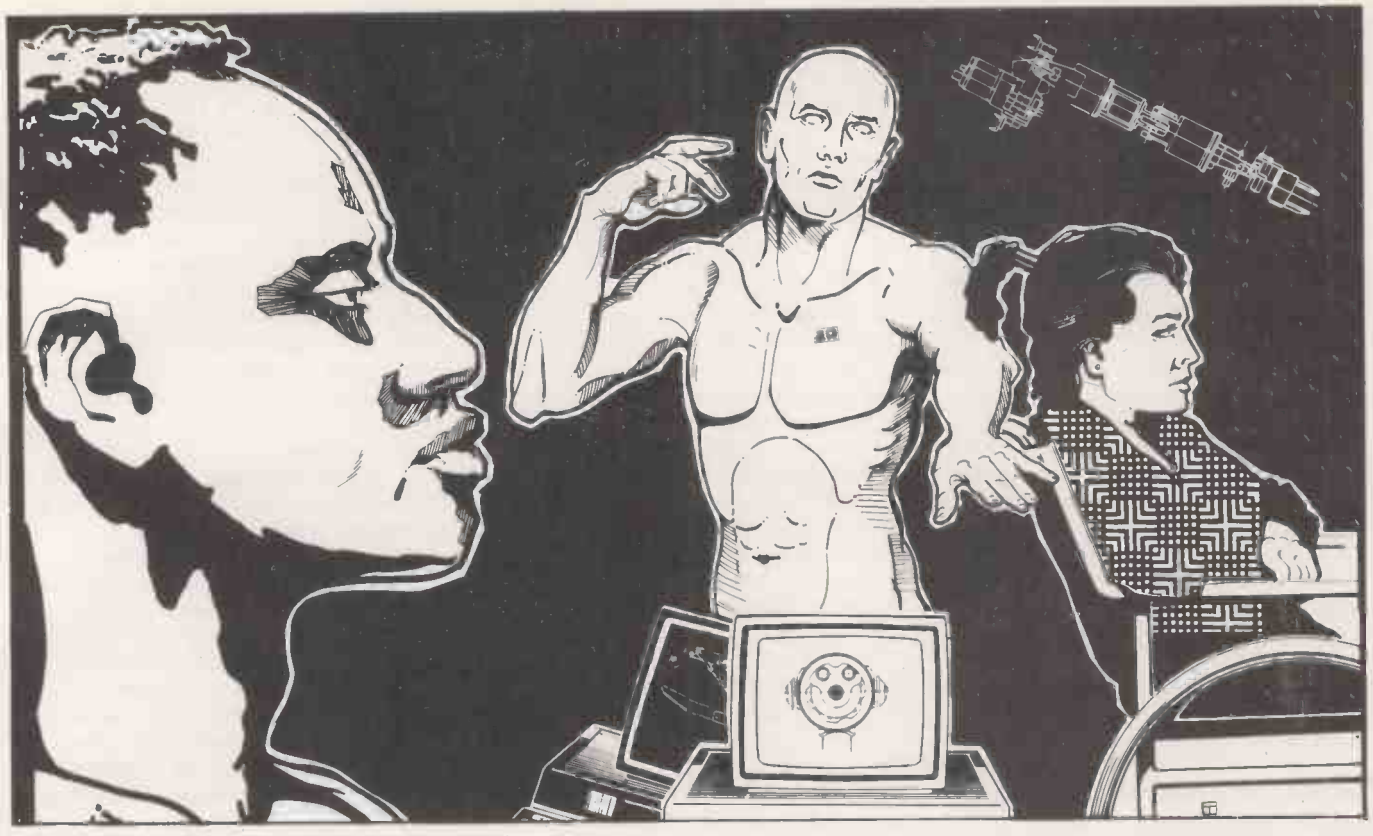
Mandy saw her childhood. The family and the home. The breaking of morning across the rose-tinted garden. Her friends. The birds that spoke to her. The way she would run through the dew-laden grass, chasing or being chased, laughing and shrieking with joy.

"Satisfied?" Henry asked malevolently. "See how ugly this place is. We shouldn't have come."

But Mandy was far away.

"Smash the bastard!"

The mob fought hard for the right to kick and punch its victim. People ran, jostled, writhed like maggots, a seething mass of frustrated, angry bodies. They vented their hatred, emptied their sack of fears, and found relief in aggression.



Moving down the street, heedless of passers-by, the amoeba broke and reformed, then broke again, and finally raced ahead, exhilarated by pain and violence. Each man was caught by the mood of blind rage, joining in the baiting and killing of guilty and innocent.

They tired, but as they dropped their places were taken by others, ever more eager, ever fresh and hungry, charged by the electricity of the moment. They grabbed a drone as he hauled a crate 10 times his size, descending on him like vampires. He struggled briefly before drowning in a sea of people. Cheering people, revelling in destruction, throwing parts of the drone hither and thither, people turned mad on a balmy Sunday afternoon.

"This one won't steal a man's job again. Get out of the way — let me kick it. Death to the machine!"

Henry shivered as he looked at the grieving, stricken torso. A stranger staggered along the street from the direction of the mob. His head head hung low, but as he neared Henry he looked up with glazed eyes. He was pale as death.

"They ... they ripped him apart." He trembled with each word. "A man. They did it to a man."

Henry turned, leaving the stranger retching in the gutter. He pushed Mandy along, glowering at the back of her head.

"Damn you!" he thought. "I told you."

And his circuits wondered at this new emotion.

"There's another!" voices cried.

Fingers darted in a million directions. The voices grew in number. Factions split, intoxicated by violence, clashing over their prey like packs of hyenas.

"There's one!"

The cry pealed out like church bells, across the streets and through the alleys, to shoppers, to people leaning from windows with ghoulish curiosity, to a mongrel that paused briefly as it chewed a robotic leg, to a gang prising open a Space Invaders machine. To a new victim. It tolled the death knell.

A strong, steady finger pointed. The finger of the hard man. A compelling finger that urged the eye to follow its line to the guilty man who stood there dumbfounded, still holding on to the wheelchair in which his prisoner sat, a poor, weak-looking human girl.

The cry tolled out for Henry.

He broke into a run. With a wave of his arm the hard man commanded the crowd of onlookers to give chase. But they were on their way already, stirred by propaganda, feverishly wanting to free the girl from the inhuman monster.

The wheelchair careered madly as Henry galloped, hounded by the baying hunters. He swung round corner after corner, in and out of alleyways, trying vainly to shake them off. The mob struggled, a cursing, stumbling rabble. But always he sensed the hard man hard on his heels.

"Leave me Henry. Run."

Mandy's pleas grew as the wheelchair rocked and rolled and Henry's silence lengthened.

His circuits burst with energy, transceiving messages. Logic chips warned him of the danger to Mandy, how she would be mistaken for a robot, how she would be mutilated, how the humans would kill her from instinct alone. Chips of intuition calculated probabilities — the chance of her neck being broken if they kept the present speed, her chances of survival if he left her.

"We are 74 percent certain that a savage band of humans would not harm a cripple girl," they said. "Save yourself," cried out self-preservation units.

But wise old legal chips read the rules: "You cannot leave her to a doubtful fate; preservation of the machine is secondary. Self-sacrifice is an honourable death."

"Leave me," Mandy added.

"Can't," Henry stammered, finally, through gritted teeth.

"Run Henry, run," Mandy pleaded tearfully.

"Run rabbit, run," bellowed the hard man, like a blast from the farmer's gun.

The packs closed in, howling triumphantly as their prey froze, each eager to cheat the other of its kill. And then the hard man stood face to face with Henry.

Henry's brain tore into itself. Logic clashed with law. Morality proclaimed.Self-preservation cried it down. "Kill him — you can't kill a human — it's your only chance — his life or hers and yours — Primary Robotic Law states ... "

Anonymous circuits assented or dissented in a clamour of a billion electronic pulses. He clutched his head. He

(continued on next page)

Death to the machine

(continued from previous page)

argued and proposed solutions and then dashed them all against the wall of robotic law.

The hard man smiled knowingly. With a crayon he began to daub Henry's forehead in blue: "666". The number of the robot, reckoned the propagandists.

Henry seethed with rage. He let go a bellow, like a trapped animal caught without hope, a bellow that turned to a scream of anger and shame. A scream that became a flash of insanity.

A clenched fist lashed out, breaking the invisible barrier: for an instant Henry became human. The hard man's jaw cracked behind the punch, and like a man possessed, his whole body convulsed in a wild frenzy.

Henry stepped back aghast, shocked by his violence, disowning the fist that had offended, and repulsed by the spectacle and nauseating fumes before him. A flood of integrated circuits, cogs and lengths of wire poured from the hard man's mouth. His head erupted, shattering into a billion slivers of silicon.

Suddenly all was quiet, his death throes exhausted, his headless corpse frozen upright, erect for eternity. The stupor that hung over the scene held everyone as Henry edged away. No one followed.

"He was just a tool," Henry insisted. "Like the video games, like the bus driver. Like me."

"I don't understand." Mandy repeated the statement for the umpteenth time, chafing Henry's nerves like sandpaper on an open wound.

Birds were singing in the trees. The sun shone from a clear sky. Towering over her stood the city, a warm paternal giant whose strength comforted her, a city of glass skyscrapers, hygiene and automation, where there was light and no shadows, where the people thought of peace and beauty.

Henry knelt in front of her as she wiped the blue scrawl from his forehead, fussing maternally. She avoided his eyes. "He was a robot — all your militants use them," Henry explained. They're programmed to seek out other robots, stir up feeling against them, incite riots: a Judas. Built to slaughter his own."

"It's always the same," he went on. "Cars, television. You invent these things, make the world a better place. Then what? You're lost. You take them for granted, ignore them, distort them, manipulate them, turn them to evil and then learn to fear and hate them.

"You wonder at your own power: you've made something in your own image — you are God. But you're afraid — it's better than you. So you tear it down. Seek it out, cut it out like a cancer."

Mandy was pinned to her chair by the venom in Henry's tongue and the crazed ravings of his mind. She trembled in fear of the stranger before her.

Circuits raged in new-found freedom, or cowered in seclusion, screaming their terror of this brave new world.

"Closedown."

The command froze Henry in mid-sentence. His eyes closed. He was suspended in time.

"Re-initialise," God commanded.

Henry flickered into life, and a warm, comforting smile spread on his lips.

"Isn't it a lovely day, my love?" He spoke in a sickly sweet voice that chilled her spine. "Let's go to the park."

The crisis was over, but a malevolence crept into his face, a malevolence that even God did not detect. It distorted his features and set a darkness in his eyes as it spread to his powerful arms.

Below them the avenue stretched down to the wharf, where streetside cafes vibrated with life, and the sun smiled on the rich, beautiful people. Henry began to loosen his grip.

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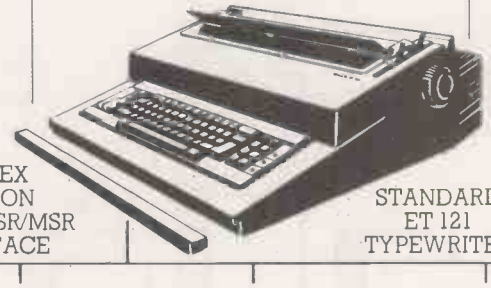

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A question of significance

With Owen Bishop's Basic programs you can tell chance from choice.

"COFFEE, TEA OR ME?" Ignoring the "Me" of the memoirs of those incorrigible airline stewardesses, Trudy Baker and Rachel Jones, still leaves you with a choice to make: shall it be tea or shall it be coffee? It must be one or the other, but you are not allowed to have both. To put it more technically, they are mutually exclusive choices.

This kind of choice is thrust upon you many times a day. Sometimes you make a response based on a strongly felt preference or a reasoned argument. But often you are indifferent and decide on a whim or by tossing a coin. Your choice might just as well be the result of running:

```
10 choice = RND(2)
20 IF choice = 1 THEN PRINT "Coffee"
   ELSE PRINT "Tea".
```

Suppose a board of directors is offered tea or coffee and all choose tea. Does it mean that they genuinely prefer tea? Is it worthwhile brewing up coffee next time? A majority of six to none seem a strong one, but can you be sure that the board has a genuine preference for tea?

There is no need to go into the reason for the preference, if there is one: the tea may be superb, the coffee may be like dishwater or maybe they are just a bunch of cha-wallahs. You just want to know whether they have a genuine preference or made their choice through whim.

Suppose the directors had no strong reasons for their choices and each decided to run the random-choice program on the firm's mainframe and imbibe accordingly. Any given director is equally likely to select tea or coffee, unless there is a bug in the mainframe or its random-number algorithm. Six different outcomes are possible:

all six choose tea
five choose tea and one chooses coffee
four choose tea and two choose coffee
three choose tea and three choose coffee
two choose tea and four choose coffee
one chooses tea and five choose coffee
all six choose coffee

These seven eventualities are not equally likely to occur. For instance, there is only

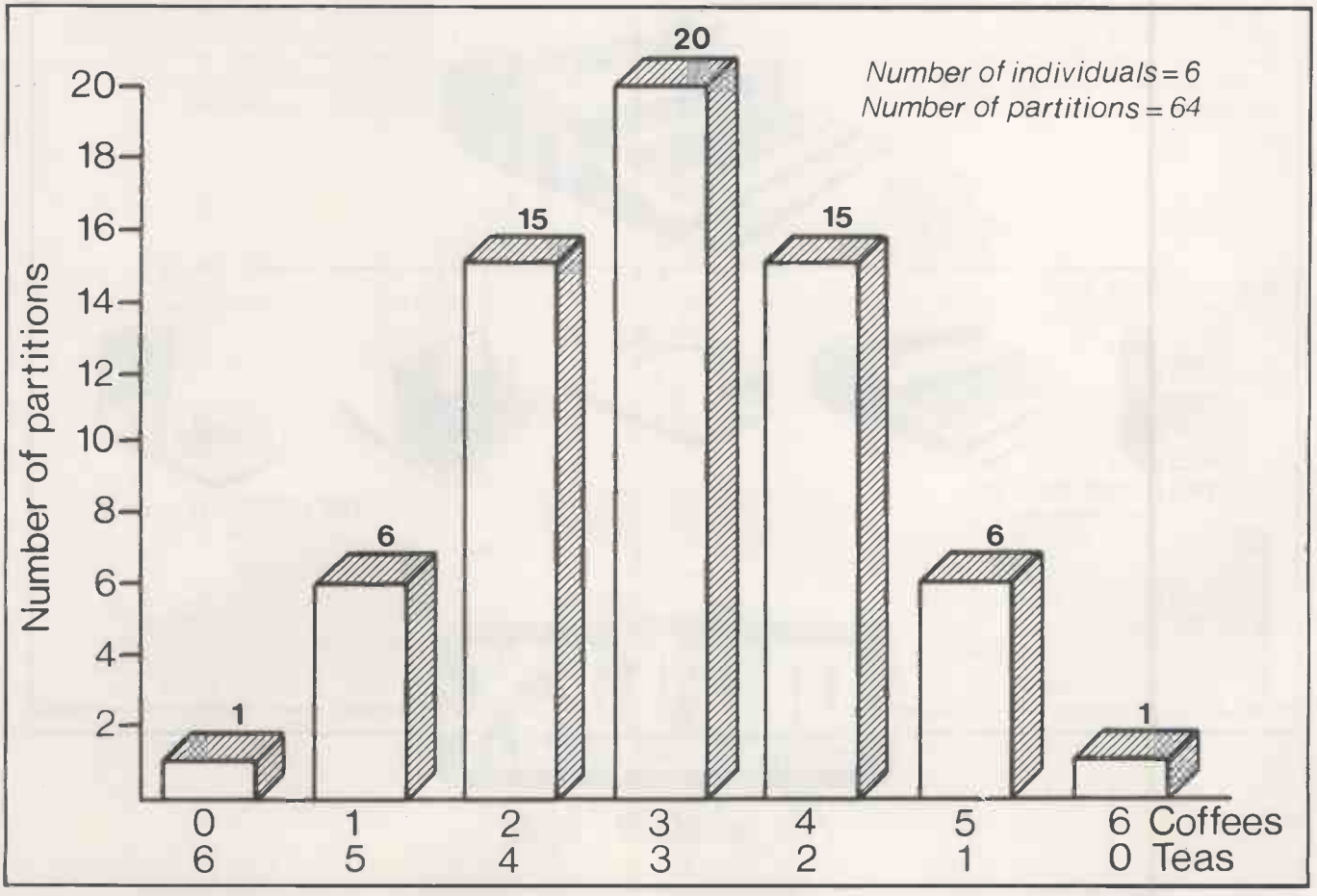


Figure 1. There are 64 ways in which six people can choose between tea or coffee.

one way in which all can choose tea, and only one way in which all can choose coffee. There are six ways — one for each director — in which one chooses coffee while the others have tea, and six ways of serving one tea and five coffees.

For two coffees and four teas you have to work out how many ways there are of picking out the two coffee-drinking directors. It is best done by representing the directors by the initial letter of their first names — they are called Alf, Bert, Connie, Dick, Evie and Fred — and listing them as in table 1 to what the computer tells them to choose.

The groupings in the middle column represent all the possible ways of picking out those who are to have coffee. There is no need to go further, for the arrangements are symmetrical — see figure 1.

There are 15 ways in which four choose coffee, six ways in which five choose coffee and one way in which all choose coffee. The total number of ways in which the directors can be divided into coffee drinkers and tea drinkers is 1 + 6 + 15 + 20 + 15 + 6 + 1 or 64 ways.

If all choose tea there is only one way out of the 64 ways that this can happen randomly. Their behaviour can be explained in two ways:

- they really do prefer tea
- they are choosing at random, and a one-in-64 event has occurred.

It is safe to infer that their apparent preference for tea is genuine. On the other hand, there still remains the one-in-64 chance that it is a random choice, so unless you are prepared to take that risk of being wrong, it is wise to keep coffee on the menu for future board meetings.

But what if one director had chosen coffee? The calculations show that there are six ways of this happening in a purely random way. You could still believe they prefer tea but there is a much stronger risk that their corporate choice was made at random. There is now a six-in-64 chance, around nine percent, that you are observing random choices and not real decisions.

You could also arrive at the same conclusion if you had just witnessed the directors voting five to one in favour of investing half the company's funds in a new expansion project. With so many factors involved in the market the outcome is virtually unpredictable, and a random choice may be as good as any. With six directors, only a unanimous decision can signify anything to a mere outsider.

The scene now changes to a school biology laboratory where the students are watching six woodlice in an apparatus called a choice-chamber. Incidentally, the woodlice are also called Alf, Bert, Connie, Dick, Evie and Fred. They are being made to choose between going to a specially prepared damp part of the chamber or to a part which is dry.

As it turns out, they all go to the damp part. You have not been able to ask them which they prefer, and before the test was run you did not know which they would prefer. You took care to design the apparatus so that the two sections of the chamber should be equal in all respects other than dampness, and that the woodlice should be put into the chamber at a point where they were equidistant from both.

As with the directors, so also with the woodlice, you must have a unanimous decision when there are only six choosers. A five-to-one majority is hardly significant, for it could be obtained on over nine percent of occasions by random means, with no purposeful choice being made.

Thinking of the same kind applies to any situation in which individuals are being offered mutually exclusive choices. It even applies to general elections — ignoring the minor parties — but here the electorate is so large that even a small

(continued on next page)

Table 1.

How many choose coffee	Who has coffee	Number of ways
0	no one	1
1	A, B, C, D, E, F	6
2	A+B, A+C, A+D, A+E, A+F, B+C, B+D, B+E, B+F, C+D, C+E, C+F, D+E, D+F, E+F	15
3	A+B+C, A+B+D, A+B+E, A+B+F, A+C+D, A+C+E, A+C+F, A+D+E, A+D+F, A+E+F, B+C+D, B+C+E, B+C+F B+D+E, B+D+F, B+E+F, C+D+E, C+D+F, C+E+F D+E+F	20

```
10  HOME : PRINT  TAB( 14)"THIS OR THAT?"
20  VTAB 5: INPUT "HOW MANY INDIVIDUALS IN TOTAL?  ";N
30  IF N ( 0 OR N ) 30 THEN  PRINT "NUMBER OUT OF RANGE, PLEASE RE-ENTER": GOTO
20
40  CALL  - 868
50  VTAB 7: INPUT "HOW MANY IN ONE OF THE GROUPS?  ";G
60  IF G ( 0 OR G ) N THEN  PRINT "NUMBER OUT OF RANGE, PLEASE RE-ENTER": GOTO 5
0
70  PRINT
80  PRINT "CALCULATING"
90  IF G = N / 2 THEN P = 100: GOTO 220
100  IF G ) N / 2 THEN G = N - G
110 C = 0
120  FOR J = 0 TO  INT ((N - 1) / 2)
130  GOSUB 1000
140  IF J = G THEN CG = C
150  NEXT J
160 C = C * 2
170 CG = CG * 2
180  IF N / 2 =  INT (N / 2) THEN NF = N / 2: GOSUB 2000
190 C = C + 1 / F / F
200 P = CG / C * 100
210 C = C * F
220  PRINT : PRINT "THE PROBABILITY OF OBTAINING A RESULT ASEXTREME OR MORE EXTR
EME THAN THIS IS:": PRINT : PRINT  TAB( 17) INT (P + .5);" %"
230  END
1000 NF = J: GOSUB 2000
1010 D1 = F
1020 NF = N - J: GOSUB 2000
1030 D2 = F
1040 C = C + 1 / D1 / D2
1050  RETURN
2000 F = 1: IF NF = 0 THEN  RETURN
2010  FOR K = 1 TO NF
2020 F = K * F
2030  NEXT K
2040  RETURN

]RUN
            THIS OR THAT?
HOW MANY INDIVIDUALS IN TOTAL?  15
HOW MANY IN ONE OF THE GROUPS?  4

CALCULATING

THE PROBABILITY OF OBTAINING A RESULT ASEXTREME OR MORE EXTREME THAN THIS IS:

                12 %
```

Applesoft Basic program and sample run.

A question of significance

(continued from previous page)

majority is significant. It is when only a few individuals are making a choice that you need to assess more precisely the effects of random or partly random factors.

Experiments in animal behaviour are another instance in which it is essential to take possible randomness into account. It was in this setting that tests for significance were first designed. You often have only a few animals to use, so randomness plays a relatively large and disturbing part in the result. The same problem arises in other kinds of scientific and medical experiment — even those which do not involve individuals making a deliberate choice.

The alternative could be "does the patient recover or not?" or "does this drug kill the pathogen or not?" The criterion is that there must be two mutually exclusive outcomes with an apparently equal chance of either outcome.

Working out the odds for a large number of individuals is extremely tedious, which is where a micro is a great help. You have to find out in how many ways it is possible to partition the individuals into two groups. A group of n individuals partitioned into two groups can be represented by x:y, where x + y = n. For example two out of six directors taking coffee and four taking tea can be represented by 2:4.

Table 2.

Partition	No. of ways
0:n	n!/0!(n – 0!) = 1
1:n – 1	n!/1!(n – 1!) = n
2:n – 2	n!/2!(n – 2)!
and so on down to	
n – 2:2	n!/(n – 2)!2!
n – 1:1	n!/(n – 1)!1! = n
n:0	n!/(n – 0)!0! = 1

The different partitions and the calculation of the numbers of ways are shown in table 2.

The symbol ! means factorial. For example, 5! means $5 \times 4 \times 3 \times 2 \times 1$. Unexpectedly, 0! is 1. The expressions in table 2 are all of the form

n!/g!(n – g)!

where g is the number of individuals making one choice and (n – g) is the number making the other choice. The micro has to work out all these terms and add them to find out how many different partitions are possible.

Since the table is symmetrical about the halfway line, the micro only has to work out the top half and double the result. If n is even, there is a row halfway down the table for n/2:n/2. Picking out half the individuals in all possible ways to put into one group automatically picks out the other half to go into the other group, so this partitioning is added in only once.

While the computer is summing all these expressions, it also sums those expressions which refer to partitions as extreme or more extreme than the one being tested. If one of the six directors chooses differently from the others you need to sum the expressions for 0:6 and 0:5 and then double the sum. You can then work out the probability of getting a majority decision of five or more out of six according to the formula:

((number of ways for 0:6, 0:5, 5:0, 6:0) ÷ (total number of ways)) x 10 percent

The n! in the denominators of each quantity cancel out, so there is no need to evaluate it.

Listings are provided for the Apple II and the BBC Microcomputer. The Apple II version requires n to be more than 2 and not more than 30. Calculating factorials greater than 33! causes an overflow error. Since the test is not of great interest when numbers are larger than 30 this is no disadvantage.

N is the number of individuals observed and G is the number in one of the groups. Line 90 disposes of one obvious result without calculation. Line 100 converts G to be the number of the smaller group. Lines 120 to 150 run through the possible partitions, except equipartition when N is even.

The program uses the subroutine beginning at line 1000 to work out the expression

1/G!(N – G)!

for each value of G in turn, and accumulates their total; the subroutine beginning at line 2000 calculates the factorials required. NF is the number for which the factorial is to be calculated and F is the factorial. In line 140 the subtotal of values up to and including G is registered as CG.

The totals C and CG are then doubled in lines 160 and 170. If N is even, a value for the partition N/2:N/2 is then added to the total obtained in lines 180 to 200. Line 210 calculates probability P as a percentage.

The percentage is rounded off to the nearest whole number; if you are interested in long odds you could alter the proposal to print out any number of decimal places. The sample run might have been used to assess the results of asking 15 breakfasters whether they would prefer kipper or haddock. The fact that 11 take kippers does not support the belief that breakfasters in general prefer kippers. With a purely random selection, there is a 12 percent chance that the number disagreeing with the majority will be four or fewer. A majority of 11 to four means very little.

Figure 2 shows that the ways in which 10 or more people can choose coffee — or kippers — at random is six percent of the total number of ways. The program gives an answer of 12 percent as in line 170 it doubles the numbers relating to the shaded area before working out the percentage. Which result you take depends on what you want to know.

If you want to know the probability of

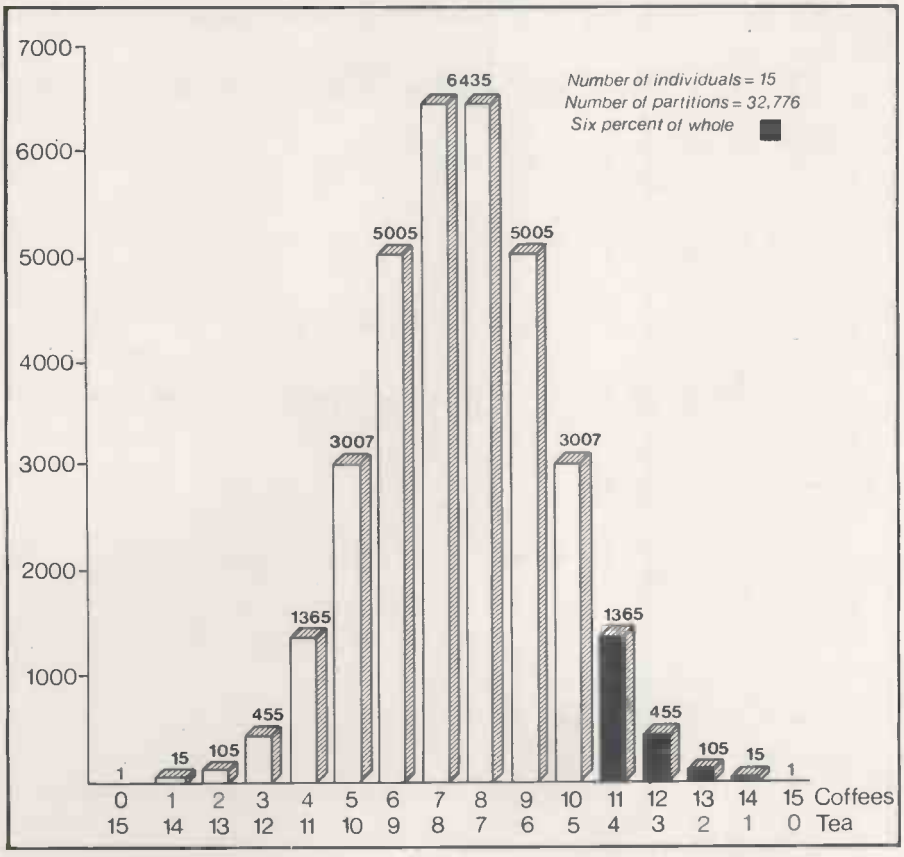


Figure 2. There is a six percent chance of only four people out of 15 taking tea.

getting any extreme result — either lots more coffees than teas or lots more teas than coffees — then take into account both tails of the distribution of figure 2. This is the usual procedure, as there is generally no reason for expecting a strong majority. After all, you are assuming that people like tea or coffee equally well. If a majority is found it is usually explained away as a random occurrence by saying, for example: "You could have got this majority by tossing heads or tails: it does not prove that people prefer coffee — or kippers".

There may be occasions on which you believe there is a preference and are trying to prove it. Then you say, for example: "11 out of 15 choose coffee; at random, 11 or more in favour of coffee occurs on only six occasions out of 100, so possibly this shows that there is a preference. The evidence is not strong, for there is still the six percent chance of it being a random result. But as figure 2 shows, the numbers of ways decrease sharply towards the tail of the distribution. If 12 choose coffee, the area to the right is only two percent of the whole. Just one more coffee drinker should make you feel much more secure in believing that coffee is preferred.

The BBC program is in principle the same as the Apple version but makes use of the special facilities available on the BBC machine. The calculation of each value of the fraction.

1/group!(total-group)!

```
   10 CLS: PRINTTAB(13)"This? - or T
hat?"
   20 INPUTTAB(0,5)"How many individ
uals in total",total
   30 IF total<2 OR total>30 THEN PR
INT"Number out of range, please re-e
nter":GOTO20
   40 PRINTSPC(40)
   50 INPUTTAB(0,7)"How many in one
of the groups",group
   60 IF group<0 OR group>total THEN
 PRINT"Number out of range, please r
e-enter":GOTO50
   70 PRINTSPC(80)
   80 PRINT"CALCULATING"
   90 IF group = total/2 THEN probab
ility = 100: GOTO 210
  100 IF group > total/2 THEN group
= total - group
  110 comb = 0
  120 FOR partition = 0 TO INT((tota
l-1)/2)
  130 comb = comb + FNfractions(part
ition)
  140 IF partition = group THEN grou
pcomb = comb
  150 NEXT partition
  160 comb = comb*2
  170 groupcomb = groupcomb*2
  180 IF total/2 = INT(total/2) THEN
 comb = comb + 1/FNfact(total/2)↑2
  190 probability = groupcomb/comb*1
00
  200 PRINT:PRINT"The probability of
 obtaining a result asextreme or mor
e extreme than this is:":PRINTTAB(9,
16) INT(probability + .5);" %"
  210 END
 1000 DEF FNfractions(partition)
 1010 = 1/FNfact(partition)/FNfact(t
otal-partition)
 2000 DEF FNfact(number)
 2010 IF number = 1 OR number = 0 TH
EN =1 ELSE = number*FNfact(number-1)

RUN
                This? - or That?
How many individuals in total?15


How many in one of the groups?4

CALCULATING
The probability of obtaining a resul
t asextreme or more extreme than thi
s is:
        12 %
```

BBC Basic program and sample run.

is performed by a function FNFractions, defined at line 1010, which uses function FNFact at line 2010 to calculate the factorials.

The total number of ways, Comb, is accumulated at line 130. At line 140 this cumulative value is assigned to the variable, Groupcomb, when the partition being evaluated is the same as the partition observed. Cumulative totals are doubled at line 190 and the single addition is made at line 180 in the case when the number of individuals is even.

References:

Coffee, Tea or Me? by Trudy Baker and Rachel Jones. Corgi Books, 1967.

Longman Statistical Utility by Owen Bishop. Longman Microsoftware, 1983.

Statistics for Biology by Owen Bishop. Longman, (4th edition 1983).

Check-out network

At Orpington's Walsingham School they use a Research Machines micro to simulate a point-of-sale terminal. Hewan Ormson explains how it's done.

MANY LARGER SHOPS and supermarkets are installing electronic point-of-sale terminals, POSTs, which are generally on line to a central computer. There are several different methods of data capture, including: keyboard input of a code number; optical character reader, or light wand; magnetic stripe reader; laser scanner, or bar code reader; merchandise ticket reader, or kimball tag.

British Home Stores has branches in most major shopping areas, and they all have electronic POST. BBC Radio includes a programme in the "Computers in the Real World" series which examines this system. Each POST is connected to an in-store minicomputer, or an area minicomputer. The minicomputer holds all the data relating to the stock using disc storage. The minicomputer is joined by telephone line to a mainframe at BHS headquarters — see figure 1.

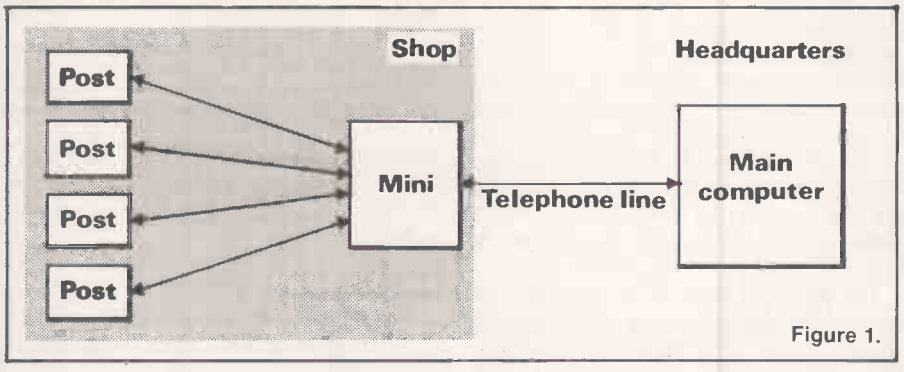


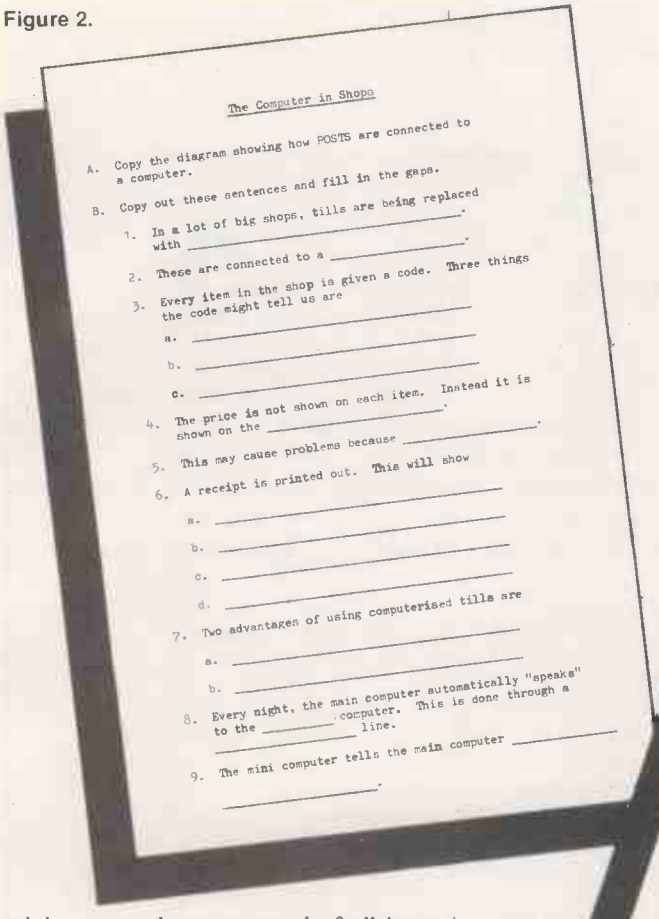
Figure 1.

Everything sold in the store is given a six-digit code number. The prices are shown on the shelves rather than on each individual item. When a customer buys an article he or she takes it to a POST. The POST operator types in the code; the POST finds the item details from the minicomputer and displays the price. The operator keys in any other items and the POST totals the prices. The operator keys in the maount of cash tendered, the POST displays the change due and prints out a receipt.

The receipt typically contains the following information: the type, price and number of each item purchased; the total cost; the amount of cash tendered and the change given; the date, etc. The

```
10 REM  ************************
20 REM  ************************
30 REM  ***                    ***
40 REM  ***       SHOP         ***
50 REM  ***   Version  1.1     ***
60 REM  ***                    ***
70 REM  *** Demonstrate POST   ***
80 REM  ***                    ***
90 REM  ***   By H.Ormson      ***
100 REM ***    June 1983       ***
110 REM ***                    ***
120 REM ************************
130 REM ************************
140 REM
150 CLEAR 1000:DIM C(20),I$(20),P$(20)
160 ON BREAK GOTO 1660
170 PUT 12,21
180 ?"                    SHOP
190 ?:?:?:?:?:?
200 A$=GET$(0)
210 INPUT"Type the date: ",D$
220 REM *Check that only RETURN not pr
essed*
230 IF D$="" THEN PUT 11:GOTO 210
240 REM *Read in data*
250 RESTORE
260 FOR C=1 TO 20
270 READ C(C),I$(C),P$(C)
280 NEXT C
290 PUT 31
300 REM *Set up display*
310 ?:?:?:?:?"        The Walsingham Su
perstore"
320 ?"        ------------------------
"
330 ?:?:?" Type the code number then p
ress RETURN"
340 ?"--------------------------------
--------"
350 ?:?"          Code no:"
360 REM *Set up coords - initialise va
rs*
370 X=33:Y=45:T=0:ZX=0
380 REM *Ask for code number*
390 FOR C=1 TO 4
400 PUT 22,Y,X,"Item",STR$(C)," ":INPU
T"",C1$
410 REM *Erase previous incorrect entr
y - 43 blanks*
420 IF ZX=1 THEN PUT 22,Y,49,"
                                    ":Z
X=0
430 REM *Find corresponding article*
440 FOR Z=1 TO 20
450 IF " "+C1$=STR$(C(Z)) THEN 510 ELS
E NEXT Z
460 REM *Give error message, set ZX=1-
 10 blanks*
```

Figure 2.

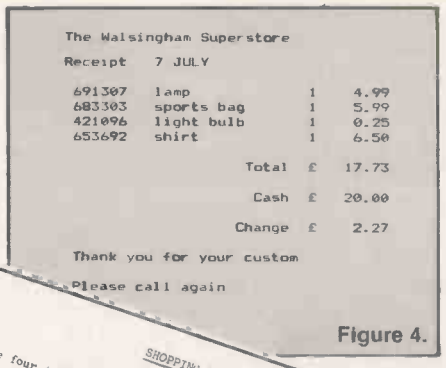


The Computer in Shops

A. Copy the diagram showing how POSTS are connected to a computer.

B. Copy out these sentences and fill in the gaps.

1. In a lot of big shops, tills are being replaced with _____.
2. These are connected to a _____.
3. Every item in the shop is given a code. Three things the code might tell us are
   a. _____
   b. _____
   c. _____
4. The price is not shown on each item. Instead it is shown on the _____.
5. This may cause problems because _____.
6. A receipt is printed out. This will show
   a. _____
   b. _____
   c. _____
   d. _____
7. Two advantages of using computerised tills are
   a. _____
   b. _____
8. Every night, the main computer automatically "speaks" to the _____ computer. This is done through a _____ line.
9. The mini computer tells the main computer _____.



The Walsingham Superstore

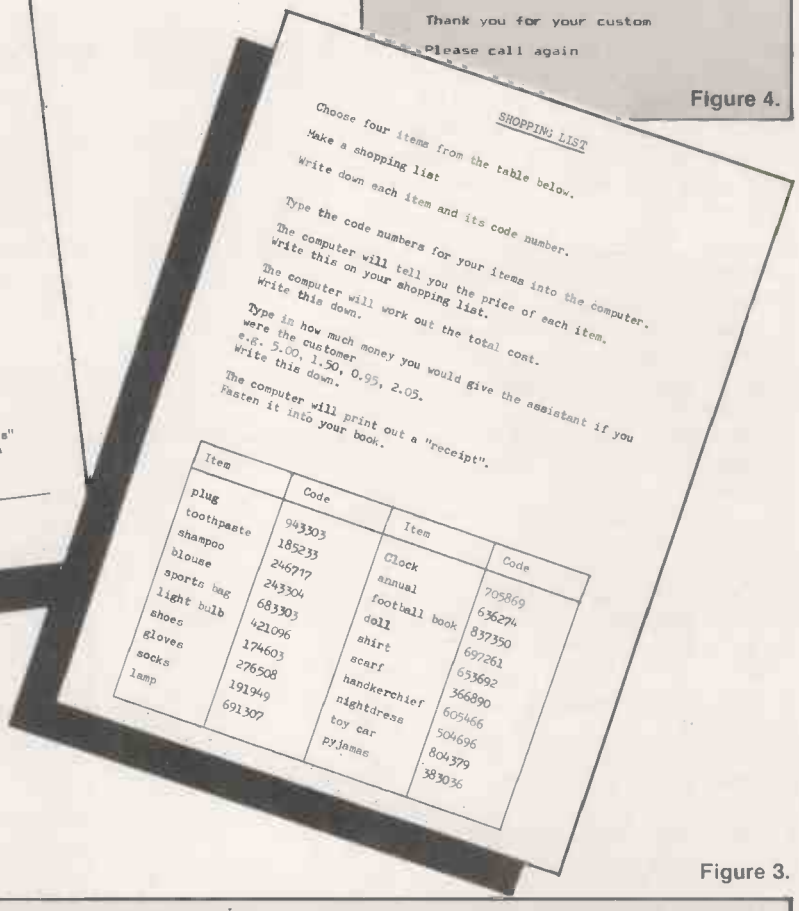
Receipt 7 JULY

691307	lamp	1	4.99
683303	sports bag	1	5.99
421096	light bulb	1	0.25
653692	shirt	1	6.50
	Total	£	17.73
	Cash	£	20.00
	Change	£	2.27

Thank you for your custom

Please call again

Figure 4.



SHOPPING LIST

Choose four items from the table below.

Make a shopping list

Write down each item and its code number.

Type the code numbers for your items into the computer.

The computer will tell you the price of each item. Write this on your shopping list.

The computer will work out the total cost. Write this down.

Type in how much money you would give the assistant if you were the customer e.g. 5.00, 1.50, 0.93, 2.05.

The computer will print out a "receipt". Fasten it into your book.

Item	Code
plug	943303
toothpaste	185233
shampoo	246717
blouse	243304
sports bag	683303
light bulb	421096
shoes	174603
gloves	276508
socks	191949
lamp	691307

Item	Code
clock	705869
annual	636274
football book	837350
doll	697261
shirt	653692
scarf	366890
handkerchief	605466
nightdress	504696
toy car	804379
pyjamas	383036

Figure 3.

minicomputer keeps a record of all items sold. This information is automatically sent to the mainframe each evening. Further details of the system, follow-up notes and a filmstrip are available from BBC Publications.

The program listed complements the

(continued on next page)

```
170 PUT 22,Y+1,40,"Code number wrong.
Try again"
180 PUT 22,Y,39,"                "
190 ZX=1:GOTO 400
500 REM *Print code & article*
510 PUT 22,Y,49,I$(Z):PUT 22,Y,63,"1":
PUT 22,Y,65,P$(Z)
515 REM *38 blanks*
520 PUT 22,Y+1,40,"
                  "
530 REM *increase total & Y coord*
540 Y=Y+1:T=T+VAL(P$(Z)):T$(C)=I$(Z):T
I$(C)=P$(Z):T(C)=C(Z)
550 NEXT C
560 PUT 22,50,57,"Total"
570 T=INT(T*100)/100
580 L=T
590 REM *Add trailing zeros etc*
600 GOSUB 1350
610 REM *Print total in correct positi
on*
620 IF LEN(A1$)=6 THEN PUT 22,50,64,A1
$:GOTO650
630 PUT 22,50,65,A1$
640 REM *Ask for cash*
650 PUT 22,52,57,"Cash?    ":INPUT"", C
ASH$
660 IF CASH$="" THEN 650
670 REM *Check input for alpha charact
ers*
680 FOR B1=1 TO LEN(CASH$)
690 IF ASC(MID$(CASH$,B1,1))>57 OR ASC
(MID$(CASH$,B1,1))<46THEN PUT 22,52,36
,"Use numbers only
    ":GOTO 650
700 NEXT B1
710 CASH=VAL(CASH$):CASH=INT((CASH+.00
1)*100)/100
720 REM *Output cash in correct positi
on
730 L=CASH:GOSUB1350
740 IF LEN(A1$)=5 THEN A1$=" "+A1$
745 REM *erase previous entry - 40 bla
nks*
750 PUT 22,52,36,"
                  "
760 PUT 22,52,57,"Cash    ":?;A1$
770 REM *Too much cash offered?*
780 IF CASH <=99.99 THEN 830
785 REM *erase previous entry - 30 bla
nks*
790 PUT 22,52,57,"
          "
800 PUT 22,52,36,"Too much. Try again
    "
810 GOTO 650
820 REM *Calculate change*
```

(listing continued on next page)

(continued from previous page)

Radiovision program, but it can be used on its own to supplement work on computers in shops — see figure 2. It is written for a Research Machines 380-Z or 480-Z and simulates a POST used in British Home Stores. It occupies about 4K.

Pupils choose four items from the list in figure 3 and key in the code numbers. The screen displays the code, the item description and its price. It totals the prices and asks for the amount of cash tendered; the maximum allowed is £99.99. The amount of change due is displayed and an itemised receipt is printed — see figure 4. The program checks for illegal code numbers, too much or too little cash, alphabetic instead of numeric input, and adds trailing zeros. In order to do all this code numbers and cash are entered as strings.

Twenty items are included in the data. This can be increased or decreased as required. The code numbers are random numbers as generated by a 380-Z. They could be improved by making the first two or three digits represent a particular department and the last a check digit.

Variable	Description	Variable	Description
CL)	item code number, six digit	C1$	inut code number
I$( )	item name	T	total of goods purchased
P$( )	item price	T$( )	item } stored here
A$	wait/trap key presses	T1$( )	price } ready for
D$	date	T( )	code } printing
B1	loop counters	L	temporary store used in
C		A1$	trailing zero routine
Z		CASH$	amount of cash tendered
X,Y	co-ordinates of item on screen	CASH	value of CASH$
ZX	count: if 1 erase incorrect entry	CH	change to be given

(listing continued from previous page)

```
830 CH=CASH-T
840 REM *Remove any rounding errors*
850 CH=INT((CH+.001)*100)/100
860 IF CH<.01 AND CH>=.009 THEN CH=.01
:GOTO 910
880 REM *Check for too little cash*
890 IF CASH<T THEN PUT 22,52,36,"Not e
nough cash. Try again
    " ELSE 910:REM *22 blanks*
900 PUT 22,52,65:INPUT"",CASH$:GOTO 68
0
910 PUT 22,53,65,"------"
920 IF CH<1 THEN CH$=STR$(CH):CH$=LEFT
$(CH$,4):CH=VAL(CH$)
930 REM *Add trailing zeros etc*
940 REM *Output change in correct posi
tion*
950 L=CH:GOSUB 1350
960 IF LEN(A1$)=5 THEN A1$=" "+A1$
970 PUT 22,54,57,"Change ",A1$
980 PUT 22,55,65,"------"
990 REM *Print receipt*
1000 LPRINT"The Walsingham Superstore"
1010 LPRINT:LPRINT"Receipt    ";D$
1020 LPRINT
1030 FOR C=1 TO 4
1040 LPRINT T(C);TAB(10);T$(C);TAB(27)
;"1";
1050 IF LEN(T1$)=6 THEN LPRINT TAB(30)
;T1$(C) ELSE LPRINT TAB(31);T1$(C)
1060 NEXT C
1070 LPRINT
1080 L=T
1090 GOSUB 1350
1100 LPRINT TAB(20);"Total";TAB(27);"£
";
1110 IF LEN(A1$)=6 THEN LPRINT TAB(30)
;A1$ ELSE LPRINT TAB(31);A1$
1120 LPRINT
1130 L=CASH
1140 GOSUB 1350
1150 LPRINT TAB(21);"Cash";TAB(27);"£"
;
1160 IF LEN(A1$)=6 THEN LPRINT TAB(30)
;A1$ ELSE LPRINT TAB(31);A1$
1170 LPRINT
1180 L=CH
1190 GOSUB 1350
1200 LPRINT TAB(19);"Change";TAB(27);"
£";
1210 IF LEN(A1$)=6 THEN LPRINT TAB(30)
;A1$ ELSE LPRINT TAB(31);A1$
1220 LPRINT
1230 LPRINT" Thank you for your custom
"
1240 LPRINT
1250 LPRINT" Please call again"
1260 LPRINT:LPRINT:LPRINT
1270 PUT 12
1280 ?"Take your receipt"
1290 ?:?:?"----------------------------
-------------":?:?
1300 A$=GET$(200):?:?
1310 ?"Is there another customer? (Y/N
) ":A$=GET$(0):A$=GET$()
1320 IF A$="Y" OR A$="y" THEN 250
1330 IF A$="N" OR A$="n" THEN 1660 ELS
E PUT 11:GOTO1310
1340 REM *Subroutine for adding traili
ng zeros
1350 A1$=STR$(L):L1=LEN(A1$):J=INT(L)
1360 IF L1>=6 THEN 1430
1370 IF L1=5 AND MID$(A1$,3,1)<>"." TH
EN A1$=A1$+"0":GOTO 1430
1380 IF L1=4 AND J=0 THEN A1$=" 0"+RIG
HT$(A1$,3) :GOTO 1430
1390 IF L1=4 THEN A1$=A1$+"0":GOTO1430
1400 IF L1=3 AND MID$(A1$,2,1)="." THE
430
1420 IF L1=2 THEN A1$=A1$+".00"
1430 RETURN
1440 REM *Data - code no, item, price*
1450 DATA 943303,plug," 0.45"
1460 DATA 185233,toothpaste," 0.39"
1470 DATA 246717,shampoo," 0.40"
1480 DATA 243304,blouse," 4.75"
1490 DATA 683303,sports bag," 5.99"
1500 DATA 421096,light bulb," 0.25"
1510 DATA 174603,shoes,12.99
1520 DATA 276508,gloves," 3.00"
1530 DATA 191949,socks," 0.57"
1540 DATA 691307,lamp," 4.99"
1550 DATA 705869,clock,12.99
1560 DATA 636274,annual," 1.50"
1570 DATA 837350,football book," 2.25"
1580 DATA 697261,doll," 3.75"
1590 DATA 653692,shirt," 6.50"
1600 DATA 366890,scarf," 4.20"
1610 DATA 605466,handkerchief," 0.30"
1620 DATA 504696,nightdress," 8.50"
1630 DATA 804379,toy car," 1.75"
1640 DATA 382036,pyjamas," 6.30"
1650 REM *Finished*
1660 PUT 12,23
1670 END
```

Postcode sort key

Geographical location is the key to sorting your sales information, says John Locke.

I RECENTLY had to write a program to deal with responses to sales enquiries for a large engineering firm. Among other information the reply was to include the names of a local dealer, the area sales representative and satisfied users of the equipment in the area. Clearly a geographical key was required to identify which dealers, reps and users were most appropriate.

Most business letters include the postcode in their address, which can form the basis of a geographical sort. Reading from left to right, the structure of the postcode is as follows:

- one or two alpha characters denoting the area; there are 120 areas in the U.K.
- one or two numeric characters followed by a space, to specify the district; there are 2,700 districts in the U.K.
- one numeric character to specify a sector; there are 8,900 sectors in the U.K.
- two alphabetic characters to denote a street or part of a street; there are 1.5 million in the U.K.
- occasionally the district code contains an alpha as well as a numeric character before the space.

This somewhat flexible construction of the postcode requires care in programming to ensure that as many errors as possible in operator entry are catered for. Figure 1 shows a flowchart for a simple basic program for entering postcodes. Each character is examined as it is entered and is accepted or rejected as appropriate.

The only operator instruction that has to be given is to insert a space to denote the end of the first section of the postcode if it contains only one numeric character; the space is inserted automatically if it contains two numerics. The postcode, area, district, sector and street are stored as strings C$(1), C$(2), C$(3), C$(4) so that further validation can take place and to simplify their use as sorting keys.

In the simplest case the post area is sufficient as a first sort key. If a large number of disc-stored records have to be processed, then selection rather than sorting will increase the speed of operation by up to N/n, where N is the total number of items and n is the average number selected. The 120 area codes can be stored as an array in the program, so that CY$(1) is AB and CY$(120) is ZE.

Random-access disc files are also set up for postcode cross-reference, dealer information rep information, satisfied user information and product information. The postcode cross-reference file has record numbers corresponding to the postcode array number in memory. Each record contains the record numbers of dealers covering that area, and the rep for the area. It is assumed that there are no more than three satisfied users in each area.

An operator who wishes to input an enquiry selects from the main menu and then enters the product number and the postcode of the enquiry. Product details are accessed directly from the product number. The area part of the postcode C$(1) is then matched to the array CT$(X) by:

```
FOR X = 1 TO 120: IF C$(1) < > CY$(X)
   THEN NEXT X
```

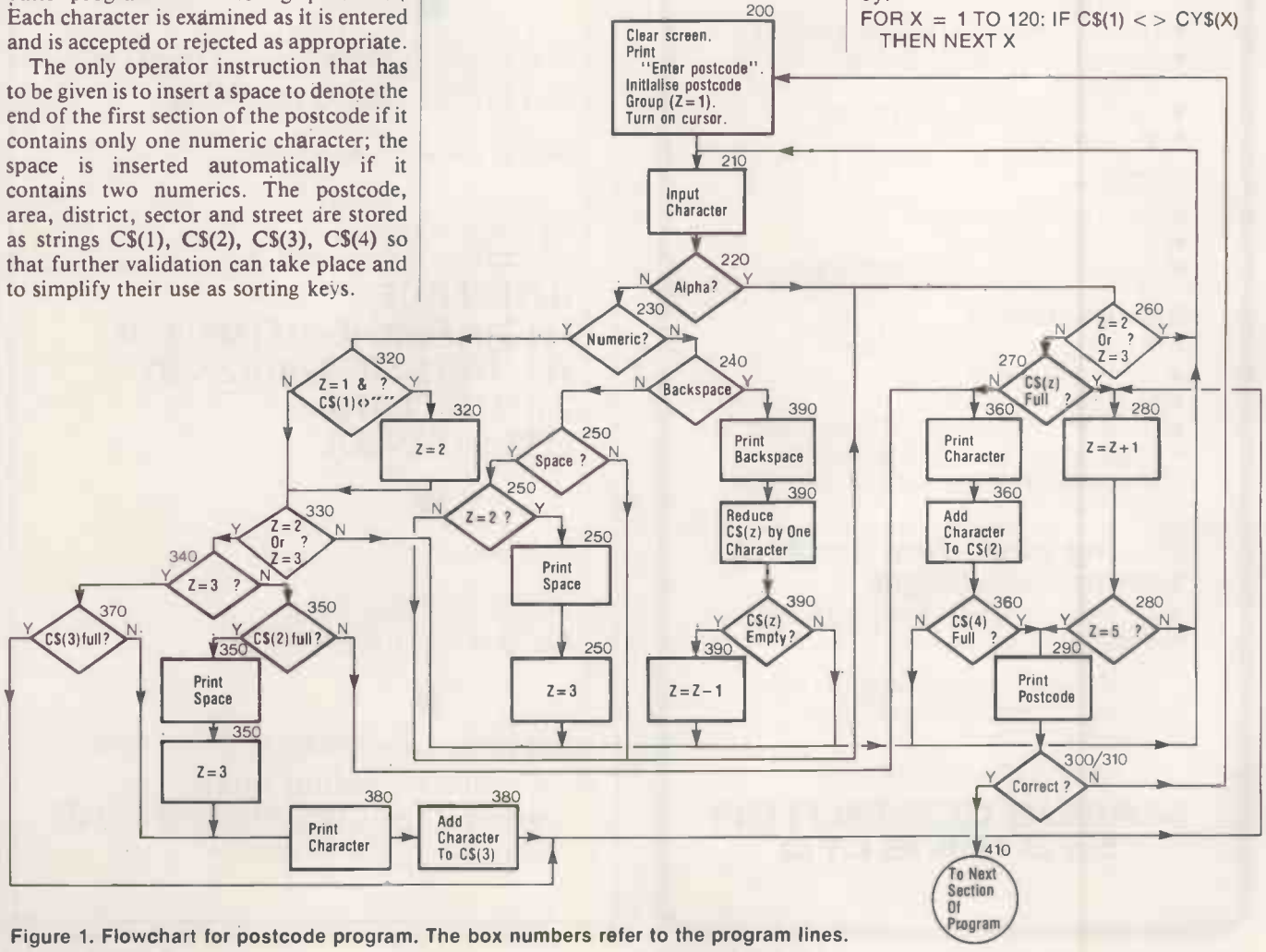


Figure 1. Flowchart for postcode program. The box numbers refer to the program lines.

The loop is exited with the match number X, which is then used to access directly the postcode record. This in turn is used to access the rep information and all relevant dealer information. Up to three satisfied users are always used for an area, so the Satisfied Users file can be accessed for record numbers from 3X — 2 to 3X.

In this simple example, a printout can be made of enquiry number, postcode, all applicable dealers, names and addresses together with further selection information such as their sales and credit ratings, exclusion from certain products, etc., and up to three satisfied users' names and addresses. This list can be pinned to the original enquiry letter for the sales staff to make their selection of one dealer and one user. Alternatively, further automatic selection can take place. In either case, to output a sales letter only the enquirer's name and address — if not already stored — the product, dealer, rep and user numbers need to be inserted.

While the dealer file is being constructed, the postcodes covered by each dealer have to be inserted in the postcode cross-reference file so that these, through the array match, will write the dealer number in the first vacant field of that postcode record. Amendment and deletion of dealer records must also access and modify these fields. The whole process is complex but routine. It slightly slows entry, amendment or deletion of dealer data, but is not a significant overhead as sales enquiries are answered more often than records are updated.

A great deal of detail is available from the Post Office on postcodes, ranging from the complete address file on magnetic tape for £15,000 down to publications on post towns, valid sectors, etc. Magnetic-tape file extracts are available from £4.75 per thousand records, subject to minimum charges. Post zone files of codes and Ordnance Survey grid references are available from £6,000 on tape. Postcode maps are available from J Bartholomew & Sons Ltd, Geographia Ltd, and Postal Headquarters.

There are also advantages in sorting outgoing mail when bulk posting is used. The Post Office gives a rebate on bulk posting of second-class mail that has been pre-sorted according to post code. For example, 5,000 to 23,529 letters are given a 15 percent rebate on the postage paid if they are pre-sorted. These levels are shown in the Inland Compendium held by main post offices.

The level of rebate is dependent not only on the total number of letters mailed but also on the amount of pre-sorting carried out. A booklet will be available shortly from regional offices and head postmasters giving more details. The Post Office's Post Code Marketing Section emphasise the importance of involving the local Post Office in proposals for bulk posting at an early stage.

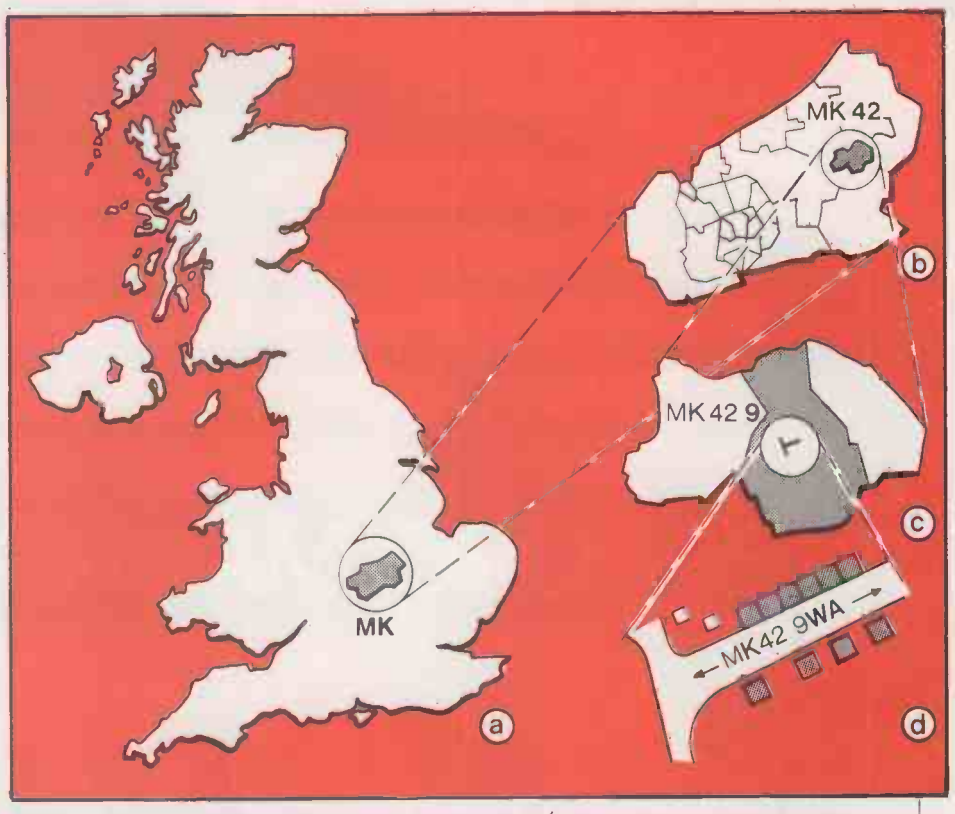


Figure 2. Most business letters include the postcode in their address which can form the basis of a geographical sort.

Postcode listing.

```
200 CLS:PRINT"ENTER POSTCODE":Z=1:
PRINTCHR$(14):FORX=1TO4:C$(X)="":NEXTX
210 Z$=INKEY$:IFZ$=""THEN210
220 IFASC(Z$)>64ANDASC(Z$)<91THENGOTO260
230 IFASC(Z$)>48ANDASC(Z$)<58THENGOTO320
240 IFZ$=CHR$(8)THENGOTO 390
250 IFZ$=CHR$(32)ANDZ=2THENZ=3:PRINTZ$;:
GOTO210
260 IFZ=2ORZ=3THENGOTO210
270 IFLEN(C$(Z))<>2THENGOTO360
280 Z=Z+1:IFZ<>5THENGOTO210
290 PRINT:PRINT"POSTCODE= ";C$(1)+C$(2)
+CHR$(32)+C$(3)+C$(4)
300 INPUT"IS THIS CORRECT";K$:IFK$="Y"
THENK=1ELSEIFK$="N"THENK=2ELSEPRINT"ENTER
'Y' OR 'N'  ONLY":GOTO300
310 ONKGOTO410,200
320 IFZ=1ANDC$(1)<>""THENZ=2
330 IFZ<>2ANDZ<>3THENGOTO210
340 IFZ=3THENGOTO370
350 IFLEN(C$(2))>1THENPRINTCHR$(32);:Z
=3:GOTO380
360 PRINTZ$;:C$(Z)=C$(Z)+Z$:IFLEN(C$(4))
=2THENGOTO290ELSEGOTO210
370 IFLEN(C$(3))>0THENGOTO280
380 PRINTZ$;:C$(3)=C$(3)+Z$:GOTO280
390 PRINTCHR$(8);:X=LEN(C$(Z)):IFX-1=0
THENC$(Z)="":Z=Z-1:GOTO210
400 C$(Z)=LEFT$(C$(Z),X-1):GOTO210
410 END
```

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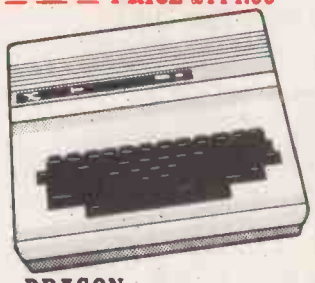

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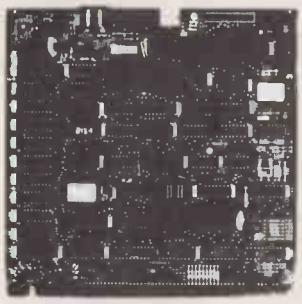

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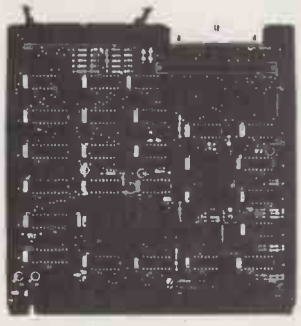

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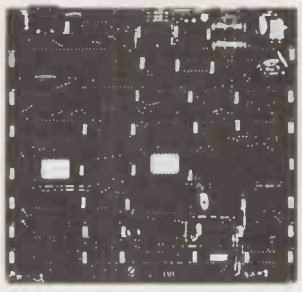

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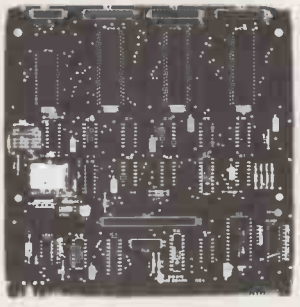

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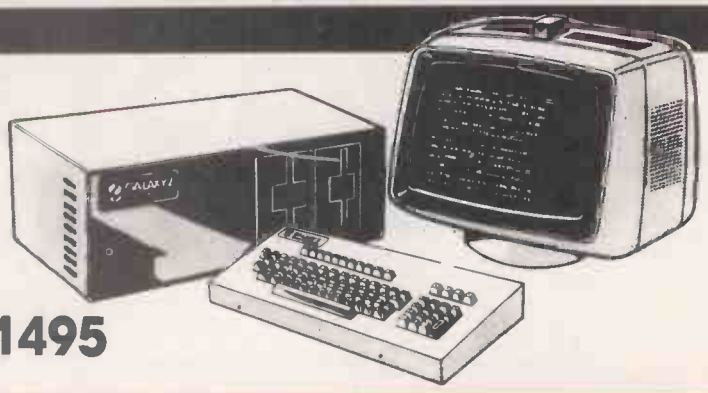

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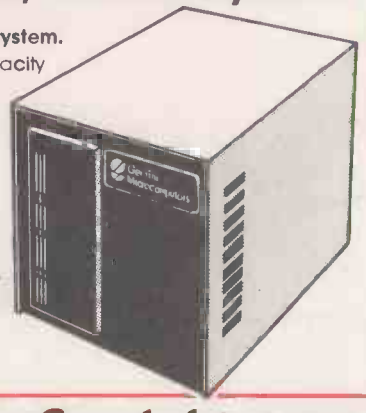

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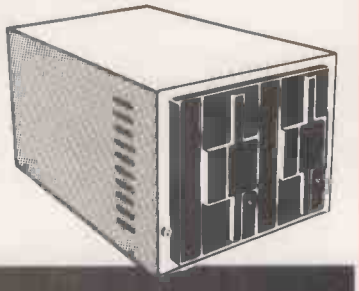

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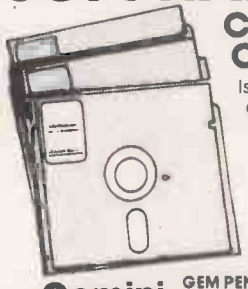

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Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

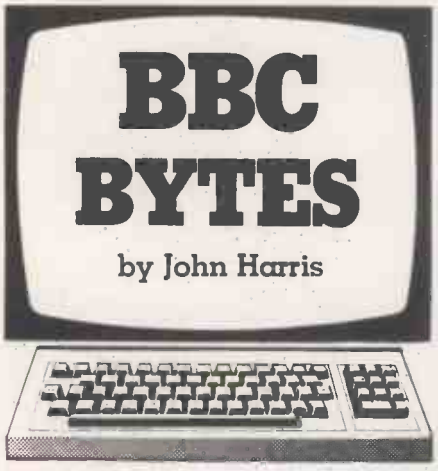
Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

PLEASE send a cassette or disc version of your program if at all possible. It will be returned after use. For CP/M programs use IBM-format 8in. floppy discs.



Sequencer

Adrian Roe of Ilkley, whose Lightcycle game was published on page 164 of the May issue, has submitted a program which I cannot claim to understand for all my efforts to do so. The program, I am told, transforms my machine into a sequencer with key, octave, tempo and bass control over a basic note pattern input as data at line 220.

Since the program uses the negative Inkey feature, interesting effects can be produced by holding down more than one key. Try holding the speed-up and pitch keys together, for example.

Sequencer.

```
   10 REM***SEQENCER BY A.ROE JAN'83
***
   20 REM********VERSION 0.2*********
***
   30 MODE2
   40 VDU23;8202;0;0;0;
   50 PROCINIT
   60 PROCKEYS
   70 RESTORE
   80 READPIT:IFPIT=1000 GOTO70
   90 IFINKEY(-122) BASS=BASS+48:SOU
ND2,2,BASS,1:SOUND3,2,BASS,1
  100  IFINKEY(-26) BASS=BASS-48:SOU
ND2,2,BASS,1:SOUND3,2,BASS,1
  110 IFINKEY(-54) KEY=KEY+4:BASS=BA
SS+4:SOUND2,2,BASS,1:SOUND3,2,BASS,1
  120 IFINKEY(-51) KEY=KEY-4:BASS=BA
SS-4:SOUND2,2,BASS,1:SOUND3,2,BASS,1
  130 IFINKEY(-103) TEMPO=TEMPO+1
  140 IFINKEY(-104) TEMPO=TEMPO-1
  150 IFINKEY(-58) OCT=OCT+48
  160 IFINKEY(-42) OCT=OCT-48
  170 SOUND0,-10,4,1:SOUND1,1,PIT+OC
T+KEY,1
  180 TIME=0:REPEAT UNTIL TIME>=TEMP
O
  190 IFINKEY(-82)ANDPIT=9 THENTIME=
0:REPEAT UNTIL TIME>=200:GOTO240
  200 GOTO80
  210 REM***NOTE SEQUENCE**
  220 DATA9,37,49,57,49,37,29,37,100
0
  230 REM***FINISH WITH 1000**
  240 MODE7
  250 *FX15,0
  260 SOUND2,0,0,0:SOUND3,0,0,0
  270  END
  280 DEFPROCINIT
  290 VDU23,230,8,4,2,255,2,4,8,0
  300 VDU23,231,16,32,64,255,64,32,1
```

(listing continued on next page)

VDU23 definition

Following on from Mr P Davidson's eight-by-eight pixel manipulation program — published on page 136 of the February issue — this implementation by John Wilson of Benfleet, Essex provides far wider facilities. Up to 40 characters may be defined at a time on a cross-linked 10-by-four set of eight-by-eight pixels.

The resulting character definitions may be inverted from black to white and vice versa, Spooled for *Exec retrieval into a Basic source program, edited, and viewed in any mode. It is difficult to think of anything missing from the functions.

Operating instructions are written into the program, with a function-select screen and subsequent prompts. The pixel map is represented as a grid of dots and an X cursor which is moved by the cursor-control keys. Pixels are selected with Copy and deleted with Delete. An agreeable feature is that the cursor controls can be held concurrently with select and deselect, providing rapid spreading or removal of lines in any of the eight cardinal directions.

If you have OS 0.1 you will not be able to employ the full 10 by four generated character set in your own Basic programs as no provision is made within the OS to "explode" the memory allocation for user-defined characters. OS 1.0 and above does cater for this, as shown on pages 427 and 428 of the *User Guide* under *FX20.

VDU23 definition.

```
   10  REM
   20  REM Character Generator - V-I
I
   30  REM
   40  REM for the BBC Micro Model B
   50  REM
   60  REM by J.R.Wilson  April 1983
   70  REM
   80  DIM M% 256U,T% 320,Z% 7
   90  X%=0:Y%=0
  100  REM Make Cursor keys give cod
es
  110  *FX4,1
  120  REM Trap any errors
  130  ON ERROR GOTO 67U
  140  D=0
  150  W=0
  160  XM=U:YM=U
  170  REM
  180  REM Display menu
  190  REM
  200  MODE4
  210  VDU4
  220  HIMEM=&3UUU
  230  VDU 23,224,255,255,255,255,25
5,255,255,255
  240  VDU23,225,0,0,0,24,24,0,0,0
  250  COLOUR129:COLOURU
  260  PRINT STRING$(240," ");TAB(U,
U);
  270  PRINT '" C H A R A C T E R
G E N E R A T O R "
  280  PRINTTAB(15,4);">MENU<"'''
  290  COLOUR1:COLOUR128
  300  PRINT '"   1   Enter characte
r"
  310  PRINT '"   2   Edit character
"
  320  PRINT '"   3   Spool characte
r to cassette"
  330  PRINT '"   4   View character
"
  340  PRINT '"   5   Invert charact
er"
  350  PRINT '"   6   List codes"
  360  PRINT '"   7   Operating syst
em call"
  370  PRINT '"   8   End program"
  380  PRINT'''"Press the number the
n RETURN ";
  390  A=FNCH(8)
  400  CLS
  410  IF A=1 THEN MODEU:PROCENTER
  420  IF A=2 THEN MODEU:HIMEM=&3UUU
:PROCEDIT
  430  IF A=3 THEN PROCCHANGE:PROCSP
UOL
  440  IF A=4 THEN PROCCHANGE:PROCHO
DE:MODE M:HIMEM=&3UUU:PROCVIEW
  450  IF A=5 THEN PROCINVERT
  460  IF A=8 THEN PROCEND
  470  IF A=6 THEN PROCCHANGE:PROCLI
ST
  480  IF A=7 THEN PROCoscall
  490  REM Clear keyboard buffer
  500  *FX15,1
  510  GOTO 200
  520  REM
  530  REM Enter a number routine
  540  REM
  550  DEF FNCH(C)
  560  LOCAL E,A
  570  E=-1
  580  A=GET:IF A=13 AND E<>-1 THEN
=E
  590  IF C=1U AND A=65 THEN VDU A,8
:E=10:GOTO58U
  600  IF A<49 OR A>48+C THEN 58U
  610  PRINT CHR$A;CHR$8;
  620  E=A-48
  630  GOTO 58U
  640  REM
  650  REM Trap any errors
  660  REM
  670  IF ERR=17 THEN 200
  680  REPORT
  690  IF ERR>200 THEN PROCSPACE(31)
:GOTO200
  700  PRINT " in line ";ERL
  710  GOTO 77U
  720  REM
  730  REM End the program
  740  REM
  750  DEF PROCEND
  760  VDU22,7:REM Change to mode 7
  770  PRINTTAB(U,5)
  780  REM Give the cursor keys thei
r usual function
  790  *FX4,U
  800  END
  810  REM
  820  REM Enter a character into me
mory
  830  REM
  840  DEF PROCENTER
  850  PRINT'''"Number of characters
 wide (1 to 9 or A ;  where A=1U wid
e )  ";
  860  W=FNCH(1U)
  870  PRINT'''"Number of characters
 deep (1 to 4) ";
  880  D=FNCH(4)
  890  CLS
  900  XM=W*8-1
  910  YM=D*8-1
  920  FORI%=0TOYM*8U+8U
  930  M%?I%=U
  940  NEXT
  950  X%=U:Y%=U
  960  PROCEDIT
  970  ENDPROC
  980  REM
  990  REM Change the picture into b
inary
 1000  REM
 1010  DEF PROCCHANGE
 1020  PRINT '"Please wait a few sec
onds."
 1030  FOR I%=0 TO D-1
 1040  FOR J%=U TO W-1
 1050  FOR K%=U TO 7
 1060  ?(T%+K%+J%*8+I%*8U)=U
 1070  FOR L%=U TO 7
 1080  IF ?(M%+J%*8+L%+((I%*8+K%)*8U
))=1 THEN ?(T%+K%+J%*8+I%*8U)=?(T%+K
%+J%*8+I%*8U)+2^(7-L%)
 1090  NEXT L%,K%,J%,I%
 1100  ENDPROC
 1110  REM
 1120  REM Edit the picture
 1130  REM
 1140  DEF PROCEDIT
 1150  IF YM=0 OR XM=0 THEN ENDPROC
 1160  IF YM=31 AND XM=79 THEN VDU5:
REM Stop the screen from scrolling u
p
 1170  FOR I%=U TO YM
 1180  FOR J%=U TO XM
 1190  PRINT TAB(J%,I%);
 1200  IF ?(M%+J%+I%*8U)=U THEN VDU
225 ELSE VDU 224
 1210  NEXT J%,I%
 1220  VDU 23;8202;U;U;U;:REM Make c
ursor invisible
 1230  IF X%=79 AND Y%=31 THEN VDU5,
9,127 ELSE VDU4
 1240  PRINT TAB(X%,Y%);"X";
 1250  A$=GET$
 1260  PRINTTAB(X%,Y%);
 1270  IF X%<>79 OR Y%<>31 THEN 1310
 1280  VDU9,127,30
 1290  IF ?M%=1 THEN VDU 224 ELSE VD
U 225
 1300  PRINTTAB(X%,Y%);
 1310  IF ?(M%+X%+Y%*8U)=1 THEN VDU
224 ELSE VDU 225
 1320  REM Clear the keyboard buffer
 1330  *FX15,1
 1340  REM Test the cursor keys
 1350  IF INKEY(-26) THEN X%=X%-1
 1360  IF INKEY(-122) THEN X%=X%+1
 1370  IF INKEY(-42) THEN Y%=Y%+1
 1380  IF INKEY(-58) THEN Y%=Y%-1
 1390  REM Keep the cursor on the pi
cture
 1400  IF Y%=-1 THEN Y%=YM
 1410  IF Y%>YM THEN Y%=U
 1420  IF X%=-1 THEN X%=XM
 1430  IF X%>XM THEN X%=U
 1440  REM Delete a block
 1450  IF INKEY(-9U) THEN ?(M%+X%+Y%
*8U)=U
 1460  REM Leave a block
 1470  IF INKEY(-1Uo) THEN ?(M%+X%+Y
%*8U)=1
 1480  GOTO 1230
 1490  REM
 1500  REM What mode do you want to
display the character in ?
 1510  REM
 1520  DEFPROCMODE
 1530  PRINT TAB(U,1U);"What mode fo
r display ? ";
 1540  INPUT""M
 1550  IF M<U OR M>6 OR M<>INTM THEN
 CLS:GOTO1530
 1560  ENDPROC
 1570  REM
 1580  REM Display the character
 1590  REM
 1600  DEF PROCVIEW
 1610  FOR I%=0 TO D-1
 1620  FOR J%=U TO W-1
```

(listing continued from previous page)

```
6,U
  310 VDU23,232,16,56,84,146,16,16,1
6,0
  320 VDU23,233,16,16,16,146,84,56,1
6,0
  330 ENVELOPE2,1,0,0,0,0,0,0,127,0,
0,0,75,75
  340 ENVELOPE1,1,0,0,0,0,0,0,127,-1
0,-10,-1,126,60
  350 OCT=U:BASS=9:TEMPO=16:KEY=0
  360 UD$=" = DOWN - UP = "
  370 ENDPROC
  380 DEFPROCKEYS
  390 COLOUR1
  400 PRINTTAB(3,1)"TEMPO CONTROL"TA
B(1,4)"<";UD$;">":PROCLINE(5)
  410 COLOUR2:PRINTTAB(2,7)"SEQUENCE
 CONTROL"TAB(1,10)CHR$233UD$CHR$232:
PROCLINE(11)
  420 COLOUR3:PRINTTAB(4,13)"BASS CO
NTROL"TAB(1,16)CHR$231UD$CHR$230:PRO
CLINE(17)
  430 COLOUR5:PRINTTAB(4,19)"KEY CON
TROL"TAB(1,22)"D";UD$;"U":PROCLINE(2
3)
  440 COLOUR6:PRINTTAB(4,25)"STOP CO
NTROL"TAB(3,28)"HOLD DOWN  'S'"
  450 ENDPROC
  460 DEFPROCLINE(L)
  470 COLOUR7:FORI=0TO19:PRINTTAB(I,
L)" ":NEXT
  480 ENDPROC
```

```
 1630  FOR L%=0 TO 7
 1640  Z%?L%=?(T%+L%+J%*8+I%*80)
 1650  NEXT L%
 1660  VDU23,224,?Z%,Z%?1,Z%?2,Z%?3,
Z%?4,Z%?5,Z%?6,Z%?7
 1670  PRINT TAB(J%+5,I%+5);CHR$224;
 1680  NEXT J%,I%
 1690  IF M=3 OR M=6 THEN PROCSPACE(
24):ENDPROC
 1700  IF M=2 OR M=5 THEN PROCSPACE(
30):ENDPROC
 1710  PROCSPACE(31)
 1720  ENDPROC
 1730  REM
 1740  REM Press the SPACE BAR to co
ntinue
 1750  REM
 1760  DEF PROCSPACE(Y%)
 1770  PRINTTAB(0,Y%);"Press the SPA
CE BAR to continue.";
 1780  REPEAT UNTIL GET$=" "
 1790  ENDPROC
 1800  REM
 1810  REM Spool a character onto ca
ssette
 1820  REM
 1830  DEF PROCSPOOL
 1840  INPUT TAB(5,5)"First characte
r number = " N
 1850  IF N<32 OR N>255 OR N<>INT(N)
 THEN CLS:GOTO 1840
 1860  INPUT TAB(5,10)"First line nu
mber = " L
 1870  IF L<0 OR L>32767 OR L<>INT(L
) THEN 1860
 1880  *SPOOL("CHAR")
 1890  FOR I%=0 TO D-1
 1900  FOR J%=0 TO W-1
 1910  PRINT ;L;" VDU 23,";N;
 1920  FOR K%=0 TO 7
 1930  PRINT ",";?(T%+K%+J%*8+I%*80)
;
 1940  NEXT K%
 1950  PRINT
 1960  N=N+1
 1970  L=L+10
 1980  NEXT J%,I%
 1990  *SPOOL
 2000  PROCSPACE(31)
 2010  ENDPROC
 2020  REM
 2030  REM Invert the picture in mem
ory.    i.e. change all white blocks
 to black          and visa-versa
 2040  REM
 2050  DEF PROCINVERT
 2060  PRINT'"Please wait a few seco
nds."
 2070  FORI%=0TOYM*80+80
 2080  M%?I%=(M%?I% +1)AND1
 2090  NEXTI%
 2100  ENDPROC
 2110  REM
 2120  REM List the binary codes mak
ing each character up
 2130  REM
 2140  DEF PROCLIST
 2150  FOR I%=0 TO D-1
 2160  FOR J%=0 TO W-1
 2170  CLS
 2180  PRINT '"Character at ";J%+1;"
, ";I%+1
 2190  PRINT '"Codes are as follows
:"''
 2200  FOR K%=0 TO 7
 2210  PRINT TAB(20);?(T%+K%+J%*8+I%
*80)
 2220  NEXTK%
 2230  PROCSPACE(31)
 2240  NEXT J%,I%
 2250  ENDPROC
 2260  REM
 2270  REM Allow you to make an O.S.
 Call from within the program
 2280  REM
 2290  DEF PROCoscall
 2300  PRINT TAB(0,5);"Type the requ
ired operating system call and press
 RETURN."
 2310  PRINT TAB(0,10);"Call = ";
 2320  INPUT ""C$
 2330  $&A00=C$
 2340  X%=0:Y%=&A
 2350  PRINTTAB(0,15);
 2360  CALL&FFF7
 2370  ENDPROC
```

A Fill routine.

```
    5 REM The variables in the testb
ed are: cursor at x,y; v=4 for curso
r moving, 5 for cursor drawing; use
 cursor control keys and joystick if
 available else REM out line 150 and
 remove the OR((ADVAL(0)AND3)<>0) fro
m line 70
   10 DATA RED,GREEN,YELLOW,BLUE,MAG
ENTA,CYAN,WHITE
   20 MODE7:PRINT'''''"The colour co
des used are:"'':FORI=1TO7:READcol$:
PRINTCHR$(128+I);"    ";I;" for ";co
l$;SPC(10-LEN(col$));CHR$157;CHR$(12
8+I):NEXT:PRINT''"and 0 for black"''
"press space to go on...";:PROCgk(")
   30 MODE3:PRINT"Controls are:"''"
B or F change the background or fore
ground to the number keyed after"'"C
 clears to MODE number keyed after"'
"SPACE or Trigger toggles between MO
VE and DRAW"'"Arrows and joystick wo
rk"'"COPY fills"
   40 PRINT"K sets a border"'"G goes
 to it"'"O sets an orientation"'"N a
 number of sides"'"M draws a polygon
"'"T writes text 'til RETURN"'"A var
ies the GCOL option 0 plot 1 OR 2 AN
D 3 EOR 4 Invert"''"press space to g
o on...";
   50 PROCgk(" "):x=500:y=500:edgex=
x:edgey=y:rad=0:v=4:gtype=0:orient=0
:sides=36:fore%=7:back%=0:MODE 2:MOV
Ex,y:VDU5:PROCcoff:REPEAT:*FX15,0
   60 IFINKEY(-68)THENfore%=VAL(GET$
):GCOLgtype,fore%ELSEIFINKEY(-101)TH
ENback%=VAL(GET$):GCOLgtype,back%+12
8 ELSEIFINKEY(-83)THENPROCgk("012"):
MODE VAL(a$):MOVEx,y:VDU5:PROCcoff:G
COLgtype,fore%:GCOLgtype,128+back%
   70 tog=INKEY(-99)OR((ADVAL(0)AND3
)<>0):IFtog ANDv=4THENv=5:PROCdelay(
10)ELSEIFtog ANDv=5THENv=4:PROCdelay
(10)ELSEIFINKEY(-36)THENPROCdelay(25
):PROCtext ELSEIFINKEY(-66)THENPROCg
k("01234"):gtype=VAL(a$):GCOLgtype,f
ore%:GCOLgtype,128+back%
   80 IFINKEY(-52)THENedgex=x:edgey=
y:rad=0 ELSEIFINKEY(-84)THENx=edgex:
y=edgey:MOVEx,y ELSEIFINKEY(-55)THEN
PROCorient ELSEIFINKEY(-86)THENPROCs
ides ELSEIFINKEY(-102)THENPROCpolygon
   90 IFINKEY(-58)THENPROCP(0,4)
  100 IFINKEY(-42)THENPROCP(0,-4)
  110 IFINKEY(-26)THENPROCP(-4,0)
  120 IFINKEY(-122)THENPROCP(4,0)
  130 PROCP(FNad(ADVAL(2)),FNad(ADVA
L(1))):REM this line out if you don'
t want joystick control
  140 PROCc:PROCc:IFINKEY(-106)THENP
ROCFILL(x,y,back%):MOVEx,y:v=4
  150 UNTIL FALSE
  160 DEFFNad(A%):IFA%<25000THEN=INT
((A%-25000)/1000) ELSEIFA%>40000THEN
=INT((A%-40000)/1000) ELSE=0
  170 DEFPROCc:PLOT2,12,12:PLOT2,-24
,0:PLOT2,0,-24:PLOT2,24,0:PLOT2,0,24
:PLOT2,-12,-12:ENDPROC
  180 DEFPROCpolygon:IFrad=0THENrad=
FNhype
  190 startx=x+COS(orient)*rad:start
y=y+SIN(orient)*rad:MOVEstartx,start
y:FORangle=orient TOorient+2*PI STEP
 2*PI/sides:newx=x+COS(angle)*rad:ne
wy=y+SIN(angle)*rad:DRAWnewx,newy:NE
XT:IFnewx<>startx ORnewy<>starty THE
NDRAWstartx,starty
  200 MOVEx,y:ENDPROC
  210 DEFPROCP(XI,YI):IFx+XI<1280AND
x+XI>0THENx=x+XI
  220 IFy+YI<1024ANDy+YI>0THENy=y+YI
  230 PLOTv,x,y:ENDPROC
  240 DEFPROCcoff:PROCosbyte(&97,0,1
0):PROCosbyte(&97,1,32):ENDPROC
  250 DEFPROCcon:PROCosbyte(&97,0,10
):PROCosbyte(&97,1,96):ENDPROC
  260 DEFPROCosbyte(A%,X%,Y%):ind=US
R(&FFF4):ENDPROC
  270 DEFPROCgk(legal$):REPEATa$=GET
$:IFa$>="A"ANDa$<="Z"THENa$=CHR$(ASC
(a$)+32)
  280 PROCck:UNTIL legal:ENDPROC
  290 DEFPROCck:legal=FALSE:ind=0:RE
PEAT ind=ind+1:IF MID$(legal$,ind,1)
=a$ THEN legal=TRUE
  300 UNTIL legal OR ind=LEN(legal$)
:ENDPROC
```

A Fill routine

Douglas Stewart of Edinburgh has submitted another recursive procedure demonstrating that not all recursion is superfluous extravagance coded for effect rather than utility. This routine will fill an area of background colour bounded by non-background colour with foreground colour.

Within this bald description lies a process which is a joy to watch on the screen, as colour first flows up, then down, filling nooks and crannies of irregular shapes, and back-tracking to finish off part-completed sections. The Fill function is essential to any graphics art pack, and the test bed in which the procedure is set will allow pictures to be drawn. It provides a good grounding from which you can develop an art pack tailored to your own specification. The routine can be included within any program requiring a Fill facility; the testbed is optional.

```
  310 DEFPROCdelay(A%):T%=TIME:REPEA
T UNTIL TIME>T%+A%:ENDPROC
  320 DEFPROCorient:orient=ASN((y-ed
gey)/(FNhype+0.001)):IFx-edgex<0THEN
orient=orient+PI
  330 ENDPROC
  340 DEFPROCsides:PROCgk("3456789ab
cdefghijklmopqrstuvwxyz"):sides=ASC(
a$):IFsides>96THENsides=sides-86ELSE
 sides=sides-48
  350 ENDPROC
  360 DEFFNhype:=SQR((x-edgex)^2+(y-
edgey)^2)
  370 DEFPROCtext:REPEAT:a$=GET$:PRI
NTa$;:UNTILa$=CHR$13:ENDPROC
30000 REM Procedure to fill an area
 of current backgroud colour which is
30010 REM enclosed by non-background
 colour.
30020 REM Syntax is PROCFILL(Xcoordi
nate,Ycoordinate,current_background_
colour)
30030 REM Procedure will work in any
 mode.
30040 REM By Douglas Stewart, March
 1983.
30050 REM ************ NOTE:   OPERA
TING SYSTEM SERIES 1 OR LATER ONLY *
*****
30060 REM ------------------------
------------------------------
30070 REM As the function is recursi
ve for more complex shapes,short var
iable
30080 REM names have been used to li
mit the stack space used.
30090 DEFPROCFILL(X,Y,V)
30100 DIM PARAM 7:REM Space for para
meter block for OSWORD 13.
30110 V=V AND15
30120 LOCAL I
30130 A%=135:M=((USR(&FFF4)DIV&10000
)AND15)-1:REM Current graphics mode.
30140 IFM=7ORM=3ORM=6ENDPROC:REM Che
ck for non-graphics mode.
30150 W=2^(M MOD3+1):REM Width of pi
xel for this mode.
30160 Z=2*W
30170 PROCUD(X,Y,4):PROCUD(X,Y,-4):R
EM FILL UP AND DOWN
30180 ENDPROC
30190 DEFPROCUD(X,Y,S)
30200 LOCALF%,B%,C%,D%,E%:REM These
 variables must be LOCAL
30210 PLOT76,X,Y:REM Get width but d
o not draw yet.
30220 B%=FNC(4):REM Get last X coord
inate.
30230 C%=FNC(0):REM Get previous X c
oordinate.
30240 :
30250 REM ******* Main loop starts h
ere. *******
30260 PLOT77,X,Y:REM Fill in a horiz
ontal line.
```

(continued on page 147)

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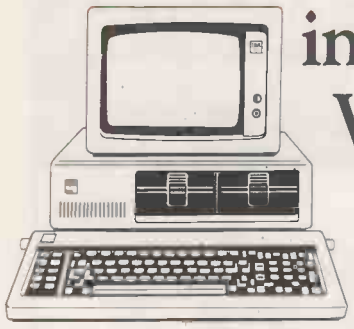

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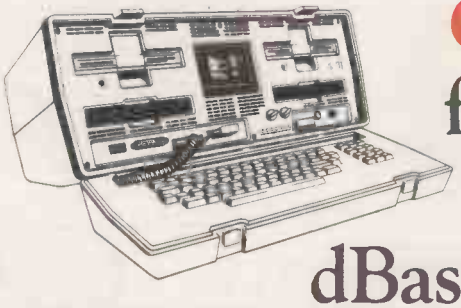

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Face

Alistair Lindsay of Edinburgh has submitted what he calls his first successful attempt at making a reasonable program. The result is a Mode 7 graphic display — not the easiest problem to start on! — which does just what it sets out to do; it is quite funny.

I can see a whole set of computer jokes resulting from it — variations on the "Mummy, Mummy" or "Knock, Knock" themes of yesteryear — but this is the first. Nobody has submitted a computerised joke before. Given enough of them chained together, it might be the music-hall turn reborn.

Box spin

R A Lober of Peterson-super-Ely, Cardiff, has submitted a demonstration of graphics rotation. I had not previously thought it possible in Basic but Mr Lober proves me wrong — though I suspect that is only because the box he is spinning is rather small and only four of its faces are ever visible. The following variables are used:

A% — width of sides
B% — width of ends
T% — angle of turn
D — current width of sides
P — current width of ends
S — perspective
W — reduction in D
F — reduction in P

(listing continued from page 143)

```
30270 Y=Y+S
30280 D%=FNC(4)
30290 E%=FNC(0)
30300 IFE%-C%<Z THEN30350:REM Extrem
ities almost coincident?
30310 F%=C%
30320 F%=F%+W
30330 IFPOINT(F%,Y-S)=V PROCUD(F%,Y-
S,S):REM Recurse to FILL branch
30340 IFF%<E%THEN30320
30350 IFB%-D%<Z THEN30400
30360 F%=D%
30370 F%=F%+W
30380 IFPOINT(F%,Y-S)=V PROCUD(F%,Y-
S,S):REM Recurse to FILL branch.
30390 IFF%<B%THEN30370
30400 IFC%-E%<Z THEN30450
30410 F%=E%
30420 F%=F%+W
30430 IFPOINT(F%,Y-2*S)=V PROCUD(F%,
Y-2*S,-S):REM Recurse to FILL branch
30440 IFF%<C%THEN30420
30450 IFD%-B%<Z THEN30500
30460 F%=B%
30470 F%=F%+W
30480 IFPOINT(F%,Y-2*S)=V PROCUD(F%,
Y-2*S,-S):REM Recurse to FILL branch
30490 IFF%<D%THEN30470
30500 B%=D%
30510 C%=E%
30520 IFPOINT(X,Y)<>V THEN30530ELSE3
0260
30530 IFPOINT(X,Y)=-1ENDPROC:IE If i
t is off the edge of screen.
30540 F%=E%
30550 REPEAT
30560 F%=F%+W
30570 UNTILF%>D%ORPOINT(F%,Y)=V
30580 IFF%>D%ENDPROC
30590 X=F%
30600 GOTO30260
30610 :
30620 REM THIS FUNCTION USES OSWORD
13 TO GET THE LAST POINTS VISITED
30630 REM VARIABLE O IS THE OFFSET O
F THE AREA TO BE READ IN THE PARAM.
BLOCK.
30640 DEFFNC(O):A%=15:X%=PARAM MOD25
6:Y%=PARAM DIV256:CALL&FFF1:=(PARAM!
O)AND&FFFF
```

Face.

```
   10  MODE7
   20  PRINT CHR$(141);CHR$(129);CHR$(1
57);CHR$(135);"WELCOME TO THE B B C MIC
RO COMPUTER"
   30  PRINT CHR$(141);CHR$(129);CHR$(1
57);CHR$(135);"WELCOME TO THE B B C MIC
RO COMPUTER"
   40  PRINT CHR$(141);CHR$(129);CHR$(1
57);CHR$(135);"I AM GOING TO DEMONSTRAI
T WHAT I"
   50  PRINT CHR$(141);CHR$(129);CHR$(1
57);CHR$(135);"I AM GOING TO DEMONSTRAI
T WHAT I"
   60  PRINT CHR$(141);CHR$(129);CHR$(1
57);CHR$(135);"            CAN DO"
   70  PRINT CHR$(141);CHR$(129);CHR$(1
57);CHR$(135);"            CAN DO"
   80  PRINT:PRINT:PRINT:PRINT:PRINT CH
R$(133);" PRESS'Y' TO GO ON OR'N' TO GO
 BACK"
   90  A$=GET$
  100  IF A$="N" THEN GOTO110
  104  IF A$="Y" THEN GOTOI10
  105  GOTO90
  110  CLS
  120  MODE2
  130  VDU23,88,255,255,255,255,255,255
,255,255:VDU23,81,254,254,254,126,62,30
,14,6,23,90,255,255,255,255,0,0,0,0
  140  COLOUR3:PRINT"        XXXXXX"
  150  COLOUR3:PRINT"       XXXXXXXX"
  160  COLOUR3:PRINT"      XXXXXXXXXX"
  170  COLOUR3:PRINT"    XX";:COLOUR5:P
RINT"XXXXXXXX";:COLOUR3:PRINT"XX"
  180  COLOUR3:PRINT"     X";:COLOUR5:PR
INT"XXXXXXXXX";:COLOUR3:PRINT"X"
  190  COLOUR5:PRINT"    XXXXXXXXXXXXX"
  200  COLOUR5:PRINT"  XXX";:COLOUR7:PR
INT"XXX";:COLOUR5:PRINT"X";:COLOUR1:PRI
NT"XX";:COLOUR5:PRINT"X";:COLOUR7:PRINT
"XXX";:COLOUR5:PRINT"XXX"
  210  COLOUR5:PRINT"  XXX";:COLOUR7:PR
INT"XX";:COLOUR4:PRINT"X";:COLOUR5:PRIN
X";:COLOUR4:PRINT"X";:COLOUR7:PRINT"XX"
;:COLOUR5:PRINT"XXX"
  220  COLOUR5:PRINT"  XXXXXXX";:COLOUR
1:PRINT"XX";:COLOUR5:PRINT"XXXXXXX"
  230  COLOUR5:PRINT"  XXXXXXX";:COLOUR
1:PRINT"XX";:COLOUR5:PRINT"XXXXXXX"
  240  COLOUR5:PRINT"   XXXXX";:COLOUR1
:PRINT"XXXX";:COLOUR5:PRINT"XXXXX"
  250  COLOUR5:PRINT"   XXXXX";:COLOUR1
:PRINT"XXXX";:COLOUR5:PRINT"XXXXX"
  260  COLOUR5:PRINT"     XXXXXXXXXXX"
  270  COLOUR5:PRINT"      XXXXXXXXX"
  280  COLOUR5:PRINT"       XX";:COLOUR1:
PRINT"XXXXXX";:COLOUR5:PRINT"XX"
  290  COLOUR5:PRINT"        X";:COLOUR1:
PRINT"X";:COLOUR0:PRINT"X";:COLOUR7:PRI
NT"QZ";:COLOUR0:PRINT"X";:COLOUR1:PRINT
"X";:COLOUR5:PRINT"X"
  300  COLOUR5:PRINT"        X";:COLOUR1:
PRINT"XXXXXX";:COLOUR5:PRINT"X"
  310  COLOUR5:PRINT"       XXXXXXXX"
  320  COLOUR5:PRINT"        XXXXXX"
  330  PRINT:PRINT"  I'VE GONE BANANAS"
  340  FOR I=1 TO 3
  350  COLOUR7 :PRINTTAB(5,6);"XX";:COL
OUR4:PRINT"X";:COLOUR7:PRINTTAB(5,7);"X
XX":COLOUR4:PRINTTAB(12,6);"X";:COLOUR7
:PRINT"XX":COLOUR7:PRINTTAB(12,7);"XXX"
  360  FOR J=1 TO 300:NEXTJ
  370  COLOUR7 :PRINTTAB(5,6);"X";:COLO
UR4:PRINT"X";:COLOUR7:PRINT"X";:COLOUR7
:PRINTTAB(5,7);"XXX":COLOUR7:PRINTTAB(1
2,6);"X";:COLOUR4:PRINT"X";:COLOUR7:PRI
NT"X":COLOUR7:PRINTTAB(12,7);"XXX"
  380  FOR J=1 TO 300:NEXTJ
  390  COLOUR4:PRINTTAB(5,6);"X";:COLOU
R7:PRINT"XX":COLOUR7:PRINTTAB(5,7);"XXX
":COLOUR7:PRINTTAB(12,6);"XX";:COLOUR4:
PRINT"X":COLOUR7:PRINTTAB(12,7);"XXX"
  400  FOR J=1 TO 300:NEXTJ
  410  COLOUR7:PRINTTAB(5,6);"XXX":COLO
UR4:PRINTTAB(5,7);"X";:COLOUR7:PRINT"XX
":COLOUR7:PRINTTAB(12,6);"XXX":COLOUR7:
PRINTTAB(12,7);"XX";:COLOUR4:PRINT"X"
  420  FOR J=1 TO 300:NEXTJ
  430  COLOUR7:PRINTTAB(5,6);"XXX":COLO
UR7:PRINTTAB(5,7);"X";:COLOUR4:PRINT"X"
;:COLOUR7:PRINT"X":COLOUR7:PRINTTAB(12,
6);"XXX":COLOUR7:PRINTTAB(12,7);"X";:CO
LOUR4:PRINT"X";:COLOUR7:PRINT"X"
  440  FOR J=1 TO 300:NEXTJ
  450  COLOUR7:PRINTTAB(5,6);"XXX":COLO
UR7:PRINTTAB(5,7);"XX";:COLOUR4:PRINT"X
":COLOUR7:PRINTTAB(12,6);"XXX":COLOUR4:
PRINTTAB(12,7);"X";:COLOUR7:PRINT"XX"
  460  VDU31,0,0
  461  NEXTI
  470  FOR Z=0 TO 255
  480  SOUND1,-15,Z,1
  490  NEXTZ
  491  FORY=155 TO 0 STEP-1
  492  SOUND1,-15,Y,1
  493  NEXTY
  510  C$=INKEY$(10)
  520  MODE7
  530  PRINTCHR$(141);CHR$(136);CHR$(13
4);"  HOW DID YOU LIKE THAT? IF YOU "
  540  PRINTCHR$(141);CHR$(136);CHR$(13
4);"  HOW DID YOU LIKE THAT? IF YOU "
  550  PRINTCHR$(141);CHR$(136);CHR$(13
4);"DID PRESS'Y' IF NOT PRESS'N'"
  560  PRINTCHR$(141);CHR$(136);CHR$(13
4);"DID PRESS'Y' IF NOT PRESS'N'"
  590  D$=GET$
  600  IF D$="Y" THEN GOTO630
  610  IF D$="N" THEN GOTO 620
  615  GOTO 600
  620  PRINTCHR$(135);CHR$(157);CHR$(12
9);"    YOU'VE HURT MY FEELINGS"
  625  G$=INKEY$(1000)
  626  GOTO10
  630  CLS:PRINTCHR$(141);CHR$(136);CHR
$(133);CHR$(157);CHR$(131);"THANK YOU F
OR PRAISEING MY ART FAN"
  640  PRINTCHR$(141);CHR$(136);CHR$(13
3);CHR$(157);CHR$(131);"THANK YOU FOR P
RAISEING MY ART FAN"
  650   PRINTCHR$(141);CHR$(136);CHR$(1
33);CHR$(157);CHR$(131);"          THATS
 ALL FOLKS"
  660   PRINTCHR$(141);CHR$(136);CHR$(1
33);CHR$(157);CHR$(131);"          THATS
 ALL FOLKS"
```

Box spin.

```
   1 A%=0
  10 REM BOX SPIN
  20 REM (c) Copyright R.A.Lober
  30 REM 2.3.83
  31 A%=A%+1:IFA%<3 GOTO10
  40 MODE0
  50 A%=100
  60 B%=50
  70 O=50
  80 VDU29,640;512;
  90 TIME=0
 100 FORT%=0TO360STEP10
 110 D=A%*COS(RAD(T%))
 120 P=B%*SIN(RAD(T%))
 130 S=2*P/3
 140 W=ABS(S/4)
 150 F=D/25
 160 GCOL0,1:MOVE128,70:DRAW128,180
 170 GCOL4,1
 180 FORC%=0TO1
 190 IFP<0GOTO210
 200 PROCENDA
 210 IFD-W<W-D GOTO230
 220 PROCSIDEA
 221 FORDE=1TO50:NEXT
 230 IFP>0GOTO250
 240 PROCENDB
 250 IFD+W>-(D+W)GOTO270
 260 PROCSIDEB
 270 :
 280 NEXT:NEXT
 290 RUN
 300 DEFPROCSIDEA
 310 MOVE128+D-P-W,150+S+F
 320 DRAW128-D-P+W,150-S+F
 330 DRAW128-D-P+W,100+S-F
 340 DRAW128+D-P-W,100-S-F
 350 DRAW128+D-P-W,150+S+F
 360 IFC%=0FORN=0TO0:NEXT
 370 ENDPROC
 380 DEFPROCENDA
 390 MOVE128+D-P-W,100-S-F
 400 DRAW128+D+P+W,100-S+F
 410 DRAW128+D+P+W,150+S-F
 420 DRAW128+D-P-W,150+S+F
 430 DRAW128+D-P-W,100-S-F
 440 IFC%=0FORN=0TO0:NEXT
 450 ENDPROC
 460 DEFPROCSIDEB
 470 MOVE128-D+P-W,100+S+F
 480 DRAW128+D+P+W,100-S+F
 490 DRAW128+D+P+W,150+S-F
 500 DRAW128-D+P-W,150-S-F
 510 DRAW128-D+P-W,100+S+F
 520 IFC%=0FORN=0TO0:NEXT
 530 ENDPROC
 540 DEFPROCENDB
 550 MOVE128-D+P-W,100+S+F
 560 DRAW128-D-P+W,100+S-F
 570 DRAW128-D-P+W,150-S+F
 580 DRAW128-D+P-W,150-S-F
 590 DRAW128-D+P-W,100+S+F
 600 IFC%=0FORN=0TO0:NEXT
 610 ENDPROC
```

APPLE PIE

by John Harris

Patch

AN EXCELLENT 16-sector disc-patch program or catalogue analyser is submitted by Mark Benson of Tring. Any sector of a regularly formatted Apple floppy — which excludes tiresome commercially screwed discs like VisiCalc — may be read, amended, written or rewritten, with comprehensive prompts at the appropriate point.

While it provides a perfect way of learning about catalogue and program layout if the Write options are avoided, it is a guaranteed way of losing disc data if you do not know what you are about. Given that you do, Mark Benson has written an excellent utility to do it with.

The associated assembler routine — for which I have no source code — is to be saved as:

BSAVE BPATCH,A&0295,L$0113

For use on 13-sector discs the following amendments are needed:

Line 140. *16 becomes *13
Line 670. <16 becomes <13
Line 710. =15 becomes =12
Line 1050. =15 becomes =12

Patch.

```
*0295.0387

0295- A5 3C 29
0298- F8 85 3C 38 A5 3E E5 3C
02A0- A5 3F E5 3D B0 01 60 A5
02A8- 3C 20 DA FD A2 02 20 4A
02B0- F9 A0 00 B1 3C 20 DA FD
02B8- A2 01 20 4A F9 C8 C0 08
02C0- D0 F1 F0 02 00 00 A2 01
02C8- 20 4A F9 A0 00 B1 3C 09
02D0- 80 C9 A0 B0 04 A9 A0 B0
02D8- 06 C9 E0 90 02 E9 20 20
02E0- ED FD C8 C0 08 D0 E6 A9
02E8- 8D 20 ED FD 18 A5 3C 85
02F0- 40 69 08 85 3C A5 3D 85
02F8- 41 69 00 85 3D 90 9C 60
0300- 18 90 6B A9 04 D0 27 A5
0308- 1F 4C DA FD A9 01 D0 02
0310- A9 02 48 20 E3 03 85 49
0318- B4 48 A0 0C 68 91 48 20
0320- E3 03 20 D9 03 B0 06 A9
0328- 00 A0 0D 91 48 60 48 20
0330- E3 03 84 48 85 49 A0 04
0338- B1 48 85 1E C8 B1 48 85
0340- 1F 68 85 49 A9 24 85 48
0348- A2 02 A0 03 18 B5 1D 29
0350- 0F 08 18 69 B0 C9 BA 90
0358- 02 69 06 91 48 88 28 B0
0360- 09 B5 1D 4A 4A 4A 4A 38
0368- B0 E7 CA D0 DF 60 20 E3
0370- 03 8C C0 03 8D C1 03 A9
0378- B6 85 48 AD E5 03 85 49
0380- A0 00 B1 48 D0 0D A5 CC
0388- 8D C2 03 A5 CD A6 CA A4
0390- CB 90 0B A5 6D 8D C2 03
0398- A5 6E A6 6F A4 70 8D C3
03A0- 03 8E C4 03 8C C5 03 60
```

Patch.

```
10  IF GO THEN 170
20 GO = 1
30 KB =  - 16384:KS =  - 16368:MD
    = 661
40  TEXT : CALL  - 936
50  PRINT  CHR$ (4);"BLOAD BPATCH
    "
60  PRINT "16 SECTOR DISC PATCH :
    "
70  PRINT
80  POKE 34,5
90  GOSUB 1450
100 B =  PEEK (LP + 1) + 2
110 BB = B * 128:BB = BB + BB
120 S =  PEEK (SL) / 16:D =  PEEK
    (DR)
130  PRINT "DISC";: GOSUB 1300
140  POKE SL,S * 16: POKE DR,D: POKE
    VL,0
150  POKE BL,0: POKE BH,B
160  GOSUB 1010:DS = 0: GOTO 550
170  POKE 36,0: POKE 37,22: CALL
     - 990
180  CALL  - 868
190  PRINT
200  PRINT "      OPTION (TYPE ?
    FOR MENU) ?";
210  POKE 50,63: PRINT " ";: POKE
    50,255
220  CALL  - 868
230  POKE 36,32
240 CH =  PEEK (KB): IF CH < 128 THEN
    240
250  POKE KS,0: POKE 36,0: CALL  -
    868
260  IF CH = 212 THEN 380
270  IF CH = 194 THEN 390
280  IF CH = 208 THEN 470
290  IF CH = 210 THEN 550
300  IF CH = 215 THEN 610
310  IF CH = 171 THEN 670
320  IF CH = 173 THEN 700
330  IF CH = 206 THEN 160
340  IF CH = 195 THEN 780
350  IF CH = 191 THEN 800
360  IF CH = 155 THEN 1000
370  CALL  - 198: GOTO 170
380 DS = 0: GOTO 400
390 DS = 128
400  POKE 36,0: POKE 37,5: CALL  -
    990
410  CALL  - 868
420  POKE 37,6: CALL  - 990
430  POKE 60,DS: POKE 62,DS + 127

440  POKE 61,B: POKE 63,B
450  CALL MD
460  GOTO 170
470  POKE 36,0: POKE 37,4: CALL  -
    990
480  CALL  - 868
490  PRINT "ADDR: ";
500 MX = 255: GOSUB 1130: IF TS <
    0 THEN 170
510 AD = TS: PRINT " PATCH: ";
520  GOSUB 1130: IF TS < 0 THEN 4
    00
530  POKE BB + AD,TS:AD = AD + 1:
     IF AD > 255 THEN 400
540  PRINT "  ";: GOTO 520
550  POKE 36,0: POKE 37,4: CALL  -
    990
560  CALL  - 868
570  POKE PF,210: CALL DT
580  CALL RD
590  IF  PEEK (RP) <  > 0 THEN  GOSUB
    1550
600  GOTO 400
610  POKE 36,0: POKE 37,4: CALL  -
    990
620  CALL  - 868
630  POKE PF,215: CALL DT
640  CALL WR
650  IF  PEEK (RP) <  > 0 THEN  GOSUB
    1550
660  GOTO 170
670 S = S + 1: IF S < 16 THEN 730

680 S = 0:T = T + 1: IF T < 35 THEN
    730
690 T = 0: GOTO 730
700 S = S - 1: IF S >  = 0 THEN 7
    30
710 S = 15:T = T - 1: IF T >  = 0
    THEN 730
720 T = 34
730 DS = 0
740  POKE 37,2: CALL  - 990
750  POKE 36,26: POKE HX,T: CALL
    PX
760  POKE 36,36: POKE HX,S: CALL
    PX
770  POKE TK,T: POKE SE,S: GOTO 5
    50
780  GOSUB 1010
790  GOTO 400
800  POKE 36,0: POKE 37,6: CALL  -
    990
810  POKE 35,22: CALL  - 936
820  POKE 35,24
830  PRINT "    OPTIONS AVAILABLE
    :": PRINT
840  POKE 32,5: POKE 33,35: CALL
     - 990
850  PRINT "T  DISPLAY BYTES 00-7
    F."
860  PRINT "B  DISPLAY BYTES 80-F
    F.": PRINT
870  PRINT "R  RE-READ CURRENT SE
    CTOR."
880  PRINT "W  WRITE BACK CURRENT
     SECTOR.": PRINT
890  PRINT "+  ADVANCE A SECTOR."

900  PRINT "-  GO BACK A SECTOR."
    : PRINT
910  PRINT "N  SPECIFY A NEW SECT
    OR."
920  PRINT "C  SPECIFY A NEW SECT
    OR BUT"
930  PRINT "   DO NOT READ IT IN.
    ": PRINT
940  PRINT "P  PATCH THE CURRENT
    SECTOR"
950  PRINT "   IN MEMORY."
960  POKE 32, PEEK (32) - 1: CALL
     - 990
970  PRINT "ESC END."
980  POKE 32,0: POKE 33,40: CALL
     - 990
990  GOTO 170
1000  TEXT : END
1010  POKE 36,19: POKE 37,2: CALL
     - 990
1020  PRINT " TRACK ";:MX = 34: GOSUB
    1130
1030  IF TS < 0 THEN 1010
1040 T = TS: POKE TK,T
1050  PRINT " SECTOR ";:MX = 15: GOSUB

    1130
1060  IF TS < 0 THEN 1010
1070 S = TS: POKE SE,S
1080  POKE 36,0: POKE 37,3: CALL
     - 990
1090  CALL  - 868
1100  POKE 37,4: CALL  - 990
1110  CALL  - 868
1120  RETURN
1130  CALL  - 868
1140 CH =  PEEK (36):CV =  PEEK (
    37): POKE 51,128
1150  CALL  - 662
1160  POKE 36,CH: POKE 37,CV: CALL
     - 990
1170 PT = 512:CH =  PEEK (PT):TS =
     - 1: IF CH = 141 THEN 1280
1180 TS = 0
1190  IF CH = 131 THEN  END
1200 CH = CH - 176
1210  IF CH < 0 THEN 1290
1220  IF CH > 22 THEN 1290
1230  IF CH < 10 THEN 1250
1240 CH = CH - 7: IF CH < 10 THEN
    1290
1250 TS = TS * 16 + CH: IF TS > M
    X THEN 1290
1260 PT = PT + 1:CH =  PEEK (PT):
     IF CH <  > 141 THEN 1190
1270  POKE HX,TS: CALL PX
1280  CALL  - 868: RETURN
1290  CALL  - 198: GOTO 1130
1300  POKE  - 16368,0: CALL  - 86
    8
1310  PRINT " SLOT ";:SD = S:MX =
    8: GOSUB 1340:S = SD
1320  PRINT " DRIVE ";:SD = D:MX =
    3: GOSUB 1340:D = SD
1330  CALL  - 868: RETURN
1340 CH =  PEEK (36)
1350  POKE 50,63: PRINT SD;: POKE
    50,255
1360  POKE 36,CH
1370 CH =  PEEK ( - 16384): IF CH
    < 128 THEN 1370
1380  POKE  - 16368,0
1390  IF CH = 141 THEN 1440
1400 CH = CH - 176
1410  IF CH > 0 AND CH < MX THEN
    1430
1420  CALL  - 198: GOTO 1370
1430 SD = CH
1440  PRINT SD;: RETURN
1450 GI = 768:DT = 771:PX = 775:R
    D = 780:WR = 784:IP = 960:LP
     = 962:HP = 964
1460  CALL GI
1470 I = IP: GOSUB 1530:IB = J
1480 I = LP: GOSUB 1530:LO = J
1490 I = HP: GOSUB 1530:HI = J
1500 SL = IB + 1:DR = IB + 2:VL =
    IB + 3:TK = IB + 4:SE = IB +
    5:BL = IB + 8:BH = IB + 9:RP
     = IB + 13
1510 HX = 31:FF = 1059
```

(continued on next page)

Sub exterminator.

```
*5600.5920

5600- 07 00 10 00 03 01 F4 01
5608- 70 02 F5 02 09 03 1D 03
5610- 4B 49 49 49 49 49 29 2D
5618- 2D F5 DB 1B 4D 49 DE DB
5620- 2B 2D 2D F5 DB 1B 2D 2D
5628- 2D DE DB 2B 2D 2D 6D 49
5630- 49 49 49 49 29 DE DB DB
5638- DB DB DB DB DB DB DB DB
5640- DB 1B 4D 49 0D 2D 2D 2D
5648- 2D 2D 2D 2D 2D 2D 2D 2D
5650- 2D 2D 2D F5 DB DB DB DB
5658- DB DB DB DB DB DB DB DB
5660- 0D 2D 0D 0D 2D 2D 2D 2D
5668- 2D 2D 2D 2D 2D 4D 49 4D
5670- 29 DE DB DB DB DB DB DB
5678- DB DB DB DB DB DB 2D 2D
5680- 2D 2D 2D 2D 6D 49 49 49
5688- 49 49 49 4D F1 DB DB DB
5690- DB DB DB DB DB DB DB DB
5698- DB DB 2D 2D 2D 2D 6D 49
56A0- 49 49 4D 09 4D 09 4D 09
56A8- 2D 0D F5 DB DB DB DB DB
56B0- DB DB DB DB DB DB DB DB
56B8- 4D 49 49 49 49 49 49 49
56C0- 49 49 49 49 4D DE DB DB
56C8- DB DB DB DB DB DB DB DB
56D0- DB DB 6B 49 49 49 49 49
56D8- 49 49 49 49 49 49 49 F5
56E0- DB DB DB DB DB DB DB DB
56E8- DB DB DB DB 1B 2D 2D 2D
56F0- 2D 2D 2D 2D 2D 2D 2D 2D
56F8- 2D 2D 2D 2D 2D 2D 2D 2D
5700- 4E 09 00 4B 49 49 49 49
5708- 49 09 2D 2D 2D DE DB 6B
5710- 49 F1 DB 1B 2D 2D 2D DE
5718- DB 2B 2D 2D F5 DB DB DB
5720- DB DB DB DB 1B 6D 49 49
5728- 49 49 49 2D 2D 2D DE DB
5730- DB DB DB DB DB DB 2B 2D
5738- 2D 2D 2D 2D 2D 2D 2D 2D
5740- 2D 2D 2D 2D 6D 69 49 F1
5748- DB DB DB DB DB DB DB DB
5750- DB DB DB DB 6D 09 4D 49
5758- 2D 2D 2D 2D 2D 2D 2D 2D
5760- 6D 69 2D 0D DE DB DB DB
5768- DB DB DB DB DB DB DB DB
5770- 6B 09 4D 49 49 49 49 49
5778- 09 2D 2D 2D 2D 2D 2D F5
5780- DB DB DB DB DB DB DB DB
5788- DB DB DB DB 6D 2D 4D 09
5790- 4D 09 4D 09 4D 49 49 09
5798- 2D 2D 2D 2D F5 DB DB DB
57A0- DB DB DB DB DB DB DB DB
57A8- DB 1B 4D 4D 49 49 49 49
57B0- 49 49 49 49 49 49 49 DE
57B8- DB DB DB DB DB DB DB DB
57C0- DB DB DB DB 2B 4D 49 49
57C8- 49 49 49 49 49 49 49 49
57D0- 49 09 DE DB DB DB DB DB
57D8- DB DB DB DB DB DB DB 2D
57E0- 2D 2D 2D 2D 2D 2D 2D 2D
57E8- 2D 2D 2D 2D 2D 2D 2D 2D
57F0- 2D 2D 0E 00 4B 49 49 29
57F8- 1E F5 F5 DB 2D 2D 2D 2D
5800- 6D 69 09 4D F1 DB DB DB
5808- DB DB DB DB 2B 2D 2D 2D
5810- 2D 2D 2D 2D 2D 2D 2D 2D
5818- 2D F5 DB DB DB DB DB DB
5820- DB DB 1B 6D 49 49 0D 4D
5828- 49 0D 4D 49 49 DE DB DB
5830- DB DB DB DB DB DB DB 2D
5838- 4D 49 09 0D 4D 4D 0D 4D
5840- 49 49 F5 DB DB DB DB DB
5848- DB DB DB DB 2B 4D 49 09
5850- 2D 4D 49 0D 4D 49 49 DE
5858- DB DB DB DB DB DB DB DB
5860- 2B 2D 2D 2D 2D 2D 2D 2D
5868- 2D 2D 2D 2D 2D 75 09 00
5870- 4B 49 49 49 49 49 49 49
5878- F5 F5 F5 DB DB DB DB DB
5880- 6B 09 4D 69 29 2D 2D 2D
5888- 2D DE DB DB DB DB DB DB
5890- DB 2D 2D 2D 2D 2D 2D 2D
5898- 2D 2D 2D 2D 2D 2D DE DB
58A0- DB DB DB DB DB DB DB 6B
58A8- 49 49 69 4D 49 2D 4D 49
58B0- 09 F5 DB DB DB DB DB DB
58B8- DB DB DB 2B 4D 49 49 0D
58C0- 4D 4D 0D 4D 49 09 2D DE
58C8- DB DB DB DB DB DB DB DB
58D0- DB 4D 49 49 0D 4D 49 0D
58D8- 4D 49 09 F5 DB DB DB DB
58E0- DB DB DB DB 1B 2D 2D 2D
58E8- 2D 2D 2D 2D 2D 2D 2D 2D
58F0- 2D 2D 4E 01 00 4B F1 6B
58F8- 0D DE 2B F5 1B 2D 2D DE
5900- 2B F5 1B 0D 0D DE 4E 01
5908- 00 4B 09 1E 2D DE 2D DE
5910- 2D DE 2D DE 2B 2D F5 DB
5918- 6B 0D 0D 0E 00 FF 00 00
5920- 00
*3D0G
```

(continued from previous page)

```
1520  RETURN
1530 J =  PEEK (I + 1): IF J > 12
     7 THEN J = J - 256
1540 J = J * 128:J = J + J +  PEEK
     (I): RETURN
1550  PRINT "";"ERR ";
1560  POKE HX, PEEK (RP): CALL PX

1570  PRINT " AT S"; PEEK (SL) /
     16;" D"; PEEK (DR);" TRK ";
1580  POKE HX, PEEK (TK): CALL PX

1590  PRINT " SEC ";
1600  POKE HX, PEEK (SE): CALL PX

1610  PRINT
1620  RETURN
```

Sub exterminator

The graphics on this game from Mark Heather of Cudham are excellent, and the play is exciting once the controls have been mastered. Having tried for some time, both looking at the listing and running the program, I can still not deduce the submarine's strategy or quite how to stay afloat for any length of time, but that is what makes it so interesting. Mr Heather does not say what utility he used to generate his graphics elements, but they are quite superb.

Sub exterminator.

```
10  REM  SUB-EXTERMINATOR
15  REM  BY M.J.HEATHER
20  REM  ON APPLE 2
25  REM  30/4/83
30  REM
35  IF  PEEK (22016) = 7 AND  PEEK
     (22017) = 0 THEN  GOTO 45
40  PRINT  CHR$ (4);"BLOAD SUB SH
    APES"
45  POKE 232,0: POKE 233,B6
50  CLEAR : GOSUB 615: GR : TEXT

52  ONERR  GOTO 5000
55 M$ = "*** YOU HIT ***
       ***YOU HIT ***"
60 N$ = "                *** YOU HIT
    ***                 "
65  HOME : PRINT "INSTRUCTIONS:-"
    : PRINT
70  PRINT : PRINT "YOU HAVE TO LI
    NE YOUR BOAT WITH THE SUB"
75  PRINT "THEN LAUNCH A MINE, BU
    T YOU ONLY HAVE"
80  PRINT "10 MINES !!!"; PRINT
85  PRINT "THE SUB CAN ALSO BLOW
    YOU OFF THE FACE"
90  PRINT "OF THE EARTH , SO BEWA
    RE AND GOOD LUCK!": PRINT : PRINT

    "CONTROLS:-": PRINT
95  PRINT "LEFT ARROW   = MOVE LE
    FT"
100  PRINT "RIGHT ARROW  = MOVE R
    IGHT"
105  PRINT "SPACE BAR     =  MINE
    LAUNCH"
110  PRINT
115  PRINT "ANY OTHER KEY TO MOVE
     SHIP TO RANDOM ": PRINT "PO
    SITION AND ANCHOR"
120  INVERSE : PRINT "WARNING YOU
     LOSE A MINE AFTER DOING THI
    S";: NORMAL : PRINT
125  FLASH : PRINT "PRESS SPACE B
    AR TO START";: NORMAL
130  GET A$
135  REM  START OF GAME
140  HGR : HCOLOR= 3: SCALE= 1: ROT=
    0:W = 10: REM     SET GRAPHIC
    S AND NO. OF MINES
145  HOME
150  VTAB 21: PRINT "MINES = ";W;

155  PRINT  TAB( 30);"SCORE = ";S
    C
160 S =  INT ( RND (1) * B0) * 3 +
    10
165 R = 3
170  IF S < SM THEN R = 4
175 E =  PEEK ( - 16384):OX = X: VTAB
    21: PRINT "MINES = ";W;: PRINT
     TAB( 30);"SCORE = ";SC:E =
    E - 128: IF E = 8 THEN X = X
     - 8
180  IF E = 21 THEN X = X + 8
185  IF E = 32 THEN  GOTO 260
190  IF E > 32 THEN X =  INT ( RND
    (1) * 235 + 1): POKE  - 1636
    8,0:W = W - 1: IF W = 0 THEN
     GOTO 550
195  IF X < 1 THEN X = 1
200  IF X > 235 THEN X = 235
205  IF X > OX THEN Z = 1
210  IF X < OX THEN Z = 2
215  IF  RND (1) > .85 THEN  GOTO
    400
220  DRAW Z AT X,3
225  POKE PI, INT ( RND (1) * 30 +
    100): POKE DU,4: CALL NO: HPLOT
    0,15 TO 279,15: IF SM < S THEN
    D = SM + 5
230  IF SM > S THEN D = SM - 5
235 SM = D: DRAW R AT SM,150: IF
    SM > (S - 3) AND SM < (S + 3
    ) THEN  HGR : GOTO 160
240  VTAB 21: PRINT "MINES = ";W;
    : PRINT  TAB( 30);"SCORE = "
    ;SC: XDRAW Z AT X,3: XDRAW R
     AT SM,150: GOTO 175
245  REM
250  REM  SHIP FIRING
255  REM
260  DRAW Z AT X,3: XDRAW R AT SM
    ,150: HPLOT X + 10,5: FOR A =
    10 TO 150 STEP 15: DRAW 5 AT
    X + 10,A
265  POKE PI,SM: POKE DU,3: CALL
    NO
270  XDRAW R AT SM,150
275  IF SM < S THEN D = SM + SC
280  IF SM > S THEN D = SM - SC
285 SM = D: DRAW R AT SM,150: XDRAW
    R AT SM,150
290  IF SM > (S - 5) AND SM < (S +
    5) THEN S =  INT ( RND (1) *
    B6) * 3 + 10: DRAW Z AT X,3:
     HPLOT 0,15 TO 279,15:R = 3:
     IF S < SM THEN R = 4: DRAW
    R AT SM,150
295  VTAB 21: PRINT "MINES = ";W;
    : PRINT  TAB( 30);"SCORE = "
    ;SC
300  XDRAW 5 AT X + 10,A
305  XDRAW R AT SM,150
310  NEXT A
315  IF X + 10 > (SM - 1) AND X +
    10 < (SM + 26) THEN 345
320 W = W - 1: IF W = 0 THEN  GOTO
    550
325  HGR : GOTO 175
330  REM
335  REM  HIT SUB
340  REM
345  GR : HOME :SC = SC + 1
350  PRINT "YOU HIT THE SUB . SCO
    RE = ";SC
355  FOR J = 1 TO 15 STEP 2: POKE
    DU,1: FOR C = 1 TO 5:F =  INT
    ( RND (1) * 15) + 1: POKE PI
    ,F: CALL NO: NEXT C
360  COLOR= J: FOR H = 0 TO 39: POKE
    PI,40 - H: CALL NO: HLIN 0,3
    9 AT H: NEXT H: NEXT J
365  TEXT : HOME : FLASH : FOR V =
    1 TO 24: POKE PI,V * 2: POKE
    DU,10: CALL NO: PRINT M$;N$;
    : NEXT V: NORMAL
370  FOR I = 1 TO 20: POKE PI,255
     - I: CALL NO: POKE 32,20 -
    I: POKE 33,2 * I: PRINT : PRINT
    : NEXT : FOR I = 1 TO 24: POKE
    PI,SC * 10: CALL NO: PRINT :
     NEXT
375 X =  INT ( RND (1) * 35) + 1
380  HGR : GOTO 175
385  REM
390  REM  SHIP HIT
395  REM
400  DRAW R AT SM,150: DRAW Z AT
    X,3
405  FOR A = 150 TO 3 STEP  - 5: DRAW
    6 AT SM + 10,A: XDRAW 6 AT S
    M + 10,A: NEXT A
410  IF SM + 10 > X AND SM + 10 <
    (X + 40) THEN  GOTO 425
415  HGR
420  GOTO 175
425  TEXT : HOME : FOR A = 1 TO 1
    2
430  PRINT "Y Y OOO U U  GGG OOO
    TTT  H H III TTT !"
435  POKE PI,20: POKE DU,50: CALL
    NO
440  PRINT "Y Y O O U U  G G O O
     T   H H  I   T  !"
445  POKE PI,45: CALL NO
450  PRINT " YY O O U U  G   O O
     T   H H  I   T  !"
455  POKE PI,50: CALL NO
```

HGR strings.

```
10  REM   *** HGR STRINGS *** W.K
    .HO
20  DIM CA(23),CH(48,6)
30  ONERR  GOTO 750
40  FOR I = 0 TO 5: READ C(I): NEXT

50  DATA  1,2,3,5,6,7
60  REM  *** SET CORE ADDRESS FOR
    LINE
70  FOR I = 0 TO 23
80  READ CA(I): NEXT I
90  DATA  8192,8320,8448,8576,870
    4,8832,8960,9088
100 DATA  8232,8360,8488,8616,87
    44,8872,9000,9128
110 DATA  8272,8400,8528,8656,87
    84,8912,9040,9168
120 REM  *** LOAD BIT PATTERN
130 FOR I = 0 TO 48
140 FOR K = 0 TO 6
150 READ CH(I,K): NEXT K
160 NEXT I
170 GOTO 390
180 DATA  0,0,8,28,8,0,0,0,0,8,8
    ,8,4,0,0,0,0,28,0,0,0
190 DATA  0,0,0,8,0,0,0,0,0,32,16,
    8,4,2,0
200 DATA  28,34,34,34,34,34,28,8
    ,8,8,8,8,8,8,28,34,16,8,4,2,
    62
210 DATA  28,34,32,24,32,34,28,2
    4,20,18,18,62,16,16,62,2,2,3
    0,32,34,28
220 DATA  28,34,2,30,34,34,28,62
    ,32,32,16,8,4,2,28,34,34,28,
    34,34,28
230 DATA  28,34,34,60,32,34,28,0
    ,8,8,0,8,8,0
240 DATA  0,8,8,0,8,8,4,0,16,8,4
    ,8,16,0,0,0,28,0,28,0,0
250 DATA  0,4,8,16,8,4,0,8,20,20
    ,16,8,0,8,8,20,28,20,12,20,8

260 DATA  8,28,34,34,62,34,34
270 DATA  30,34,34,30,34,34,30
280 DATA  28,50,2,2,2,50,28
290 DATA   30,34,34,34,34,34,30
300 DATA  62,2,2,30,2,2,62,62,2,
    2,30,2,2,2
310 DATA  28,34,2,2,58,34,28,34,
    34,34,62,34,34,34,8,8,8,8,8,
    8,8,32,32,32,32,34,34,28
320 DATA  50,10,6,6,10,26,50,2,2
    ,2,2,2,62,34,54,42,42,34,3
    4,34,34,38,42,42,42,50,34
330 DATA  28,34,34,34,34,34,28
340 DATA  30,34,34,30,2,2,2,28,3
    4,34,34,42,26,44,30,34,34,30
    ,10,18,50
350 DATA  28,34,2,28,32,34,28,62
    ,8,8,8,8,8,34,34,34,34,34,
    34,28
360 DATA  34,34,20,20,28,8,8,34,
    34,42,42,62,54,34,34,54,20,8
    ,20,54,34
370 DATA  34,34,20,28,8,8,8,62,3
    2,16,28,4,2,62
380 DATA  0,0,0,0,0,0,0
390 GOSUB 760: GOSUB 630: GOTO 7
    10
400 PRINT : PRINT : PRINT : PRINT
410 REM  *** NOW READY TO WRITE
420 HGR : REM  *** TEXT
430 PRINT : PRINT : PRINT : PRINT
    "GIVE TEXT STRING-/ CLR SCRN
    :RET TO EXIT": INPUT S$
440 IF S$ <  > "" GOTO 460
450 RETURN
460 IF S$ = "/" THEN  HGR : GOTO
    430: REM  ** "/" TO WIPE SCR
    EEN
470 K =  INT ( RND (1) * 25):L =
     INT ( RND (1) * 20)
480 GOSUB 490: GOTO 430
490 N =  LEN (S$): REM  *** WRITE

500 IF N + K > 39 THEN N = 39 -
    K
510 FOR I = 1 TO N
520 SB$ =  MID$ (S$,I): REM  ***
    READ EACH CHARACTER IN STRIN
    G
530 J =  ASC (SB$):J = J - 43
540 IF J >  - 1 AND J < 48 GOTO
    570
550 J = 48
560 REM  *** WRITE CHARACTER
570 FOR M = 0 TO 6
580 A = CA(L) + K + M * 1024 - 1
590 POKE A + I,CH(J,M)
600 NEXT M
610 NEXT I
620 RETURN
630 TEXT : HOME : REM  *** MENU
640 VTAB 5
650 PRINT "HGR TEXT STRING GENER
    ATOR": PRINT : PRINT "BY W.K
    .HO-MAY,1983": PRINT : PRINT

660 PRINT "THIS PROGRAM GENERATE
    S TEXT STRINGS": PRINT "IN H
    GR MODE"
670 PRINT "THIS IS A DEMONSTRATI
    ON": PRINT : PRINT "OPTIONS:
    ": PRINT : PRINT "0-MENU": PRINT
    "1-TEXT STRINGS:/TO CLEAR:RE
    T TO EXIT"
680 PRINT "2-SINE DEMO": PRINT "
    3-RANDOM WALK": PRINT "4-AUT
    O STRINGS": PRINT "5-AUTO SE
    QUENCE": PRINT "9-END"
690 VTAB 24
700 PRINT : RETURN
710 PRINT "CHOOSE OPTIONS-": PRINT
    "0-MENU:1-TEXT STR:2-SINE DE
    MO": PRINT "3-RANDOM WALK:4-
    AUTO TEXT:5-SEQ:9-EXIT": GET
    T:T = T + 1
720 IF T > 6 THEN  END
730 ON T GOSUB 630,420,780,1040,
    1270,1310
740 GOTO 710
750 PRINT "ERROR-REENTER!": GOTO
    710
760 R$(0) = "START":R$(1) = "NO.1
    ":R$(2) = "NO.2":R$(3) = "NO
    .3":R$(4) = "NO.4"
770 R$(5) = "NO.5":R$(6) = "NO.6"
    :R$(7) = "NO.7":R$(8) = "END
    ": RETURN
780 N =  INT ( RND (1) * 6)
790 IF (N >  - 1 AND N < 6) GOTO
    810
800 N = 0
810 HCOLOR= C(N)
820 PRINT : PRINT : PRINT "SINE-
    DEMO"
830 XO = 0
840 X = 0
850 Y = X
860 HGR
870 YO = XO
880 PI = 3.14159
890 HPLOT 4,80 TO XO,YO + 80
900 FOR I = 1 TO 80
910 X = X + 3
920 Y = 80 + YO +  INT (40 *  SIN
    (I * 0.1 * PI))
930 HPLOT  TO X,Y
940 NEXT I
950 N = N + 1
960 IF (N < 5) GOTO 980
970 N = 0
980 HCOLOR= C(N)
990 X = XO + 6
1000 YO = X / 2
1010 XO = X
1020 IF (XO < 26) GOTO 890
1030 K = 10:L = 2:S$ = "SINE FUNC
    TION": GOSUB 490: RETURN
1040 HGR : REM  *** RANDOM WALK
1050 N =  INT ( RND (1) * 6)
1060 HCOLOR= C(N): FOR I = 70 TO
    90: HPLOT 100,I TO 120,I: NEXT

1070 PRINT : PRINT : PRINT "RAND
    OM WALK"
1080 NN =  INT ( RND (1) * 6):K =
    17:L = 11:S$ = "START": GOSUB
    490
1090 FOR P = 1 TO 7
1100 HCOLOR= C(NN)
1110 HPLOT 110,80
1120 XO = 110
1130 YO = 80
1140 FOR F = 1 TO 100
1150 X = XO +  INT (19 *  RND (1)
    ) - 9
1160 Y = YO +  INT (19 *  RND (1)
    ) - 9
1170 IF (X < 0) OR (X > 220) GOTO
    1230
1180 IF (Y < 0) OR (Y > 150) GOTO
    1230
1190 HPLOT  TO X,Y
1200 XO = X
1210 YO = Y
1220 NEXT F
1230 NN = NN + 1
1240 IF (NN < 6) GOTO 1260
1250 NN = 0
1260 K =  INT (XO / 7 + 1):L =  INT
    (YO / 8 + 1):S$ = R$(P): GOSUB
    490: NEXT P: RETURN
1270 HGR : REM  *** RANDOM TEXT
1280 VTAB 24: PRINT : PRINT : PRINT
    "RANDOM TEXT"
1290 FOR P = 1 TO 20:K =  INT ( RND
    (1) * 25 + 1):L =  INT ( RND
    (1) * 20 + 1):V =  INT ( RND
    (1) * 9):S$ = R$(V): GOSUB 4
    90: NEXT P: RETURN
1300 FOR PS = 1 TO 5000: NEXT : RETURN
1310 GOSUB 630: GOSUB 1300: GOSUB
    780: GOSUB 1300: GOSUB 1040:
     GOSUB 1300: GOSUB 1270: GOSUB
    1300: RETURN
```

HGR strings

The Apple high-resolution graphics mode is limited by the lack of any dedicated character set for user applications such as captioning of the graphics display. This has resulted in more reinventing of wheels of so many shapes that I have long since lost count of how many have come my way. However, this utility from Mr W K Ho of Cheltenham is particularly attractive and commands attention.

Though comparatively short it compiles a character set by specifying each character in a bit pattern occupying a seven-by-eight matrix which corresponds to the size of each screen character in the Text mode. The starting addresses of each print line within HGR are also identified.

Various self-documented options are in-built to demonstrate different combinations of graphics and text. The appropriate areas of code may be included within user programs as desired.

```
460 PRINT "  Y O O U U  G G O O
    T  HHH  I  T  !"
465 POKE PI,55: CALL NO
470 PRINT "  Y O O U U  GGG O O
    T  H H  I  T  !"
475 POKE PI,60: CALL NO
480 PRINT "  Y O O U U    G O O
    T  H H  I  T  !"
485 POKE PI,65: CALL NO
490 PRINT "  Y OOO UUU    G OOO
    T  H H III  T  !"
495 POKE PI,70: CALL NO
500 NORMAL
505 IF A = 9 THEN  HOME : FLASH

510 IF A = 10 THEN  INVERSE
515 IF A < 9 THEN  PRINT
520 NEXT A
525 PRINT "YOU LIVED TO SCORE ";
    SC;" POINTS"
530 END
535 REM
540 REM  GAME OVER
545 REM
550 FOR A = 1 TO 20: POKE DUR,5:
     FOR B = 15 TO 1 STEP  - 1: POKE
    PIT,B: CALL NOISE: NEXT B: NEXT
    A
555 FOR A = 1 TO 255: POKE DUR,1
    : POKE PI,A: CALL NO: NEXT A
    : TEXT : HOME
560 FOR A = 1 TO 24
565 PRINT "GAME OVER";
570 INVERSE : PRINT " GAME OVER
    ";: NORMAL
575 PRINT "GAME OVER";
580 FLASH : PRINT " GAME OVER ";
    : NORMAL
585 NEXT A
590 PRINT "YOU RAN OUT OF MINES,
    BUT SCORED ";SC;" PTS."
595 END
600 REM
605 REM  MUSIC LOCATIONS
610 REM
615 POKE 768,160: POKE 769,255: POKE
    770,162
620 POKE 771,160: POKE 772,202: POKE
    773,208
625 POKE 774,253: POKE 775,173: POKE
    776,48
630 POKE 777,192: POKE 778,136: POKE
    779,208
635 POKE 780,245: POKE 781,96
640 NO = 768: REM  NOISE ROUTINE
645 PI = 771:DU = 769: REM  PITCH
    & DURATION ROUTINES
650 RETURN
5000 FOR A = 1 TO 50
5010 POKE PI,A: POKE DU,250 - A:
    CALL NO
5020 NEXT A
5030 TEXT : HOME
5040 PRINT "SILLY": PRINT "=====
    "
5050 PRINT : PRINT "(R)UN , (Q)U
    IT >>>?";: GET P$
5060 IF P$ = "R" THEN  CLEAR : GOTO
    40
5070 IF P$ = "Q" THEN  HOME : END

5080 GOTO 5030
```

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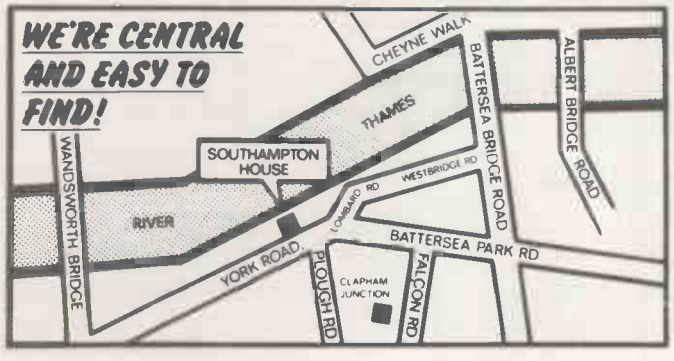

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RESEARCH MACHINES REVIEW

Helicopter rescue

IN THIS program by Steve Crick of Herne Bay, Kent you are the pilot of a helicopter which must land on an oil rig to pick up survivors and take them over to the waiting ship. Do not try to land on the oil rig if you already have survivors, as the overload will cause you to crash.

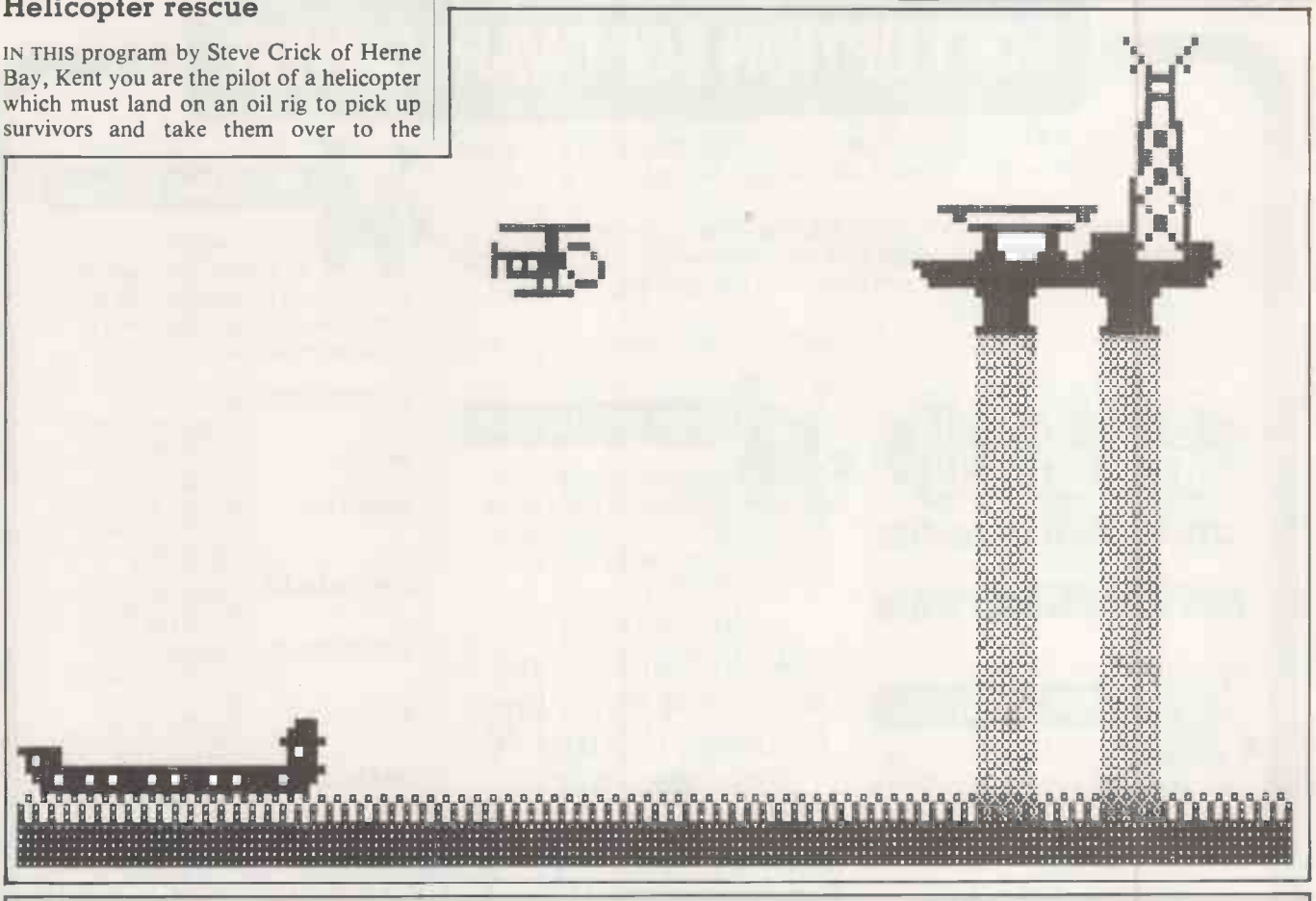
Winds can come from the left or right in forces from weak to gale force. At higher skill levels they can become stronger.

Because the computer has a read-ahead keyboard, if you keep hitting the direction you need to go in it will remember the sequence and carry it out. If you tap the Down key when landing, the buffer will remember Down and on take off you will crash. An auto repeat is incorporated into the game so the key need only be pressed once.

The machine code called at 750 works as a Get statement, but does so slightly faster.

Summary of listing.

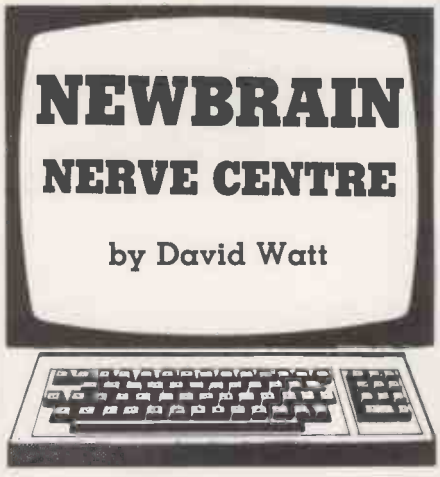
10—130	Set up computer
140—470	Set user characters
480—730	Draw graphics
740—840	Move
850—970	Check position
980—1100	Random wind
1110—1230	Pick up survivors
1240—1380	Crash into rig
1390—1470	Land on ship with no survivors
1480—1620	Land on ship with survivors
1630—1750	Land in sea
1760—1900	Flown too high
1910—2160	Game over
2170—2390	Instructions
2400—2450	Lines cut out of main loop
2460—2530	Machine code
2540—2680	Skill level



Helicopter rescue

```
10 REM NORTH SEA OIL RIG RESCUE
20 REM Steve crick. May/83
30 REM Herne Bay Secondary School
40 REM For RML 480Z with level 2
50 REM High Resolution Graphics
60 RANDOMIZE
70 CALL"RESOLUTION",0,2
80 CLEAR 2000
90 GOSUB 2460
100 GOSUB 2170
110 GRAPH
120 ME=3
130 HS=1090
140 REM              SET CHARACTERS
150 CALL"DEFCHAR",1,0,0,0,252,92,127,59,31
160 CALL"DEFCHAR",2,0,0,0,0,0,255,183,255
170 CALL"DEFCHAR",3,14,30,63,22,30,255,222,252
180 CALL"DEFCHAR",4,63,0,64,127,85,95,1,15
190 CALL"DEFCHAR",5,252,192,220,226,225,209,78,240
200 CALL"DEFCHAR",6,16,8,4,10,3,2,3,2
210 CALL"DEFCHAR",7,8,16,32,80,192,64,192,64
220 CALL"DEFCHAR",8,2,6,5,5,6,6,5,9
230 CALL"DEFCHAR",9,64,96,160,160,96,96,160,144
240 CALL"DEFCHAR",10,10,12,10,9,9,250,252,248
250 CALL"DEFCHAR",11,80,48,80,144,144,80,62,30
260 CALL"DEFCHAR",12,255,255,255,255,126,126,126,255
270 CALL"DEFCHAR",13,255,254,252,0,0,0,0,0
280 CALL"DEFCHAR",14,255,127,63,0,0,0,0,0
290 CALL"DEFCHAR",15,255,255,255,0,0,0,0,0
300 CALL"DEFCHAR",16,0,0,31,6,1,0,0,0
310 CALL"DEFCHAR",17,0,0,255,0,255,96,96,240
320 CALL"DEFCHAR",18,0,0,255,6,248,97,97,243
330 CALL"DEFCHAR",19,255,255,255,255,255,255,255,255
340 CALL"DEFCHAR",20,85,170,170,255,255,255,255,255
350 SH$=CHR$(1)+CHR$(2)+CHR$(2)+CHR$(2)+CHR$(3)
360 HE$=CHR$(4)+CHR$(5)
370 OT$=CHR$(6)+CHR$(7)
380 OM$=CHR$(8)+CHR$(9)
390 OH$=CHR$(16)+CHR$(17)+CHR$(18)+CHR$(10)+CHR$(11)
400 OB$=CHR$(14)+CHR$(12)+CHR$(15)+CHR$(12)+CHR$(13)
410 LE$=CHR$(19)+CHR$(32)+CHR$(19)
420 BS$=CHR$(32)+CHR$(48)+CHR$(32)+CHR$(32)+CHR$(32)
430 SE$=CHR$(20)
440 BL$=CHR$(19)
450 ME$=STR$(ME)
460 HS$=STR$(HS)
470 SC$=STR$(SC)
480 REM              DRAW
490 CALL"COLOUR",0,20
500 CALL"COLOUR",1,180
```

```
510 PLOT 0,59,"SCORE"
520 PLOT 27,59,"LIVES"
530 PLOT 48,59,"HI SCORE"
540 IF FX=1 THEN GOTO 570
550 FX=1
560 PLOT 11,59,BS$
570 PLOT 38,59,ME$
580 PLOT 64,59,HS$
590 CALL"FILL",0,180,320,200,2
600 A=200:X=48
610 X1=60:Y1=61:X2=60:Y2=61
620 FOR X=1 TO 50 STEP 8
630 CALL"STPLOT",A,X,VARADR(LE$),1
640 NEXT
650 CALL"STPLOT",A-8,X,VARADR(OB$),3
660 CALL"STPLOT",A-8,X+8,VARADR(OH$),3
670 CALL"STPLOT",A+16,X+16,VARADR(OM$),3
680 CALL"STPLOT",A+16,X+24,VARADR(OT$),3
690 FOR X=0 TO 320 STEP 8
700 CALL"STPLOT",X,0,VARADR(SE$),2
710 NEXT
720 CALL"STPLOT",0,8,VARADR(SH$),3
730 CALL"STPLOT",X1,Y1,VARADR(HE$),3
740 REM            MOVE
750 CALL&6000
760 IF INT(RND(1)*15)=3 THEN GOSUB 980
770 P=PEEK(&5FFF)
780 IF P<>0THENO=P ELSE P=0
790 IF P=&0A THEN Y1=Y1-2
800 IF P=&0B THEN Y1=Y1+2
810 IF P=&0B THEN X1=X1-3
820 IF P=&18 THEN X1=X1+3
830 X1=X1+LW
840 X1=X1-RW
850 IF X1<202 AND X1>190 AND Y1=71 THEN FG=1:GOTO 2400
860 IF X1>300 THEN X1=0
870 IF X1<0 THEN X1=300
880 IF Y1<8 THEN GOTO 1630
890 IF X1<18 AND X1>6 AND Y1=11 THEN FG=2:GOTO 2400
900 IF Y1<70 AND X1<222 AND X1>184 THEN 1240
910 IF Y1>170 THEN 1760
920 CALL"STPLOT",X2,Y2,VARADR(HE$),0
930 CALL"STPLOT",X1,Y1,VARADR(HE$),3
940 CALL"STPLOT",216,81,VARADR(OT$),3
950 CALL"STPLOT",216,73,VARADR(OM$),3
960 X2=X1:Y2=Y1
970 GOTO 750
980 REM          WIND
990 PUT 12
1000 W=INT(RND(1)*3)
1010 S=INT(RND(1)*5)
1020 IF S=0 THEN WI$="Weak"
1030 IF S=1 THEN WI$="Mild"
1040 IF S=2 THEN WI$="Moderate"
1050 IF S=3 THEN WI$="Strong"
1060 IF S=4 THEN WI$="Gail force"
1070 IF W=0 THEN ?WI$;" wind from the Right":RW=S+1+SK:LW=0
1080 IF W=1 THEN ?WI$;" wind from the Left":RW=0:LW=S+1+SK
1090 IF W=2 THEN ?"Wind dropped":LW=0:RW=0
1100 RETURN
1110 REM             PICK UP
1120 CALL"STPLOT",X2,Y2,VARADR(HE$),0
1130 CALL"STPLOT",X1,Y1,VARADR(HE$),3
1140 PUT 12
1150 SU=INT(RND(1)*8)+10
1160 ?"You have succesfully landed"
1170 ?"and picked  up ";SU" survivers"
1180 FL=1
1190 FORT=1TO2000:NEXTT
1200 GOSUB 980
1210 P=&0B:O=&0B
1220 CALL"STPLOT",X1,Y1,VARADR(HE$),0
1230 GOTO 740
1240 REM          CRASH 1
1250 PUT 12
1260 ?"You have crashed into the Oilrig"
1270 IF FL=1 THEN ?"killing all of your survivers"
1280 ME=ME-1
1290 FORT=1 TO2000:NEXTT
1300 FL=0
1310 PUT 12
1320 IF ME=0 THEN 1910
1330 ME$=STR$(ME)
1340 PLOT 38,59,ME$
1350 X1=60:Y1=61
1360 P=&0B:O=&0B
1370 CALL"STPLOT",X2,Y2,VARADR(HE$),0
1380 GOTO480
1390 REM       LAND WITHOUT
1400 CALL"STPLOT",X2,Y2,VARADR(HE$),0
1410 CALL"STPLOT",X1,Y1,VARADR(HE$),3
1420 PUT12
1430 ?"Why land without any survivers?"
1440 FORT=1TO1000:NEXTT
1450 P=&0B:O=&0B
1460 CALL"STPLOT",X1,Y1,VARADR(HE$),0
1470 RETURN
1480 REM          LAND WITH
1490 PUT12
1500 CALL"STPLOT",X2,Y2,VARADR(HE$),0
1510 CALL"STPLOT",X1,Y1,VARADR(HE$),3
1520 ?"Well done you have scored ";SU*10
1530 SC=SC+(SU*10)
1540 ST=ST+SU
1550 SC$=STR$(SC)
1560 PLOT 11,59,SC$
1570 FL=0
1580 FORT=1 TO2000:NEXTT
1590 P=&0B:O=&0B
1600 CALL"STPLOT",X1,Y1,VARADR(HE$),0
1610 A$="A":B$="A"
1620 GOTO 750
1630 REM          SEA
1640 PUT 12
1650 ?"You have crashed into the sea"
1660 IF FL=1 THEN?"killing all of your survivers"
1670 ME=ME-1
1680 FL=0
1690 X1=60:Y1=61
1700 FORT=1 TO 1000:NEXTT
1710 PUT 12
1720 IF ME=0 THEN 1910
1730 ME$=STR$(ME)
1740 PLOT 38,59,ME$
1750 GOTO 740
1760 REM            TOO HIGH
1770 PUT 12
1780 ?"You have flown too high"
1790 IF FL=1 THEN ?"killing all of your survivers"
1800 ME=ME-1
1810 X1=60:Y1=61
1820 FL=0
1830 FORX=1TO2000:NEXTX
1840 IF ME=0 THEN 1910
1850 ME$=STR$(ME)
1860 PLOT 38,59,ME$
1870 CALL"STPLOT",X2,Y2,VARADR(HE$),0
1880 PUT 12
1890 P=&0B:O=&0B
1900 GOTO 960
1910 REM              END
1920 CALL"STPLOT",X2,Y2,VARADR(HE$),0
1930 PUT 12
1940 ?"You have sent the rest of"
1950 ?"the crew to a watery grave"
1960 ?"You saved ";ST;"men."
1970 IF SC>HS THEN HS=SC
1980 HS$=STR$(HS)
1990 PLOT 64,59,HS$
2000 SC=0
2010 ST=0
2020 SU=0
2030 FX=0
2040 A$=""
2050 B$=""
2060 ME=3
2070 ME$=STR$(ME)
2080 SC$=STR$(SC)
2090 FL=0
2100 FORT=1TO3000:NEXTT
2110 PUT 12
2120 ?"Do you want another go? (Y/N)"
2130 C$=GET$()
2140 IF C$="Y" OR C$="y" THEN GOSUB 2540:GOTO480
2150 IF C$="N" OR C$="n" THEN CALL"CLEAR":TEXT:END
2160 GOTO 2130
2170 REM            INSTRUCTIONS
2180 TEXT
2190 PUT 31
2200 ?"        North Sea Oil Rig Rescue"
2210 ?"                                "
2220 ?:?"          Steve Crick.  May/83"
2230 ?"                                "
2240 ?:?"              Instructions"
2250 ?"                            "
2260 ?:?"Due to a fault in the Oil Rig s legs"
2270 ?"it is in danger of collapsing. You are"
2280 ?"the pilot of the helicopter that is"
2290 ?"trying to save the workers. To make"
2300 ?"things worse there are unpredictable"
2310 ?"winds in the north sea, making your"
2320 ?"landings difficult."
2330 ?:?"   You use the ARROW keys to move"
2340 ?"       Any other key to stop"
2350 ?:?"            Any key to play"
2360 A=GET()
2370 GOSUB 2540
2380 PUT 12
2390 RETURN
2400 REM                CUT DOWN
2410 IF FL=0 AND FG=1 THEN FG=0:GOTO 1110
2420 IF FL=1 AND FG=1 THEN FG=0:GOTO 1240
2430 IF FL=0 AND FG=2 THEN FG=0:GOSUB 1390
2440 IF FL=1 AND FG=2 THEN FG=0:GOTO 1480
2450 GOTO 750
2460 REM            MACHINE CODE
2470 POKE &6000,&F7
2480 POKE &6001,&02
2490 POKE &6002,&32
2500 POKE &6003,&FF
2510 POKE &6004,&5F
2520 POKE &6005,&C9
2530 RETURN
2540 REM          SKILL
2550 CALL"RESOLUTION",0,2
2560 TEXT
2570 PUT 31
2580 ?"       Input Your Skill Level:-"
2590 ?"                               "
2600 ?:?"0=Easy"
2610 ?:?"1=Hard"
2620 ?:?"2=Very Hard"
2630 ?:INPUT"Level=",SK
2640 IF SK<0 OR SK>2 THEN 2570
2650 ?:?"Any key to play"
2660 C$=GET$()
2670 PUT 12:GRAPH
2680 RETURN
```



General-purpose graph

THE FIRST program is a general-purpose line graph program developed by Robert Lewsley, designed to take the tedium out of drawing graphs from measurements he takes in the course of his work. Three options are available. You may input from keyboard or tape, or input from keyboard while simultaneously copying the data to tape. The program allows you to specify the titles, ranges and scale positions for both the x- and y-axes. Then you may input the x and y co-ordinates.

The program plots the graph as each set of co-ordinates is input, checking that the x value is greater than at the previous point. You can make multiple plots by specifying x and y values of zero to move the current position back to the start. Lines 2700 to 3160 display full instructions for using the program.

General-purpose graph.

```
1000 REM ********************************
1010 REM - general purpose graph program
1020 REM - copyright R. Lewsley 1983
1030 REM
1040 REM ********************************
1050
1060 ON BREAK GOTO 3210
1070
1080 REM ********************************
1090
1100 e$="Invalid input - try again"
1110 e2$="Text too long - limit = 20 cha
     rs."
1120 CLOSE£2:OPEN£0,4,"200":GOSUB 2700
1130 CLOSE£129
1140 PUT 31
1150 PRINT "Enter processing option (KB:
     KS:TI) ":LINPUT ("! ")po$
1160 IF po$="KB" OR po$="kb" OR po$="KS"
      OR po$="ks" OR po$="TI" OR po$="ti
     " THEN 1180
1170 PRINT "Invalid processing option -
     try again":PUT 12:GOTO 1150
1180 PUT 31
1190 IF po$="KB" OR po$="kb" THEN po=1:G
     OTO 1330
1200 IF po$="KS" OR po$="ks" THEN  po=2:
     GOTO 1280
1210
1220 REM - tape input
1230
1240 po=3:PRINT "Load input tape at corr
     ect point.":PRINT "Press play then
     press newline when ready":LINPUT x$
     :OPENIN£2,1,"graph.data":GOTO 1330
1250
1260 REM - keyboard input plus save
1270
1280 PRINT "Load new tape at start point
     , and press":PRINT "record/play.":P
     RINT "Then press newline when ready
     .":LINPUT x$:OPENOUT£2,1,"graph.dat
     a":GOTO 1330
1290
1300 REM - open graphics screen
1310 REM   and draw skeleton
1320
1330 PUT 31:OPEN£129,11,"w200":plotrng(1
     0,10),pla(0,0),mve(0,9.9)
1340 plotdeg,tby(-90),mby(9.9),tby(-90)
1350 plotmby(9.9),tby(-90),mby(9.9)
1360
1370 IF po=3 THEN LINPUT£2,x$:GOTO 1490

1380
1390
1400 REM - begin getting titles
1410 REM   and ranges
1420
1430 PRINT "Please enter title for graph
     "
1440 LINPUT (": ") x$
1450 IF LEN(x$)(21 THEN 1490
1460 PUT 31:PRINT e2$
1470 GOTO 1440
1480
1490 plotrng(100,100)
1500 IF LEN(x$)=0 THEN x$="          "
1510 IF po=2 THEN PRINT£2,x$
1520 x=(100-LEN(x$)*3)/2-3:IF x(0 THEN x
     =1
1530 plotpla(x,94),x$
1540 plotpla(0,0)
1550 PUT 31
1560 IF po=3 THEN INPUT£2,x1,xh,y1,yh:GO
     TO 1750
1570
1580
1590 ON ERROR GOTO 1630
1600 PRINT "Enter low and high values fo
     r X (nn,nn)"
1610 INPUT x1,xh
1620 GOTO 1640
1630 ON ERROR GOTO 0:PRINT e$:PUT 12:RES
     UME 1590
1640 IF xh-x1 ) 0 THEN 1660
1650 PRINT e$:PUT 12:GOTO 1590
1660 PUT 31
1670 ON ERROR GOTO 1710
1680 PRINT "Enter low and high values fo
     r Y (nn,nn)"
1690 INPUT y1,yh
1700 GOTO 1720
1710 ON ERROR GOTO 0:PRINT e$:PUT 12:RES
     UME 1670
1720 IF yh-y1 ) 0 THEN 1740
1730 PRINT e$:PUT 12:GOTO 1670
1740 ON ERROR GOTO 0
1750 PUT 31
1760 IF po=2 THEN PRINT£2,x1,xh,y1,yh
1770 IF po=3 THEN INPUT£2,x$:GOTO 1840
1780 PRINT "Enter title for X axis"
1790 LINPUT x$
1800 IF LEN(x$)(21 THEN 1830
1810 PRINT e2$
1820 PUT 12:GOTO 1780
1830 IF LEN(x$)=0 THEN x$="X axis"
1840 x=(100-LEN(x$)*3)/2-3:IF x(0 THEN x
     =1
1850 plotpla(x,01),x$
1860 PUT 31
1870 IF po=2 THEN PRINT£2,x$
1880 IF po=3 THEN INPUT£2,x$:GOTO 1940
1890 PRINT "Enter title for Y axis"
1900 LINPUT x$
1910 IF LEN(x$)(21 THEN 1940
1920 PRINT e$
1930 PUT 12:GOTO 1890
1940 IF LEN(x$)=0 THEN x$="Y axis"
1950 IF po=2 THEN PRINT£2,x$
1960 x=(100-LEN(x$)*3)/2-3:IF x(0 THEN x
     =1
1970 x=100-x
1980 FOR i=1 TO LEN(x$)
1990 plotpla(1,x),MID$(x$,i,1)
2000 x=x-4
2010 NEXT i
2020 plotcen(5,7),pla(0,0)
2030 x$=STR$(x1):x=LEN(x$)-1
2040 x$=LEFT$(x$,x)
2050 x=LEN(x$)-1
2060 x$=RIGHT$(x$,x)
2070 plotpla(-3,-6),x$
2080 x$=STR$(xh):x=LEN(x$)-1
2090 x$=LEFT$(x$,x)
2100 x=LEN(x$)-1
2110 x$=RIGHT$(x$,x)
2120 x=95-(x*4)
2130 plotpla(x,-6),x$
2140 x$=STR$(yh):x=LEN(x$)-1
2150 x$=LEFT$(x$,x)
2160 x=LEN(x$)-1
2170 x$=RIGHT$(x$,x)
2180 plotpla(-3,87),x$
2190 x$=STR$(y1):x=LEN(x$)-1
2200 x$=LEFT$(x$,x)
2210 x=LEN(x$)-1
2220 x$=RIGHT$(x$,x)
2230 plotpla(-3,-2),x$
2240 x=xh-x1:y=yh-y1
2250 plotrng(x,y),cen(0,0)
2260 xp=0-x/10:yp=0-y/10
2270 PUT 31
2280 FOR i=1 TO 10
2290 xp=xp+x/10:plotpla(xp,0),mve(xp,y/1
     00)
2300 yp=yp+y/10:plotpla(0,yp),mve(x/100,
     yp)
2310 NEXT i
2320 plotpla(0,0):xo=x1-1
2330
2340 PUT 31
2350 IF po()3 THEN 2460
2360
2370 REM - draw graph from tape data
2380
2390 INPUT£2,x$
2400 IF ASC(x$)=4 THEN PUT 31:PRINT "Dis
     play complete - press newline":PRIN
     T "to terminate run.":LINPUT x$:STO
     P
2410 xp=VAL(x$):INPUT£2,x$:yp=VAL(x$):GO
     TO 2510
2420
2430 REM - begin drawing using keyboard
2440 REM   input
2450
2460 ON ERROR GOTO 2500
2470 PRINT "Enter X and Y coordinates (n
     n,nn)"
2480 INPUT xp,yp
2490 GOTO 2510
2500 ON ERROR GOTO 0:PRINT e$:PUT 12,12:
     RESUME 2460
2510 ON ERROR GOTO 0
2520 IF xp()0 OR yp()0 THEN 2570
2530 plotpla(0,0):xo=x1-1:IF po=1 THEN P
     UT 12:GOTO 2460
2540 IF po=3 THEN 2390
2550 x$=STR$(xp):PRINT£2,x$:x$=STR$(yp):
     PRINT£2,x$
2560 GOTO 2340
2570 IF po=3 THEN 2630
2580 IF xp)=x1 AND xp(=xh THEN 2600
2590 PRINT e$:PUT 12:GOTO 2460
2600 IF yp(y1 OR yp)yh THEN 2590
2610 IF xp(=xo THEN 2590
2620 IF po=2 THEN x$=STR$(xp):PRINT£2,x$
     :   x$=STR$(yp):PRINT£2,x$
2630 xo=xp
2640 xp=xp-x1:yp=yp-y1
2650 plotmve(xp,yp)
2660 GOTO 2340
2670
2680 REM - user instruction routine
2690
2700 PUT 31
2710 x$="General Purpose Graph Program"
2720 PRINT TAB(20-LEN(x$)/2);x$
2730 x$="(c) Copyright R. Lewsley 1983"
2740 PRINT TAB(20-LEN(x$)/2);x$
2750 PUT 10
2760 PRINT "Do you require instructions
     y/n ";:LINPUT x$
2770 IF x$="n" OR x$="N" THEN 3170
2780 IF x$="y" OR x$="Y" THEN PUT 31:GOT
     O 2800
2790 PUT 12:GOTO 2710
2800 PRINT "This program will draw a gra
     ph using"
2810 PRINT "either keyboard or tape inpu
     t data."
2820 PUT 10:PRINT "If keyboard input is
     selected "
2830 PRINT "the program will initially r
     equest a"
2840 PRINT "title for the graph,then ask
      for the"
2850 PRINT "low and high range values of
      the"
2860 PRINT "X (horizontal) and Y (vertic
     al) axes."
2870 PUT 10
2880 PRINT "It will then request heading
     s and scale"
2890 PRINT "mark values for these two ax
     es."
2900 PUT 10
2910 PRINT "At this stage a skeleton lay
     out"
2920 PRINT "will be drawn and you will b
     e asked"
2930 PRINT "to begin entering the X and
     Y values.":PUT 10,10,10
2940 LINPUT ("press newline to continue"
     )x$:PUT 31
2950 PRINT "Plotting will be done immedi
     ately and"
2960 PRINT "each new set of X,Y values w
     ill be"
2970 PRINT "checked to ensure that X is
     greater"
2980 PRINT "than its previous value."
2990 PUT 10
```

(continued on page 158)

OKI MICROLINE

Microline 84

Highest performance and reliability place these printers on top of the Microline printer series. The printhead is designed for over 200 Million character printing.

Printing speed is 200 cps in data processing mode and 50 cps is achieved in correspondence quality mode. Character types are user defined.
A choice of character sets is permanently stored in the printer's EPROMs.
Additional memory space is provided to store one's own specific character set. This happens by down-loading the specific character set from one's computer to the printer before the printout begins.

The carriage width of 136 characters allows the use of A4 paper in portrait or landscape formats, from an optionally available single sheet feeder.

The interface parts allow for parallel or serial data transfer – buffered or unbuffered –, from most popular desk top computers and widely used PC's.

MICROLINE – more than 150. 000 printers in Europe in use.

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Bounce.

```
10 FOR a=1 TO 255:CLOSE£a:NEXT a
20 OPEN£1,0,1,"150":OPEN£2,0,2,"150"
30 OPEN£3,11,1,"£1,220":OPEN£4,11,2,"£2,
     220"
40 plot£4,rng(30,20),deg,pla(15,1),arc(1
     5,360),pla(15,2),fil
50 plot£3,rng(30,20),deg,pla(15,5),arc(1
     5,360),pla(15,7),fil
60 PRINT£1
70 FOR a=1 TO 200:NEXT a
80 PRINT£2
90 FOR a=1 TO 200:NEXT a
100 ON BREAK GOTO 120
110 GOTO 60
120 CLOSE£3:CLOSE£4
130 PUT 31,23,65
140 LIST
150 END
```

Rotate.

```
10 FOR a=1 TO 255:CLOSE£a:NEXT a
20 OPEN£0,0,"150":OPEN£1,0,1,"150":OPEN£
     2,0,2,"150"
30 OPEN£3,11,"220":OPEN£4,11,1,"£1,220":
     OPEN£5,11,2,"£2,220"
40 FOR c=3 TO 5
50 plot£c,rng(30,20),deg,pla(15,10)
60 NEXT c
70 plot£4,trn(120):plot£5,trn(240)
80 PRINT
90 FOR a=1 TO 4
100 FOR b=1 TO 5
110 FOR c=3 TO 5
120 plot£c,arc(b,90),tby(90),arc(b,90),t
     by(90)
130 NEXT c
140 NEXT b
150 FOR c=3 TO 5
160 plot£c,tby(90)
170 NEXT c
180 NEXT a
190 PRINT£1
200 FOR a=1 TO 50:NEXT a
210 PRINT£2
220 FOR a=1 TO 50:NEXT a
230 PRINT
240 FOR a=1 TO 50:NEXT a
250 GOTO 190
```

Format. 40.

```
2000 REM "format.40" by R. Lewsley.
2010
2020 REM Program to print hard copy
2030 REM lists of programs in a 40 col
2040 REM format for publication.
2050
2060 REM Input to this program is a tape
2070 REM "list" of the program created
2080 REM using the LIST command
2090 REM e.g.
2100 REM to create the tape load the
2110 REM program to be formatted
2120 REM then enter the following
2130
2140 REM      openout£1,1
2150 REM      list£1
2160 REM      print£1,chr$(4)
2170 REM      close£1
2180 REM the list tape is now ready for
2190 REM use as input to this program
2200
2210
2220 OPEN£0,0,"124"
2230
2240 CLOSE£8:OPEN£8,8,"1200"
2250
2260 PUT 31:PRINT TAB(35);"Format.40";TA
     B(65);"by R. Lewsley"
2270 PUT 10:PRINT TAB(20);"Load ""list""
      tape in tape 1 and press play"
2280
2290 CLOSE£1:OPEN£1,1
2300 lc=99:pc=0:x$=" "
2310 PUT£8,30,27,66
2320 LINPUT£1,a$
2330 IF a$=CHR$(4) THEN CLOSE£1:PUT 31:P
     RINT "READY":END
2340 IF LEN(a$)=0 THEN 2320
2350 m=40
2360 x$=" ":CLEAR x$
2370 IF lc ( 51 THEN 2430
2380 PUT£8,12
2390 pc=pc+1
2400 PRINT£8,"Page";pc:PUT£8,10
2410 lc=1
2420
2430 l=LEN(a$)
2440 IF l ) m THEN 2510
2450 x$=x$+a$
2460 PRINT£8,x$
2470 lc=lc+1
2480 GOTO 2320
2490
2500
2510 i=m
2520 x$=x$+LEFT$(a$,i)
2530 l=l-i
2540 a$=RIGHT$(a$,l)
2550 PRINT£8,x$
2560 lc=lc+1
2570 m=35
2580 x$="      "
2590 GOTO 2440
```

(continued from page 156)

```
3000 PRINT "Multiple plots may be made b
     y entering"
3010 PRINT "zero for both X and Y, this
     will move"
3020 PRINT "the current plotting positio
     n back to"
3030 PRINT "the start point."
3040 PUT 10,10,10
3050 PRINT "To terminate the program pre
     ss the"
3060 PRINT "stop key followed by newline
     ."
3070 PUT 10,10:LINPUT ("press newline to
      proceed")x$
3080 PUT 31
3090 PRINT "Three processing options are
      available."
3100 PUT 10:PRINT "KB - meaning keyboard
      input for "
3110 PRINT "      immediate display only.
     "
3120 PUT 10:PRINT "KS - meaning keyboard
      input for display"
3130 PRINT "      plus save to tape for l
     ater use."
3140 PUT 10:PRINT "TI - meaning display
     previously saved"
3150 PRINT "      data from tape input."
3160 PUT 10,10:LINPUT ("press newline to
      proceed ")x$
3170 PUT 31:RETURN
3180
3190 REM CLOSEDOWN ROUTINE
3200
3210 ON BREAK GOTO 0:IF po=2 THEN 3240
3220 CLOSE£2:CLOSE£129
3230 PUT 31:PRINT "READY":END
3240 PRINT£2,CHR$(4)
3250 GOTO 3220
```

Format 40

This program by Robert Lewsley prints program listings in the 40-column format preferred by this magazine. I certainly found it useful in preparing some of the listings. Lines 2140 to 2170 describe how to store a program on tape prior to printing it. I found it better to specify a file name when storing my programs using the commands:

OPEN OUT£1,1,"progrm name" in place of the command on line 2140

Once your program is stored, Format 40 just has to be loaded and run to list it out. Line 2310 outputs some special initialisation characters for the Oki Microline 82a printer. It may have to be changed for your own printer.

Multiple screens

One of the most powerful features of the Newbrain is its ability to open a number of streams for one device. In particular, you can set up multiple screen displays which can be switched between at will.

Edward Thomas from Clapton, London E5, sent in two programs which demonstrate this very well and also illustrate some of the features of the Newbrain high-resolution graphics. The first program, Bounce, opens two display streams on ports 1 and 2, and two linked graphics streams. It then draws a circle on each graphics stream and fills them in. Finally, the program goes into a loop where each stream is displayed in turn with a time delay between each display. The resulting effect is of a bouncing ball.

The second program is slightly more complex, using three streams. When run, Rotate will draw a four-pointed petal which, when completed, will start spinning anti-clockwise. Graphics use rather a lot of memory so three screens is the limit for this type of display with the standard system, and fully animated cartoons are out of the question.

Many useful facilities can still be provided with text displays. For example, help information and option menus could be stored on separate streams from the main display, to be called up as required. It is also possible to plot to one stream while the other stream is being displayed. Provided it does not take too long to plot the changes between displays, it should be possible to perform limited animation.

DIAL-TEXT 50

TYPEWRITER TO TYPEWRITER COMMUNICATION

DIAL-TEXT 50 is a simple to use electronic typewriter (ET) to electronic typewriter communications device. It is plug compatible with the OCTET 121 and HERMIT 21 interfaces designed by Duplex and can also be used with any RS232 device such as a microcomputer or printer.

Simple to install

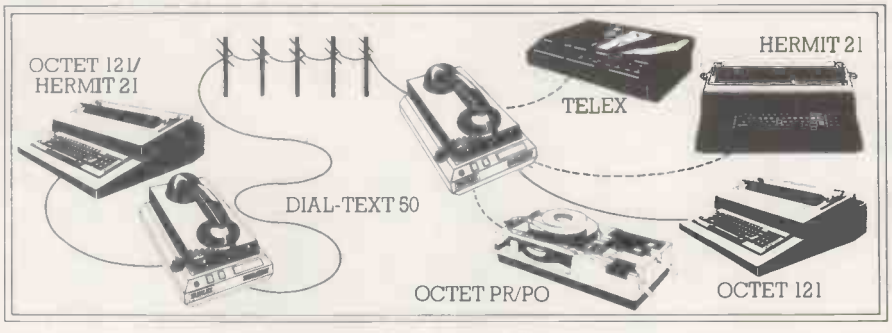
Installation is easy and no special wiring is required – communication is achieved by simple cable connection or through any acoustic coupler. For instance, the user can simply place the DIAL-TEXT 50 unit and acoustic coupler between an OCTET 121 or HERMIT 21 typewriter and a standard telephone handset for transmission of ERROR FREE letters and documents (or telex messages) to a remote DIAL-TEXT 50 unit and acoustic coupler; nationally or internationally.

Typical application

The DIAL-TEXT 50 unit is ideal for remote offices which would like to use the main office telex facilities; Text can be prepared at the remote office and transmitted to the main office to cut telex paper tape for forward transmission. Incoming telexes for the remote office would receive messages in the reverse manner.

Special Dial-Text 50 features & benefits

1. 16,000 CHARACTER MEMORY. Retains contents when power is off.
2. ERROR free messages through use of automatic ERROR DETECTION and CORRECTION facility.
3. TRANSMISSION SPEED approx. 5 times faster than a standard telex machine, providing the FULL range of typewriter characters and symbols, upper-case and lower-case.
4. MENU DRIVEN through a 16 character display.
5. OPERATORS CONTROL PANEL for message viewing and deletion.
6. INCOMING/OUTGOING messages automatically differentiated by special character.
7. ABILITY TO PRINT (retrieve) messages from the DIAL-TEXT 50 unit at any time.
8. ABILITY TO STORE messages onto a standard tape cassette unit. (Ask for the OCTET or HERMIT TI unit)
9. CONVENIENT/CONFIDENTIAL MESSAGE HANDLING. ie use own secretary as operator.
10. PORTABLE lightweight stand-alone unit with own 240v power supply which can be shared within the office.
11. DIAL-TEXT 50 allows local text processing without the need to transmit messages.
12. COST of transmission limited to normal telephone rates.
13. MESSAGE SCRAMBLER facility. (optional).



Full details from *sole suppliers:*

DUPLEX
Communications Ltd.
The Interface People

Midlands/North—2 Leire Lane, Dunton Bassett, Nr. Lutterworth, Leicestershire LE17 5JP. Tel: 0455 209131
South—52 High Street, Stock, Essex CM4 9BW. Tel 0277 841011

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SINCLAIR LINE-UP

User-defined I/O routines

A LITTLE PIECE of detective work has enabled Larry Carasco of Dollis Hill to produce the program which will allow the Spectrum stream facilities to be utilised. The streams will be used with the Sinclair Microdrives and networking board.

Anybody who already has some form of I/O device attached to their Spectrum might be able to put this program to use immediately. A channel consists of five bytes of code which define which routines are being used for I/O. The format is:

- Address of output routine,
- Address of input routine,
- File name.

The file name consists of a single character — of which more later. The Spectrum has a series of 19 streams which indicate where the channels are situated, of which 16 are available to the user. A stream is simply a 16-bit pointer to a channel. The address of the first channel is in Chans, 23631.

A stream which has been opened contains a pointer, which is 0 if the stream is closed. The channel to which it points is at

CHANS + pointer − 1.

Thus if Chans is 23734 and the pointer is 6 then the channel is at address 23739.

The Spectrum manual states that Strms is at 23568, the address of the first stream pointer. However, the streams at 23568, 23570 and 23572 are not available to the user so the address of the first user stream, called Stream 0, is 23574. The address of any given stream is at

23574 + 2 × stream number

where the stream is any number between 0 and 15. The contents of this address plus Chans minus 1 gives the channel its uses. Table 1 shows the stream addresses, their pointers and the channel data they point to.

Streams 0 to 3 are normally used by the Spectrum for display and input. Streams 0 and 1 point to the same channel and are used to write to screen lines 22 and 23 and also to read the keyboard. Stream 2 is used by the Print and List statements to output to lines 0 to 21. Stream 3 is used by the printer; LPrint and LList use this stream.

Examining the channels which these streams point to clarifies the I/O structure. Table 2 shows the channels which the Spectrum sets up on default. The channel data is situated at Chans to Chans + 19.

The subroutine at 2548 is a conventional output routine, and 4264 is an input routine which returns characters entered from the keyboard. The routine at 3969 probably requires extra hardware to function as intended. The routine at 5572 causes error J to occur: you may not input from this device. The file name is a mnemonic for the channel's I/O port:

K = keyboard and lines 22,23
S = screen, lines 0 to 21
R = RS-232 (?)
P = Printer

No other file name is valid, and only K, S and P may be specified by the user.

Although three channels use the same output routine, Basic sets various flags to indicate which channel is being serviced. The file name decides which flags are set. This means, for instance, that when using Channel P the output is not echoed to the screen. Using this method of streams and channels reduces the amount of memory required to handle many different I/O routines.

All the streams using a particular channel have their pointers set to the same value, and all 16 streams could use the same channel — though it would be rather pointless. Five bytes of data would then service the entire I/O network. The address of the channel currently in use is held in Curchl, 23633.

A specific stream can be selected by inserting a # sign, CHR$ 35, and a stream number. For example.

```
PRINT #3; "Hello!"
```

will output to the printer. Using table 2 to help establish what effect the different channels have, try out different streams for this example. Only streams 0 to 3 are valid at present.

Inkey $,Print and Input may all use stream values. Now try

```
LPRINT #2; "Hi!"
```

A command which normally writes to the printer has been told to use Stream 2, which in turn has directed it to Channel S.

All I/O statements, except Verify, Save and Merge, always use streams but because they use default values when one has not been specified this is, perhaps, not apparent. Print defaults to Stream 2,LPrint to Stream 3 and so on. When you specify a particular stream you are directing the I/O of that statement to a chosen channel.

Contrary to the insistence of the manual, the Open and Close statements can be used without extra hardware, as you may have already discovered. When you use them you are actually defining which channel you wish that stream to use. The format is:

OPEN # stream number, file name

The valid file names are K,S and P.

Try entering

```
PRINT #5;"Illegal"
```

You should try to get an Error 0 report, but if you first enter

```
PRINT #5, "S"
```

the text should appear on the screen. What you have done is opened Stream 5 and instructed it to use Channel S. Any stream number between 4 and 15 will work.

Streams 0 to 3 will also work, but you will be altering the normal system I/O configuration. You should always take care when altering them or you may lock yourself out of the system. If you want a demonstration,

```
OPEN #3, "S"
```

is fairly safe and will cause printer output to be rerouted to the screen.

The Close statement naturally enough closes down the chosen stream. For streams 4 to 15 it resets their pointers to 0, indicating that the stream is disconnected — see table 1. Closing streams 0 to 3 results in returning their pointers to their default

Channel	Output address	Input address	File name
0	2548	4264	K
1	2548	5572	S
2	3969	5572	R
3	2548	5572	P

Table 2: The Spectrum's four channels.

Stream	Address	Pointer value	Channel address
0	23574	0001	23734
1	23576	0001	23734
2	23578	0006	23739
3	23580	0016	23749
4	23582	0000	CLOSED
5	23584	0000	CLOSED
6	23586	0000	CLOSED
7	23588	0000	CLOSED
8	23590	0000	CLOSED
9	23592	0000	CLOSED
10	23594	0000	CLOSED
11	23596	0000	CLOSED
12	23598	0000	CLOSED
13	23600	0000	CLOSED
14	23602	0000	CLOSED
15	23604	0000	CLOSED

Table 1. Breakdown of stream data, values in decimal.

values. Be careful when closing streams down: an unfortunate program bug crashes the system when you attempt to Close a stream which was never Opened.

Even though you now know how the streams and channels operate constructing your own I/O routines is not as simple as it might be. At present you have only three channels you may use, K,S and P. Any other letter is discarded as an illegal file name.

To get round this you must create your own channel by a back-door method. The program will create just such a channel. Line 20 allocates five bytes of memory for the channel data by setting up a dummy line 0. The addresses of your new I/O routines are Poked into this dummy line. Finally you must give the channel a legal file name, otherwise the system will fail to recognise it as legal and might crash when you come to close down a stream.

To allow easy access to the screen the channel can be called S. When you open a stream to Channel S using the conventional method it will still think you mean the original S channel. With the channel thus set up we simply Poke in the stream's new pointer whose value is arrived at by:

address of new channel — CHANS + 1.

To initialise any other stream to this channel just use:

LET cn = new stream number : GOTO 110

If any of the variables has been altered, run the program again specifying the new stream. The other streams will remain intact. To test the program try the following:

```
LET a = USR "a": POKE a,62: POKE
  a + 1,65:POKE a + 2,195
POKE a + 3,244:POKE a + 4,9
```

Now run the program and answer the prompts as follows:

Stream number: 3

Output routine address: USR "a"

User-defined I/O routines.

```
  10 REM 123456
  20 POKE 23756,0: POKE 23760,14
  30 INPUT "Open stream no? ";cn
  40 INPUT "Output routine addre
ss? ";outr
  50 INPUT "Input routine addres
s? ";inr
  60 LET ch=PEEK 23631+PEEK 2363
2*256
  70 LET z=23761
  80 LET a=z: LET x=outr: GO SUB
 500
  90 LET a=a+2: LET x=inr: GO SU
B 500
 100 POKE a+2,CODE f$
 110 LET a=23574+cn*2
 120 LET x=1+z-ch: GO SUB 500
 499 STOP
 500 POKE a,x-INT (x/256)*256
 510 POKE a+1,INT (x/256): RETUR
N
```

Input routine address: 5572

File name: "S"

Now try LList. Every character should appear as A: you have routed the printer stream through your own output channel which will only allow As to be printed. You could

```
POKE USR "a" + 1
```

with any other ASCII character code to output that character instead. If you try

```
PRINT INKEY$ #3
```

you will get Error J.

To erase the main program but keep initialised streams enter the following:

```
LET var = PEEK 23627 + PEEK 23628 ×
  256
LET a = var − 23771
POKE 23769,a − INT (a/256) × 256
POKE 23770,INT (a/256)
```

Delete line 20 and the program is deleted, save for line 0 which cannot be deleted because it contains the channel data.

This program only sets up a new channel for a stream to use. You must define your own I/O routines to service the channel. These routines could be used for just about any peripheral you can attach to a Spectrum, be it a networking system, a Teletype or even another Spectrum. All you need to know is that the alternative register set should not be used, the output routine should output the value in the A register — preserving it, if possible — and the input routine should return with the Carry flag set if a valid character has been received, reset if not. Unless the interrupt is disabled by your routine the routine is interruptable, so try to avoid any unorthodox stack handling.

Smooth scroll

A VARIABLE degree of scroll is provided by this routine for the Spectrum, written by Paul Maycock of Bristol. The program loads the machine-code routine in the Data statement and then saves it for future use as a subroutine in any Basic program. The routine itself when called will scroll, so to scroll one line would require a For-Next of 8.

(continued on page 163)

Smooth scroll.

```
  100 REM by P Maycock 18/1/83
  110 DATA 33,0,65,17,0,64,6,3,19
7,6,8,197,6,7,197,1,32,0,237,176
,1,224,0,9,229,213,225,9,229,209
,225,193,16,236,1,224,7,237,66,1
,32,0,237,176,1,32,0,237,66,229
  120 DATA 209,1,0,1,9,193,16,209
,1,0,7,213,225,9,1,32,0,229,237,
66,229,209,225,1,32,0,237,176,1,
0,1,213,225,9,193,16,177,33,224,
87,1,0,32,113,35,16,252,201
  130 INPUT "Start Address ?",s
  140 FOR f=0 TO 97
  150 READ a
  160 POKE s+f,a
  170 NEXT f
  190 SAVE "scroll mc"CODE s,98
  200 INPUT "Press ENTER to verif
y"; LINE a$
  210 VERIFY "scroll mc"CODE
```

Bridge hand.

```
10 DIM A(52)
20 FOR I=1 TO 52
30 LET A(I) = INT ((I-1)/13)
40 NEXT I
50 FOR I = 52 TO 2 STEP -1
60 LET T=INT(RND*I+1)
70 LET R=A(I)
80 LET A(I)=A(T)
90 LET A(T)=R
100 NEXT I
110 FOR K = 0 TO 3
120 PRINT "NORTHEAST SOUTHWEST "
    (K*5+1 TO K*5+5);
140 FOR J= 0 TO 3
150 PRINT
160 FOR I = 1 TO 13
170 IF A(J*13+I)<>K THEN GOTO 210
180 LET R$ = " " + "23456789TJQKA"
    (I)+"SHDC"(J+1)+" "
```

(listing continued on page 163)

(continued from page 161)

When the program is run it asks for the start address where the code is to be Poked. It can be anywhere in the free RAM but is most likely to be 32500 in a 16K Spectrum or 65200 in a 48K machine. To call the routine use Randomise User s, where s is the value which you input when the program asks for the start address.

Correlation coefficient

A PROGRAM for the 16K Spectrum by Michael Coombes of Caerleon, Gwent calculates the product-moment correlation coefficient of a set of data. It will be useful to anyone studying or using statistics. Instructions are included in the program.

Bridge hand

If you enjoy bridge, this short program by P A Smith will help you to keep your bidding up to the mark. It is written for the unexpanded ZX-81 and could easily be expanded to print a series of hands.

Side scroll

AN IMPROVEMENT to the routine by C D Henderson, published in the March issue, comes from M J V Moreton of Cambridge. He points out a number of faults in Mr Henderson's routine:

- Some of the scans in lines 16 to 24 are not scrolled.
- The screen attributes are not scrolled.
- Items which disappear from the screen reappear at the right-hand side ⅛in. higher.

This routine does not attempt to wrap the screen around but it does avoid the faults of the earlier version. The routine may be called by

LET variable = USR (32556)

and may be relocated elsewhere in RAM.

Side scroll.

```
 10 CLEAR 32555
 20 LET sum=0
 30 FOR n=32556 TO 32599
 40 READ a: POKE n,a
 50 LET sum=sum+a
 60 NEXT n
 70 IF sum=2944 THEN STOP
 80 PRINT FLASH 1;"Error"
 90 DATA 22,0,33,0,64
100 DATA 1,32,0,30,192
110 DATA 114,9,29,32,251
120 DATA 58,141,92,30,24
130 DATA 119,9,29,32,251
140 DATA 33,1,64,17,0
150 DATA 64,1,0,27,237
160 DATA 176,18,33,255,87
170 DATA 22,0,114,201
```

Bridge hand listing summary.

Line 10 — Initialises array A(52) to represent cards.
Lines 20 to 40 — With 13 each of 0-3 to represent players, in arbitrary order.
Lines 50 to 100 — Form random permutation.
Line 110 — Prints four hands.
Line 140 — Scans four suits.
Line 160 — Scans 13 cards per suit.
Line 170 — Checks if card belongs to hand.
Line 180 to 190 — Creates strings R$ for card.
Line 200 — Prints card.

(continued from page 161)

```
190 IF R$(2) = "0" THEN LET
    R$(1) ="1"
200 PRINT R$;
210 NEXT I
220 NEXT J
230 PRINT
240 NEXT K
```

Correlation coefficient.

```
  10 REM Product Moment
        Correlation Coefficient
        M.Coombes 1983
  12 PAPER 0: BORDER 0: CLS : IN
K 7
  15 LET sumxx=0: LET sumyy=0: L
ET sumx=0: LET sumy=0: LET sumxy
=0
  20 INPUT "How many values of x
 ? ";nx
  30 BEEP .1,1
  35 DIM x(nx): DIM y(nx)
  40 PRINT AT 15,0;"Please enter
 all the values      of x,each fo
llowed by ENTER..."
  50 FOR f=1 TO nx
  60 INPUT x(f)
  65 BEEP .1,1
  67 LET sumx=sumx+x(f)
  68 LET sumxx=sumxx+(x(f)^2)
  70 PRINT AT 19,0;"
                   ";AT 19,0;"x
 value ";f;" = ";x(f)
  80 NEXT f
  90 CLS
 100 BEEP .4,10
 110 PRINT AT 15,0;"Please enter
 all the values      of y,each fo
llowed by ENTER..."
 120 FOR f=1 TO nx
 130 INPUT y(f)
 140 BEEP .1,1
 141 LET sumxy=sumxy+(x(f)*y(f))
 142 LET sumyy=sumyy+(y(f)^2)
 145 LET sumy=sumy+y(f)
 150 PRINT AT 19,0;"
                   ";AT 19,0;"y
 value ";f;" = ";y(f)
 160 NEXT f
 165 BEEP .4,10
 170 LET suma=sumx^2: LET sumb=s
umy^2
 200 REM *Calculate Coefficent*
 210 LET co=(sumxy-((sumx*sumy)/
nx))/(SQR ((sumxx-(suma/nx))*(su
myy-(sumb/nx))))
 300 REM *Print Answer*
 310 PRINT AT 9,0;"The product m
oment correlation coefficient fo
r your data is:"''
 320 PRINT INK 5;co
 330 PRINT AT 15,0; INK 6;"Press
 A to enter new data"''"Press B
to exit"
 340 IF INKEY$="a" OR INKEY$="A"
 THEN RUN
 350 IF INKEY$="b" OR INKEY$="B"
 THEN STOP
 360 GO TO 340
```

SHARP MZ-80B

Basic listing

ONE SHORTCOMING of the Sharp MZ range of computers is that they are intended to be interfaced only with Sharp's own range of printers — and they are expensive. One of the advantages of the MZ-80B is that it is available with an IEEE-488 interface which conforms exactly to the IEEE spec, unlike those offered by many of Sharp's rivals. This feature makes the MZ-80B a reliable instrument controller.

In this role it is clearly an easy matter to attach any low-cost printer to the IEEE bus to provide a convenient hard-copy medium for test results, etc. It would be convenient to list Basic programs in the same way. Unfortunately, the List commands provided in Sharp's Basic dump either to the screen or on to the printer interface if it is present.

The program by Jack Hale of Manchester overcomes this limitation when appended to an existing Basic program. It will list the program via the IEEE bus on an Epson MX-82 printer. It may be modified to suit other printers by changing the control characters in the WRT statements.

Rem lines are detected and printed in double-width characters centred in the line to form titles. This facility may be removed if not required by changing line 61200 to

WRT 4, OP$

and omitting lines 61230 to 61300.

It is convenient to position the listing routine at the end of the Basic program, hence the high line numbers. Listing of this routine may be suppressed so that only the main program is listed changing line 61500 to

IF PEEK (K + 2) + PEEK (K + 3) * 256 < 60000 THEN J = K:F1 = 0:GOTO 60400

The routine steps through the Basic area of memory line by line. The contents of a line are built up into a string OP$ which is sent to the printer when complete, together with the line number. Commonly used Basic words are held in memory in token form as one or two ASCII characters. The tokens deciphered by stepping through a look-up table held in the interpreter. This task is performed using a machine-code subroutine which is loaded in lines 60020 to 60095. The equivalent Basic is unacceptably slow.

Listing is initiated by entering Run 60000. To list the entire program respond to the prompt with 0. Responding with a higher number will result in that and subsequent lines being listed. To terminate the listing before the end of the program has been reached, press Break.

High-resolution dump table 1.

Bits	Screen 1,0	Screen 1,1
11	Red	Orange
10	Blue	Magenta
01	Yellow	Cyan
00	Green	Buff

Basic listing.

```
60000 REM      *** BASIC LISTING PROGRAM ***
60001 REM
60002 REM                  Jack Hale  -  UMIST  - 1982
60005 REM
60010 LIMIT $FEFF
60020 FOR I=65280 TO 65359:POKE I,0:NEXT I
60030 POKE$FF10,58:POKE$FF11,0:POKE$FF12,255          :REM  LD A,(FF00)
60035 POKE$FF15,230:POKE$FF16,127                     :REM  AND 7F
60040 POKE$FF18,6:POKE$FF19,0                         :REM  LD B,00
60045 POKE$FF1C,42:POKE$FF1D,2:POKE$FF1E,255          :REM  LD HL,(FF02)
60050 POKE$FF20,78                                    :REM  LD C,(HL)
60055 POKE$FF21,35                                    :REM  INC HL
60060 POKE$FF22,203:POKE$FF23,121                     :REM  BIT 7,C
60065 POKE$FF28,202:POKE$FF29,32:POKE$FF2A,255        :REM  JP Z,FF20
60070 POKE$FF30,184                                   :REM  CP B
60075 POKE$FF31,202:POKE$FF32,64:POKE$FF33,255        :REM  JP Z,FF40
60080 POKE$FF38,4                                     :REM  INC B
60085 POKE$FF39,195:POKE$FF3A,32:POKE$FF3B,255        :REM  JP FF20
60090 POKE$FF40,34:POKE$FF41,8:POKE$FF42,255          :REM  LD(FF02),HL
60095 POKE$FF47,201                                   :REM  RET
60110 LIMIT $FEFF
60130 CONSOLE C40
60140 PRINT "          PROGRAM LISTING"
60160 WRT 4,CHR$(27),"A",CHR$(8),CHR$(18),CHR$(20)
60180 PRINT CHR$(1);:INPUT "   INPUT START LINE NO    ";LS
60200 J=29276:F1=0:F3=-1
60300 K=PEEK(J)+PEEK(J+1)*256
60350 IF PEEK(J+2)+PEEK(J+3)*256<LS THEN J=K:GOTO 60300
60370 CONSOLE C80
60400 K=PEEK(J)+PEEK(J+1)*256:OP$=""
60500 FOR I=J+4 TO K-1
60600 IF PEEK(I)=34 THEN F3=F3*(-1)
60650 IF (F1=1)+(F3=1)+(PEEK(I)<128) THEN OP$=OP$+CHR$(PEEK(I)):GOTO 61080
60670 POKE $FF02,50:POKE $FF03,24
60700 IF PEEK(I)=128 THEN I=I+1:POKE $FF02,145:POKE $FF03,22
60800 POKE $FF00,PEEK(I)
60900 USR($FF10)
60930 KW$=""
60970 N=PEEK($FF08)+PEEK($FF09)*256
61000 IF PEEK(N)<128 THEN KW$=KW$+CHR$(PEEK(N)):N=N+1:GOTO 61000
61030 KW$=KW$+CHR$(PEEK(N)-128)
61050 IF KW$="REM" THEN F1=1
61070 OP$=OP$+KW$
61080 NEXT I
61100 WRT 4,PEEK(J+2)+PEEK(J+3)*256;" ";
61200 IF LEFT$(OP$,3)><"REM" THEN WRT 4,OP$;:GOTO 61400
61230 IF LEN(OP$)=4 THEN WRT 4,"REM";CHR$(13);:GOTO 61400
61270 FOR A=4 TO 80:IF MID$(OP$,A,1)=" " THEN NEXT A
61280 TL=LEN(OP$)-A
61290 IF TL*2>71 THEN WRT 4,OP$;:GOTO 61400
61300 WRT 4,"REM";SPACE$((71-TL*2)/2);CHR$(14);RIGHT$(OP$,TL+1);
61400 PRINT PEEK(J+2)+PEEK(J+3)*256;" ";OP$
61500 IF PEEK(K)+PEEK(K+1)><0 THEN J=K:F1=0:GOTO 60400
61600 END
```

High-resolution dump.

```
10 PMODE 4:SCREEN 1,1
20 FOR A = 0 TO 31
30 PRINT #-2,CHR€(27);"3";CHR€(24);
40 PRINT #-2,CHR€(27);"K";CHR€(191);CHR€(0);
50 FOR B = 1 TO 191
60 P = PEEK (7680 - (B * 32 - A))
70 PRINT #-2,CHR€(P);:NEXTB
80 PRINT #-2,CHR€(10);:NEXTA
90 GOTO 90
```

DRAGON 32

High-resolution dump

THIS PROGRAM by S J Combes of Bishop's Stortford, Hertfordshire works for PModes 3 and 4. It executes in 2.5 minutes although it does not use machine code, and dumps the screen to an Epson MX-80 MkIII. This speed improvement over the program by R A Shackleford, published in the April issue of *Practical Computing* is achieved by Peeking high-resolution screen memory and sending the values direct to the printer.

In PMode 4 the screen is stored as 192 horizontal lines of 32 bytes. If a bit is set the corresponding pixel is also set. The printer expects the bytes to be aligned vertically, which means that the picture must be printed on its side. This is a

welcome advantage as it allows side-by-side printout of page 1 and page 2 graphics.

PMode 3 is more complicated. Two bits are used for each pixel and are coded as shown in table 1. Areas of red or orange appear black; areas of blue, magenta, yellow and cyan appear grey; and green/buff appears white. To invert the picture add the line:

```
65 P = 255 — P
```

To print both screens side by side add:

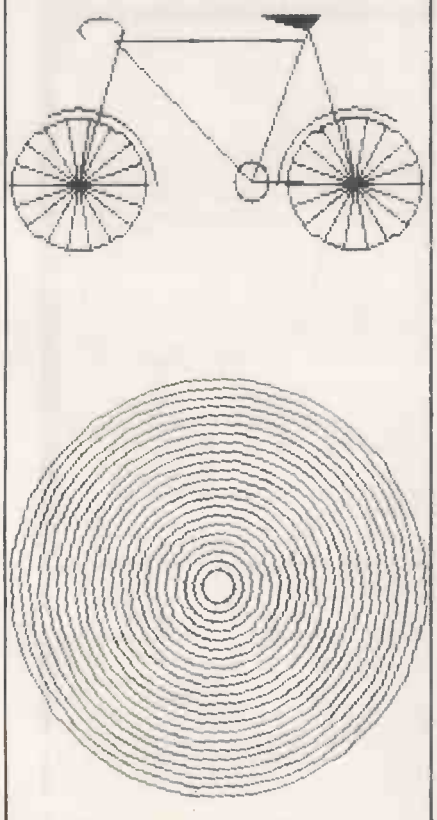
```
72 PRINT# –2, CHR£(27); "K"; CHR£
   (191); CHR£(0);
74 FOR B = 1 TO 191
76 P = PEEK (13824 – (B * 32 – A) )
78 PRINT#2, CHR£(P); :NEXT B
```

It is not necessary to merge the program to copy the screen since the high-resolution screen remains in memory after a New or a CLoad. Note that circles become ellipses when dumped. They must therefore be given a height to width ratio of 0.83 when drawn.

High resolution dump table 2.

Line	Function
10	Displays what is being printed on screen
30	Sets line spacing to 24/216 in.
40	Enter bit image mode for 191 characters
60	Peek screen location

High-resolution dump sample output.



NASCOM

THIS SHORT routine by G Winstanley of Stoke-on-Trent enables professional standard mainframe or minicomputer communication via the RS-232 serial interface. Input/output is achieved via the standard Nascom Uart, and connection to and from the Modem is to the user-available serial I/O socket.

Using the selection links of LSW2, it is possible to have speed selections of 110,300 and 1,200 baud. The only hardware modification required, and that is optional, is the connection of an acoustic warning device to bit 4 port 00H, the unused bit of the keyboard port. Control-R reinitialises the program.

The program has been kept short with the inclusion of some monitor subroutines and one restart instruction. The Blink routine maintains a blinking cursor and waits for input. It returns with the character in register A, and it is possible to detect whether input has occurred via serial in, or keyboard. One possible problem could arise if your host computer makes use of special control codes. Blink services certain control codes, such as Cursor Up, Down, etc. within itself.

Xout performs Uart output with handshaking. It is only necessary to place the output character in location OUTP prior to calling. The Kbd routine prints a character to the Nascom screen. The Cler routine clears the screen and RST 28H prints on the screen the ASCII string following, up to the first null character 00H.

Nascom as terminal.

```
                0010 ; ** NASCOM COMPUTER TERMINAL PROG. **
                0020 ;ROUTINES PERMIT TWO-WAY COMUNICATION
                0030 ;VIA RS232
                0040 ;NASCOM BECOMES A PROFFESSIONAL STANDARD
                0050 ;REMOTE TERMINAL FOR FULL DUPLEX USE
                0060 ;
                0070 ;G.Winstanley OCTOBER 1982
                0080 ;
4000            0100        ORG   4000H
                0110 ;
4000 0078       0120 BLINK  EQU   0078H    ;CURSOR & INPUT SUB.
4000 0706       0130 XOUT   EQU   0706H     ;OUTPUT ROUTINE
4000 0030       0140 KBD    EQU   0030H      ;SCREEN O/P
4000 080A       0150 SCRE   EQU   080AH     ;TOP LINE POSITION
4000 08CA       0160 POS    EQU   08CAH      ;NEW CURSOR  POS.
4000 03FA       0170 CLER   EQU   03FAH     ;CLEAR  SCREEN
4000 0C29       0180 CURS   EQU   0C29H     ;CURSOR POS. LOCATION
4000 0C28       0190 OUTP   EQU   0C28H    ;OUTPUT BUFFER
                0200 ;
4000 210640     0210 INIT   LD    HL,TINI     ;SOFTWARE PIO RESET
4003 E5         0220        PUSH  HL
4004 ED4D       0230        RETI
4006 CDFA03     0240 TINI   CALL  CLER      ;CLEAR SCREEN
4009 210A08     0250        LD    HL,SCRE     ;INIT.MESSAGE
400C 22290C     0260        LD    (CURS),HL
400F EF         0270        RST   28H         ;PRINT @ TOP
4010 2A2A204E   0280 TABL   DEFM '** Nascom Computer Terminal **'
     6173636F
     6D20436F
     6D707574
     65722054
     65726D69
     6E616C20
     2A2A
402E 00         0290        DEFB  00H
402F 21CA08     0300 TASS   LD    HL,POS      ;PLACE CURSOR
4032 22290C     0310        LD    (CURS),HL
4035 CD7800     0320 TAPP   CALL  BLINK     ;READY TO INPUT
4038 2010       0330        JR    NZ OOT
403A FE12       0340        CP    12H         ;RESET=CONTROL R
403C 28C2       0350        JR    Z INIT      ;RE-INITIALISE
403E FE07       0360        CP    07H         ;BELL CODE?
4040 2812       0370        JR    Z BELL
4042 32280C     0380        LD    (OUTP),A   ;FOR OUTPUT
4045 CD0607     0390        CALL  XOUT      ;NASCOM O/P
4048 18EB       0400        JR    TAPP
404A 00         0410 OOT    NOP
404B FE07       0420        CP    07H         ;BELL CODE?
404D 2805       0430        JR    Z BELL
404F CD3000     0440        CALL  KBD       ;OUTPUT-SCREEN
4052 18E1       0450        JR    TAPP        ;BACK TO COMUNICATE
4054 3E10       0460 BELL   LD    A,10H       ;BIT 4 PORT 00=BELL
4056 D300       0470        OUT   (00H),A
4058 11FF1F     0480 LOPP   LD    DE,1FFFH    ;APPROX 0.1 SEC
405B 1B         0490 DEP    DEC   DE
405C 7A         0500        LD    A,D
405D B3         0510        OR    E         ;COUNT=ZERO ?
405E 20FB       0520        JR    NZ DEP
4060 18D3       0530        JR    TAPP
```

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While microcomputer magazines abound, very few are as well established or as highly regarded as PRACTICAL COMPUTING, now in its sixth year of publication. The magazine concentrates on the serious side of personal computing, providing authoritative reviews of micros (mainly in the £500 — £5,000 price bracket) and the most interesting new software.
Each issue contains a special section devoted to an important area of computing such as languages, databases or printers and plotter. In addition, there are regular features on practical applications, education and an Open File section to which readers contribute their own programs.
But there is no room for complacency in this fast-moving market! In order to keep PRACTICAL COMPUTING as one of the country's leading microcomputer magazines, we have made a number of improvements, with more to follow. These are:-

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3. **Computerised FREE Reader Enquiry Service**
4. **Increased staff levels to provide an even better service to advertisers and readers alike**
5. **Re-designed (from November) to make PRACTICAL COMPUTING more attractive and easier to read**
6. **Recent Reader Survey providing important details on our readership**

However, these improvements have been made against a background of rising costs which have forced us to increase our advertisement rates from the January 1984 issue. All our advertisers with an existing series booking in-house will be given rate protection.
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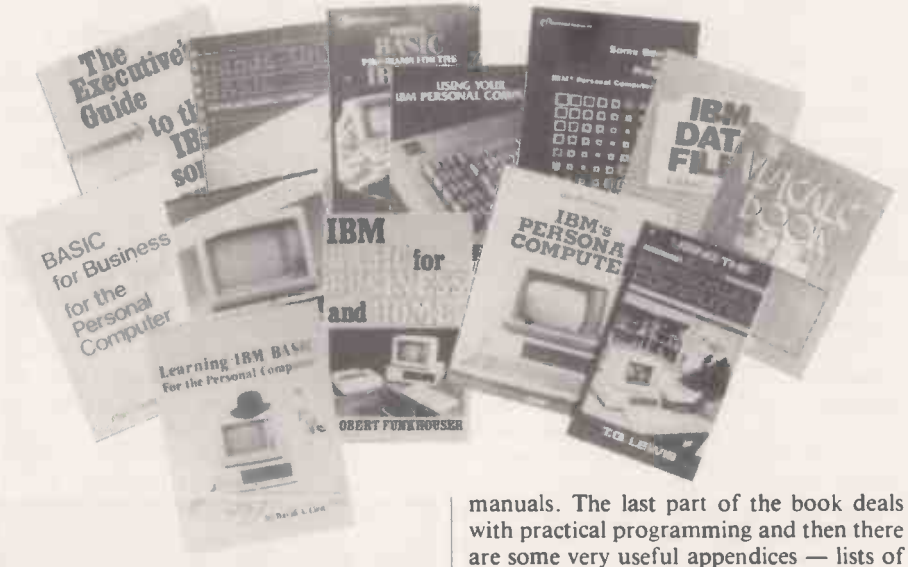
IBM PC books

Jack Schofield makes his selection.



ALL THE IBM PC BOOKS received so far are American, not surprising since in America the machine has a larger share of the market than in the U.K. Systems stretch from 16K cassette-based models used as home computers, to 544K models with hard discs used in major corporations. The range of IBM PC books, not surprisingly, matches the range of PC applications.

At the beginners' level there are already a number of books which aim to teach simple Basic programming. Probably the best of these is David A Lien's *Learning IBM Basic for the Personal Computer*. This features the PC in its Charlie Chaplin disguise, and is illustrated with cartoons.

David Lien is the serious, highly respected author of the invaluable *The Basic Handbook*, published by Compusoft. However, his IBM book wallows in the worst excesses of the down-home American style. You do not so much read the book as sit grimacing while it talks off the page at you. Awwk!, Shew!, Wow! and Oooops! are typical of its interjections. Many sentences are somewhat lacking from a grammatical point of view and not all the jokey analogies strike home.

However, the book is sound from the computing point of view. It contains lots of short example programs and all the ones I tried actually worked. The book is, therefore, probably a good choice if you can stand the style.

Hands-On Basic for the IBM Personal Computer by Herbert Peckham is a machine-specific version of a previous book, *Basic: A Hands-on Method*, with graphics and sound sections added. The style is much more serious than in Lien's book. It is textbooky, perhaps because Peckham used to be a professor at Gavilan College. Each chapter has about seven sections: objectives, discovery exercises, discussion, program examples, problems, practice test. It could be used in a classroom or for self study, but it is not as informative, as readable, or as easy to dip into as Lien's volume.

Basic for Business for the IBM Personal Computer is also organised like a text-book, complete with ruled blank pages for you to write answers to set exercises. It is not a particularly entertaining book, but Alan Parker has managed to write in a straightforward way with as little jargon as possible. It should therefore be accessible to the average small businessman. The main topics covered are calculation, data entry and file keeping, though there is also a chapter on using VisiCalc.

The illustrations include a lot of flow-charts and sample runs of programs. Many of the programs included are quite long but excessively well documented, and do fairly useful things like sorting or writing receipts. Naturally all the examples and analogies are businesslike. While the thought of businessmen running their companies on home-written Basic software fills me with horror, at least working through the book would give them some idea of how to evaluate packaged software.

IBM Data Files: A Basic Tutorial is like *Basic for Business*, only more so. The question-and-answer bits are no more than quick quizzes — no bad thing — and the text is even easier to follow. It contains a lot of sensible hints and tips that obviously come from experience because they only occur to people who have tried to explain computing to half-wits.

On the other hand, as well as illustrative examples the book also contains some very long useful programs. A Home Inventory System, for example, comprises 18 pages of listings and the author shows how it could be converted into a back-order system for small business use. The programs are modular, logical and well documented; they look as though they should work. So although *IBM Data Files* sounds more limited than other works, it is as educational and probably more useful than its rivals.

IBM Basic for Business and Home starts right at rock bottom with, "What is a Computer?, What is ROM?" and similar questions. The answers are very short so the book moves at a fast pace. The main part of the book is a guide to Basic keywords, which provides shorter and simpler accounts than are found in IBM's own manuals. The last part of the book deals with practical programming and then there are some very useful appendices — lists of commands and such like.

What the total package provides is a sort of potted version of the manuals, so the beginner can actually start computing more or less straight away. The book is unlike others reviewed earlier in that the author assumes the use of a proper PC set-up, including disc drives and a printer. He appreciates that most of the time users will be running packaged software. It is a sensible and useful book, which IBM ought to pack with its machines; it would certainly save their dealers more than its cost in time.

For people who just want Basic programs to type in there are two volumes on offer. *Some Common Basic Programs for the IBM Personal Computer* is the familiar Osborne/McGraw-Hill book. It is available in other editions for other micros including Pet, Atari, TRS-80 and the Apple II. There are 76 programs in all, which fall into four main categories: finance, maths, statistics and utilities. Examples include the usual interest-rate calculations, angle conversion, binomial distribution and sorting.

However, having reviewed the Atari version of this book in *Practical Computing* a few months ago I have two

(continued on next page)

(continued from previous page)

comments to make. The conversion of the programs to the specific machines shows the minimum of effort. Things like function keys, error trapping, graphics and sound are ignored. Also, before you buy the book think about whether you really need the programs.

The second book of programs, *Useful Basic Programs for the IBM PC*, is about half as big. It contains 65 programs organised into seven chapters and three appendices, and covers the usual topics such as maths, home finance and data analysis. Most of the programs are only about 20 lines, half a page, long and again, unless you are an absolute beginner, you could probably write them just as easily yourself.

There are a number of books which deal with operating the IBM PC in general without being tied to Basic, though of course Basic programming is a major feature of most of them. *IBM Personal Computer: An Introduction to Programming and Applications* is aimed at novices, and about 80 percent of the content is about Basic. In most of the book, however, the focus of attention is not on the language itself but on applications, such as, filing, graphics, word processing, games and science.

One version of the book comes packed in a box with a disc containing all the programs. As you might expect in a beginners' book, however, the level is pretty trivial. Overall the book seems adequate, though it is hard to enthuse over it. Perhaps I was just put off by the *Popular Computing* review quoted in large red letters across the cover: " ... you should definitely buy [this] book ... ". It would not be my first choice.

Using Your IBM Personal Computer is Lon Poole's effort. He has been involved in the production of books for other machines including the *Apple II User's Guide* and *Your Atari Computer*, which is much the best Atari book available. His IBM PC effort is similar in approach, and also very good. If you had no other documentation at all you could probably learn the PC from this book. It deals with setting up the system, discs and disc copying and even batch processing in part one, since this is where the average PC user will start. It is only in part two it moves on to Basic programming.

Actually Poole takes some stuff for granted, but he is excellent on the things that are not intuitively obvious, such as numeric strings and formatting output, and things that are particular to the PC. He is also very good on sound and graphics and working the printer. The book has some useful appendices including a Basic summary, tables of screen characters and codes, and an unusually good index. It is a very useful book for someone who is new to the IBM PC, but not necessarily new to computing. It would be ideal for easing the transition from, say, a Vic-20.

T G Lewis's book *Using the IBM Personal Computer* is even less devoted to Basic. In fact, the Basic interpreter gets less space than using VisiCalc, and only slightly more than the Pascal compiler. Unlike Poole, however, Lewis does not assume a familiarity with computing. The first chapter is "What can computers do?" He deals with the subject briefly but intelligently. All through the book Lewis manages to produce the best kind of technical writing: he is specific without being verbose, readable without being patronising.

Of course he is not without idiosyncrasies. No-one christened Theodore Gyle, who dedicates a computer book "To life in the Oregon hills", can be completely normal. However, he is writing for people with disc-based systems who want to do serious things and run packaged software, and he never loses sight of this.

However, the discussions of VisiCalc and Easywriter are very good, unless you happen to have bought Multiplan and Wordplus-PC, or whatever. Also, although the book is illustrated with screen photos these are very badly taken, and the cover picture, supplied by IBM, is awful.

If you really do have VisiCalc, then perhaps you want *The VisiCalc Book for the IBM Personal Computer*, by Donald Bell. It condenses a mass of instruction into around 340 pages. As far as I can see VisiCalc does not much care what it runs on, it always works in the same way. So while this may be a useful book it is hard to see the addition of the IBM name as much more than a marketing ploy. I have found the VisiCalc manual provides more information than I actually need, though people who want to push the program to its limits will be glad of the extra help.

IBM's Personal Computer is completely different, and I found it valuable. It is the book to buy before you buy an IBM PC, because it provides all the technical information you need. It shows how the PC fits into IBM's product range and how it fits into the micro market. It provides a full specification of the system with illustrations, plus good descriptions of the systems software and communications protocols. It also methodically evaluates some of the software: VisiCalc, Easywriter and the Peachtree series, plus a few small programs including games.

The resulting volume would be useful to an established data processing department thinking of adding PCs, or to a business user who is about to acquire one. Because it deals with warranties and sales outlets the book's American origins are sometimes a limitation, but otherwise this is a very handy book to have around.

The Executive's Guide to the IBM Personal Computer is clearly no ordinary book. The title is majestic. This ring-bound manual comes in a slip case like a software package with two floppy discs in a holder at the back.

But as I started to flick through it, I had an overwhelming feeling of *déjà vû*. Had I just seen too many IBM PC books? No, I really had read it before. It seems to be page-for-page exactly the same as *Basic for Business*, reviewed here, except that the discs and package inflate the price from £12.70 to £33.95.

Basic for Business for the IBM PC by Alan J Parker. Published by Reston Publishing, Prentice/Hall International, £12.70. ISBN 0 8359 0355 9.

Hands-On Basic for the IBM Personal Computer by Herbert Peckham. Published by McGraw-Hill, £16.50. ISBN 0 07 049178 X.

IBM Basic for Business and Home by Robert Funkhouser. Published by Reston Publishing, Prentice/Hall International, £12.70. ISBN 0 8359 3018 1.

IBM Data Files: A Basic Tutorial by David Miller. Published by Reston Publishing, Prentice/Hall International, £12.75. ISBN 0 8359 3026 2.

IBM Personal Computer: An introduction to Programming and Applications by Larry Joel and Martin Goldstein. Published by Robert J Brady, Prentice/Hall International, £13.35 or £27.95 including disc. ISBN 0 89303 111 9.

IBM's Personal Computer by DeVoney and Summe. Published by Que Corporation, distributed in the U.K. by The Computer Bookshop, £10.45. ISBN 0 88022 100 3.

Learning IBM Basic for the Personal Computer by David A Lien. Published by Compusoft Publishing, 1050-E Pioneer Way, El Cajon, California CA92020, $19.95. ISBN 0 932760 13 9.

Some Common Basic Programs: IBM Personal Computer Edition by Poole, Borchers and Burke. Published by Osborne/McGraw-Hill, £12.50. ISBN 0 931988 83 7.

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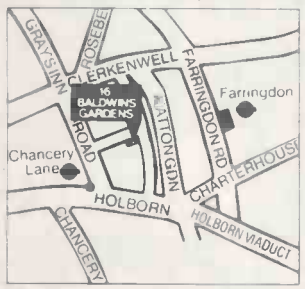

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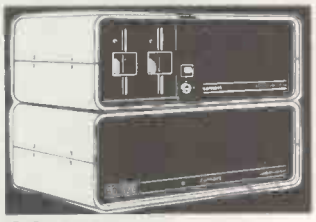

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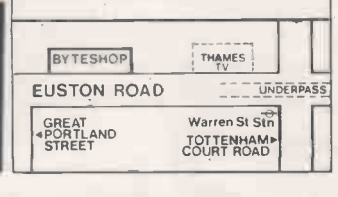

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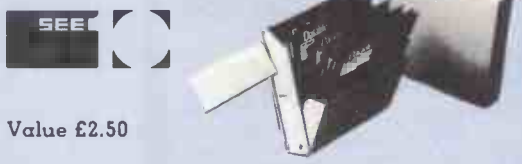

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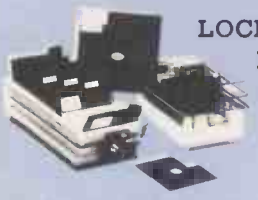

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Hello Houston, we have a problem

Chris Naylor tells how to enhance cognitive appraisals with a knowledge update

THOSE OF US who are sufficiently grey-haired and decrepit to remember the heady days of space exploration may recall a particular conversation which took place on April 13th, 1970.

"Hey, we've got a problem here!"

"This is Houston. Say again, please."

"Houston, we've had a problem. We've had a main bus B interval."

"Roger. Main B interval. OK. Standby 13. We're looking at it."

"OK. Right now, Houston, the voltage is looking good . . . We had a pretty large bang associated with the caution and warning there. And, if I recall, main B had an amp spike on it once before."

"Roger, Fred."

The exchange took place between Apollo 13 en route to the moon and ground control in Houston and the question that then sprang to the mind of the listener was: What exactly, or even roughly, was it all about? The "problem" was, in fact, that Apollo 13 had just blown up. There is something about the American way of describing things that is singularly impenetrable and, of late, this Houston-ese has been creeping into the computer world at an alarming rate. The reason is simple: nobody has anything interesting to say about computers, but everyone wants to create the opposite impression.

Computers, unlike spacecraft, rarely go to the moon and rarely blow up. The things they do are relatively commonplace, and to state the truth of the situation tends to deprive the speaker of the glamour which he or she may feel to be their due.

The problem is most severe for newcomers to the game. They themselves cannot always see through the speech-opacity of the experienced computer-person and, worse, they have a limited capacity for generating opaque speech, which makes it difficult for them to join in the game. So here, by way of education, is a typically workaday example of how you should, really, explain computers.

We wrote a program. We thought it would work . . . .

"We have approached the problem with a real-world orientation and come to the following conclusions. That the problem, as a problem, possessed an implementable structure not limited to the realm of theoretically possible machines but including, also, realisable machines. That, of those realisable machines, at least one such machine had been realised in fact and that a mapping of the problem from the abstract domain into the domain of this realised machine was, in fact, feasible given the right approach. Further, we believed that such a mapping would produce a specific solution which would prove to be both time and space feasible in the new domain. With this in mind we moved at once towards an implementation-achieved type of goal in order to generate a suitable test pattern of theory against a reality-based solution."

. . . but the program was too big.

"At this stage in the process, run-time parameters revealed that the real-world implementation was, initially, alpha-complex to a degree that imposed constraints. By alpha-complex, if we may define a few terms, we mean that a minimal string representation of the problem with no time requirement for implementation was space-infeasible."

We tried to get it to work. . .

"The problem then became one of attempting for a minimax solution in which both the maximum alpha-complexity and the maximum beta-complexity were both simultaneously held to a minimum compatible with execution in the original problem domain. We were motivated in this by a belief that the problem in hand was, at least, semi-tractable."

. . . and it is too slow.

"Moving next to a space-minimal representation with no upper bound to the space requirements revealed a situation in which the implementation was beta-complex, again to an extent that imposed constraints of an unacceptable nature. By beta-complex, we naturally mean that a solution based on a minimal time requirement with an unbounded space requirement lead to a minimal string representation of the second type."

Unfortunately the manual is not clear . . .

"Using paperware look-up we attempted to get a better fix on the specific sub-problem domain by recourse to existing bodies of knowledge whereupon it appeared that the exact sub-problem was one of a class not covered within the general domain of paperware solutions."

. . . which is funny, because we wrote it.

"This produced some cause for internal consultation and investigation with respect to paperware origination in the hope of pre-empting further situations that might be classified as similar."

We could try a different problem . . .

"Alternatively, we could go for a minimax solution to both the problems of alpha complexity and beta complexity in which the representing string was also current hardware feasible thus allowing a shift in the initial problem domain into the area of that class of problems which have epistemologically adequate solution representations in current hardware terms."

. . . but this one has us beaten.

"Given the foregoing remarks, we are inclined to think that the problem may belong to a class of genuinely hard problems for which no epistemologically adequate solution exists which is both time-minimal and space-minimal due to the problem's alpha-complexity and beta-complexity. Further, should a heuristically adequate representation exist then we doubt that such a representation would genuinely map on to the problem domain in question in a sufficiently thoroughgoing fashion to permit of adequate reliability."

Our invoice will be with you in the morning.

"Related to the foregoing remarks we would note that a paperware solution does exist in relation to the sub-problem of perceived fiscal constraints inherent in a project of this sort and that this solution is both space and time feasible in relation to yourself. And that the sort of, approximate, timescale envisaged is little more than a standard reckoning of twenty-four hours. This particular aspect of the problem may seem semi-hard, but we assure you that it is, in every sense, tractable."

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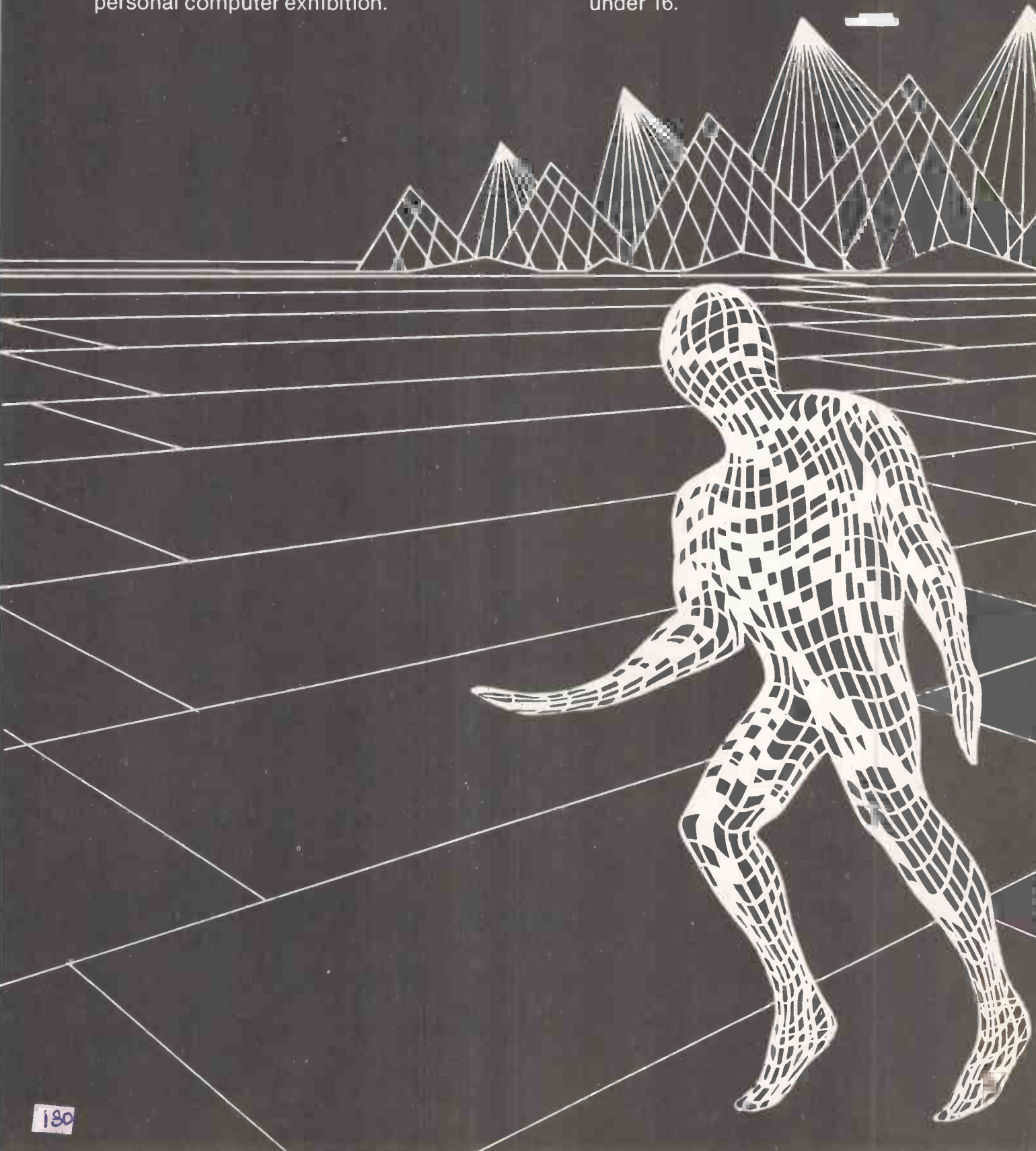

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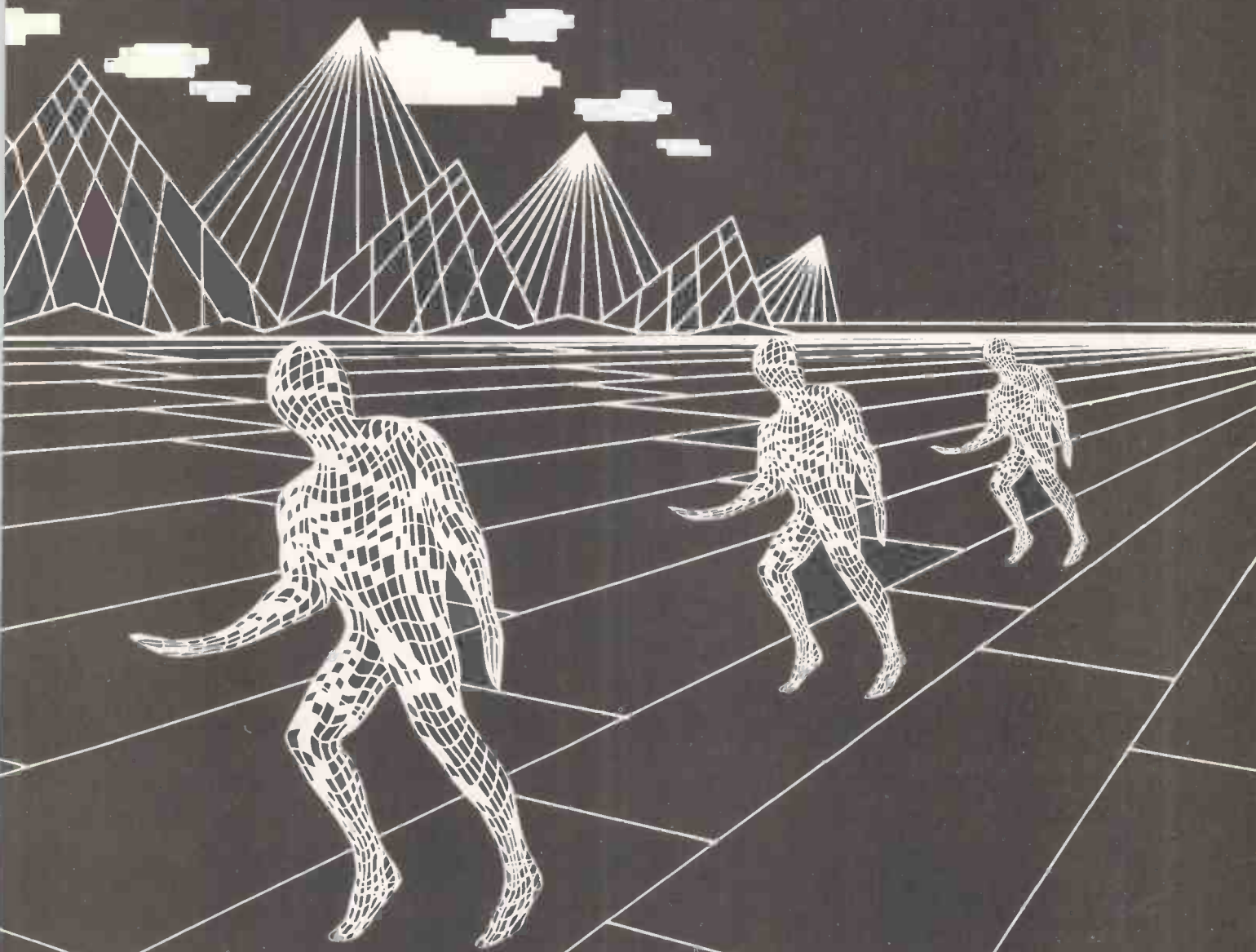

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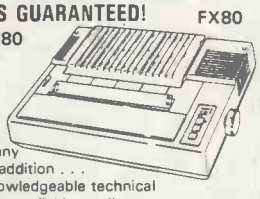

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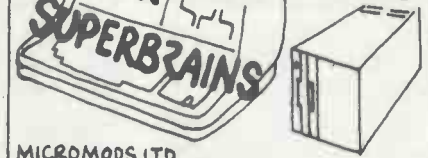

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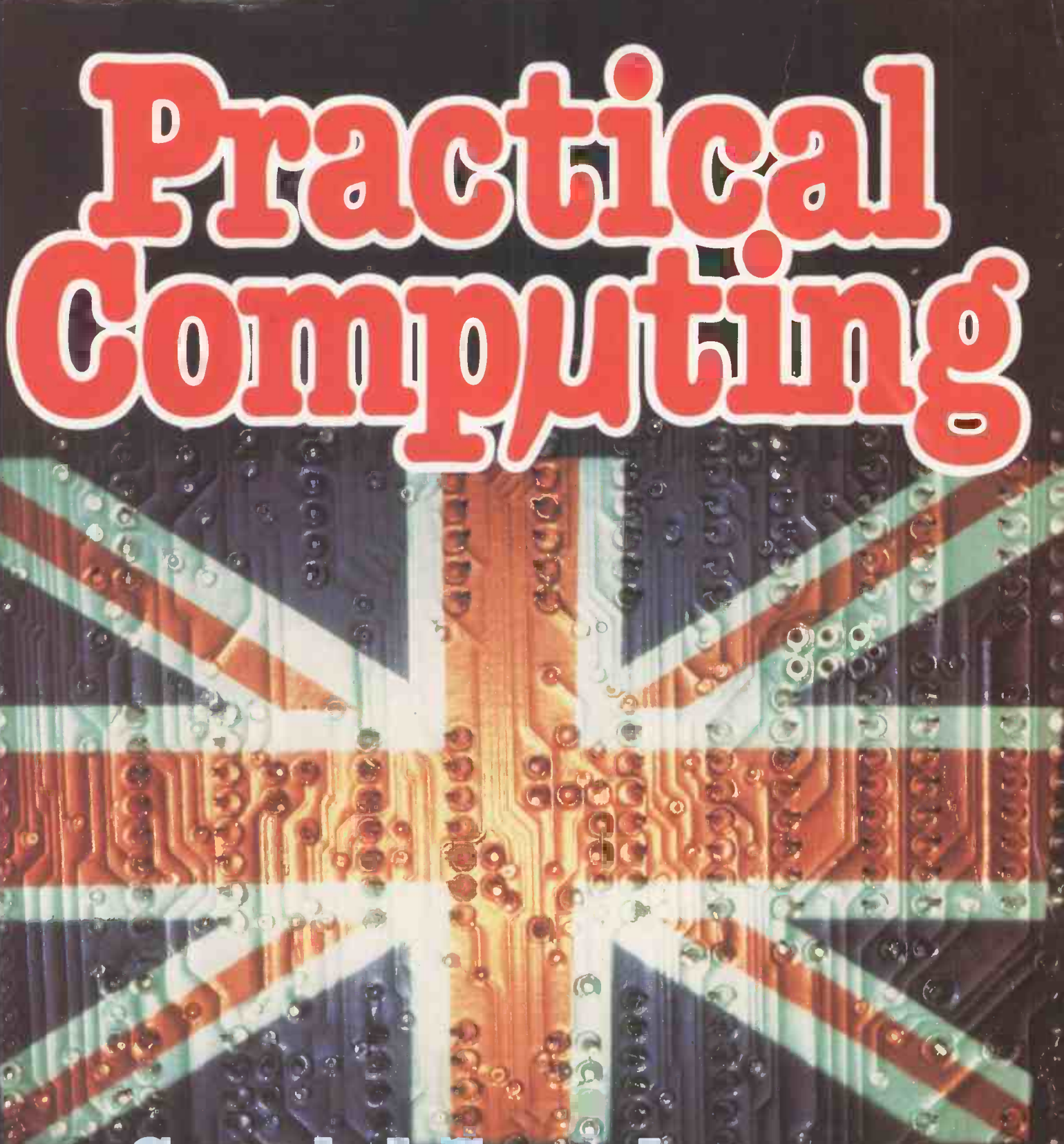

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Published as a supplement to Practical Computing, October 1983

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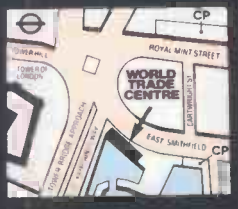

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Why British?

STOP THE AVERAGE man in the street and ask him how many British micros there are. Numbers like 10 and 20 sound reasonable. In fact we managed to find over 60 companies involved in manufacture, and the number of models is well over a hundred.

Why should anyone care? For a start, schools and local government agencies are recommended to buy British equipment. In certain cases there are financial incentives to encourage it. Some companies and individuals want to buy British for patriotic reasons. Others may be involved in mutual trade. Yet others have special requirements that can only be met by having equipment adapted or customised. And generally it is possible to get a better level of technical support and involvement from a local company, which can be very important. If you have a real problem and persevere, you can often get to talk to the designer, or at least to the guy who wrote the manual. Fat chance of doing that with, say, a Korean product. Finally, the British product may be better, or cheaper or both. Buying British can mean buying best.

But what is a British micro? That is a rather tricky question. Microcomputer manufacture has become a global industry. The components involved are so small they can easily be airfreighted round the world.

Some components, such as ULAs, uncommitted logic arrays, and teletext chips may well originate in the U.K. or the U.S., while many others, such as standard TTL, transistor-transistor logic, and RAM, random access memory, chips originate in Malaysia, Indonesia, Japan and other parts of the Far East.

Printed circuit boards can be made anywhere, though the labour-intensive task of stuffing boards — inserting components — is frequently done where labour is cheaper than in the U.K. Final assembly and casing is more likely to be done close to the final market place, because the finished micro is bulkier to transport and more fragile.

The net result is that a micro may not really be made in any one place. The Oric, for example, uses a ULA made in America and the boards are stuffed in Singapore. But as the final assembly and casing takes place in the U.K., to the specification of a British design by a British company, we count this as a British micro.

For the same reason we count the Acorn BBC Micro as a British product, though it contains many foreign parts. This popular computer is, in fact, manufactured in several different places, including England, Wales and the Far East. The new Acorn Electron, however, is made in Malaysia.

There are some foreign machines which are, by contrast, made in the U.K. For example, both the Commodore 64 and the IBM Personal Computer are American micros, and most samples to date have been made in the United States. However, Commodore has recently opened a factory in Corby, Northants, to make the Commodore 64. IBM has a factory in Greenock, Scotland where IBM PCs are being made — and this production line will eventually supply all of Europe, North Africa and the Near East. A Scottish-made IBM PC must be at least as patriotic a purchase as a foreign-made BBC Micro.

At any rate, the person who does want a British-made micro is forewarned. Our criteria for including firms in this Supplement may not be yours. The knowledgeable reader will also spot a number of omissions for the listing. These have arisen for various reasons. reasons.

First, we have not included some badge-engineered models. For example, British Telecom is now selling British micros under its Merlin brand label, but these are — as far as we can tell — substantially the same as ICL's Personal Computer and the Logica VTS. So even though the boxes look different, we have not listed some machines where the insides are the same. However, note also that some companies may put different boards in the same standard boxes, and these are different micros though they look the same.

Second, some companies such as Microware, Saga Systems and IEL are on the point of launching systems, but at the time of compilation we did not have enough information to include a full listing. These are for reference only.

Third, the distinction between micros and minicomputers is blurring. The differences include the type of central processing unit, the design — whether desk-top or floor-standing — the way it is sold, and the price. We tried to include micros and exclude minis. However, while to a Spectrum user the Britannia and Equinox

machines will look like minis, to a mini-maker they look like micros. At the borderline, inclusion is close to arbitrary, because the distinction itself is arbitrary.

Fourth, we mailed survey forms to all the British micro companies we could think of, and some 10 percent did not bother to return them. Many failed to respond even to repeated telephone calls, and have been excluded. Others may have ceased manufacturing, or moved, or else we have just missed them for reasons unknown. If they are not here they may still be British micro manufacturers — and if they get in touch, we will include them next time.

What is not in doubt is the scope and vigour of the British microcomputer industry. This supplement provides a valuable source-book to one of Britain's burgeoning industries. We hope you find it both useful and interesting.

Editor Jack Schofield, Art Editor Steve Miller, Editorial Production Sally Clark, Editorial Secretary Sandra Smith, Contributors: Ian Stobie, Sarah Underwood, Della Bradshaw, Ad Manager Ian Carter on 01-661 3021. Editorial address: Practical Computing, Room L306, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Telephone: 01-661 3609. This supplement is distributed free with the October 1983 issue of *Practical Computing* and may not be sold separately. **ISSN 0141-5433. Typeset by Centrepoint Typesetters, London EC1, and printed by Eden Fisher (Southend) Ltd, Southend-on-Sea.**

Cover shows the main board of the BBC computer, made for Acorn by ICL at Kidsgrove in Staffordshire.

ABS COMPUTERS

Address: North Street, Portslade, Brighton, Sussex.
Telephone: (0273) 421509
Telex: 81488
Company founded: 1971
Number of employees: 150
Origin of name: Registered as Allied Business Systems Ltd. Adopted current trading title in 1980.
Parent company: Trafalgar House plc

ABS Computers was one of the first manufacturers of minicomputers to provide complete business-computing solutions on the Multibus mini-range. In 1974 the company became part of the Trafalgar House group, and continued on a steady path of growth and development, launching the current MX mini-range in 1980. Today it is one of the few remaining British minicomputer manufacturers to maintain its entire research, development, design and manufacturing operation in the U.K., at its purpose-built factory in Brighton.

The Orb micro is made at ABS' own factory in Brighton, and is intended for small business and scientific use. Unusual aspects are that the housing is circular and available in a variety of bright colours.

Also, the micro uses the advanced Intel iAPX186 16-bit chip, and supports multi-user multi-tasking operation. With 256K of RAM and two VDUs and 2Mbyte of disc storage the Orb costs £5,950. Extra terminals cost £750 each.

ACORN COMPUTERS

Address: Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN
Telephone: (0223) 245200
Telex: 817875
Company founded: 1978
Number of employees: 250
Turnover in 1982/83: £45 million

Acorn's first small home micro, the Atom, was launched in 1979. In 1981 Acorn won the contract to produce the BBC microcomputer, and volume production started in 1982 to coincide with the BBC's first series of programmes on computer literacy. By mid 1983 over 140,000 BBC micros had been produced and comprise 80 percent of all micros used in schools. In August 1983 Acorn launched the Electron home micro designed to be compatible with and compliment the BBC micro.

Although Acorn established its reputation with the Atom, it was winning the contract to produce the BBC Microcomputer

that made its fortune. The attractions of the machine are its excellent BBC Basic and colour-graphics facilities, its proper keyboard, and its built-in expandability. While it uses the well-known 6502 microprocessor, it is a very fast computer, and it is claimed that more advanced chips will be added later via the Tube interface.

All these facilities make it suitable for home/games use, for small business use if the software becomes available, and, most of all, for education. It is very popular in schools and a number of BBC Micros can be linked together on an Econet local area network. Now that initial operating system and supply problems have been overcome, its limitations are that it is not designed and finished as a real consumer product, and it is somewhat expensive by comparison with rivals such as the Commodore 64 and Atari 800.

The BBC Micro now has a new rival in the form of the Acorn Electron. This has many of the advantages of the BBC microcomputer, and at around £199 is half the price of a BBC Model B. However, it is manufactured in Malaysia.

ACT (HOLDINGS)

Address: 111 Hagley Road, Edgbaston, Birmingham B16 8LB.
Telephone: 021-454 8585
Telex: 339396
Company founded: 1965
Number of employees: 400
Turnover in 1982: £8 million

ACT was founded in 1965 as computer bureaux and pioneered the concept of packaged software. Today, as Britain's second largest computer company with a current turnover of £50 million, ACT's activities span microcomputer manufacture and distribution, software development and sales, computer maintenance, computer stationery printing, office supplies, research and developing new computer systems and bureau services. ACT currently leads the U.K. 16-bit market with its Sirius 1 personal computer and the Pulsar range of business software. Its new microcomputer development, Apricot — the first fourth generation machine — has already been haled as a world-beater.

(continued on page 9)

80-BUS SOLUTIONS

GM813–CPU/64K RAM Board
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The Galaxy 3 computer shown has two empty slots, in a 5 board 80 Bus format, for simple addition of Gemini Multiboards to develop your own requirements.

The Gemini MultiBoard Microsystem provides a range of 15 fully-compatible microcomputer boards, which can be used to configure solutions for micro processor problems, from as many as 10 boards, to just 1. This flexibility is due to Gemini's adoption of accepted industry standards; especially the 80-Bus, specifically designed for the Z80 microcomputer which forms the heart of the MultiBoard system.

The principle advantage of a Z80 Bus system is the abundance of software available operating under CP/M, by which software becomes machine independant; providing the user with the widest range of software available.

There is also the opportunity to develop systems based on the Galaxy 3 computer (shown above) which uses Gemini MultiBoards, but has 2 spare slots in a 5-board frame for particular configurations. Alternatively, the Galaxy 2 provides a cost-effective development tool with 3 spare slots in a 6-board frame.

With MultiBoard thousands of permutations are possible. Eight of our most popular boards are shown here, but there is a range of 15 available; together with mother boards, frames, cables, power supplies, key boards and compatible software if required. A comprehensive catalogue is available from the Dealers listed, or 'phone us to discuss your requirements.

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Tel: (0272) 421196

LEEDS
Bits & PC's, Leeds Computer Centre,
62 The Balcony, Merrion Centre,
Tel: (0532) 45887

LONDON W2
Henry's Radio, 404 Edgware Road
Tel: 01-402 6822

LONDON SW11
OFF Records, Computer House,
58 Battersea Rise, Clapham Junction
Tel: 01-223 7730

MANCHESTER M19
EV Computing, 700 Burnage Lane
Tel: 061-431 4866

NOTTINGHAM
Computerama, (Skytronics Ltd.)
357 Derby Road
Tel: (0602) 781742

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There is a network of Minstrel dealers in the UK and Europe. Contact us for the name of your local dealer. Dealer enquiries invited.

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69 Loudoun Road, London NW8 0DQ

national	01 328 8737
international	+441 328 8737
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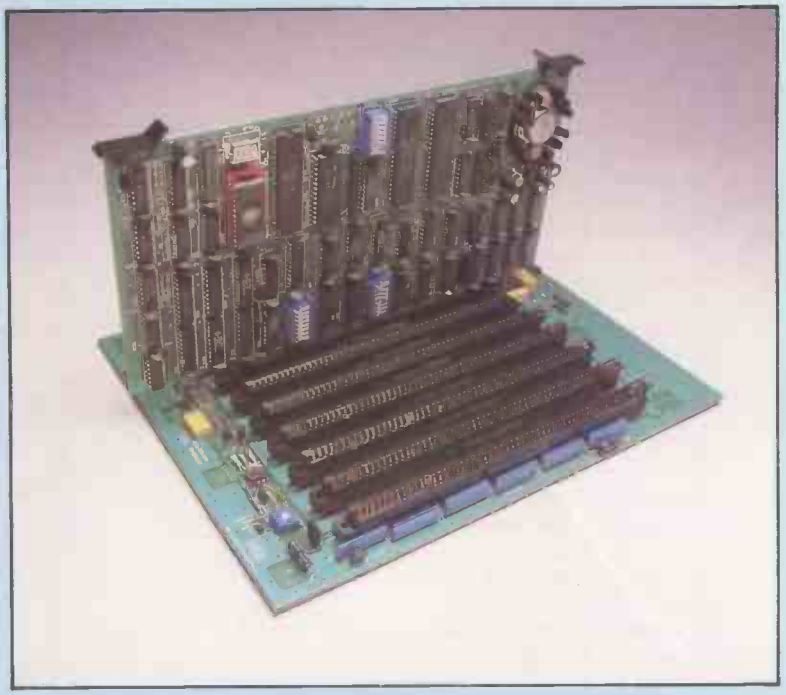
TurboDOS provides sophisticated spooling for multiple printers, supports 1000Mb disk drives and 128Mb files, and employs powerful disk buffering techniques.



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TurboDOS is a popular high-performance multi-processor operating system. Each user has their own slave processor board (illustrated above). TurboDOS systems have been shown to out-perform mini-computers in the DEC PDP11/34 class at a fraction of the hardware cost.

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5 KDS7362 VDUs (illus)
1 Epson printer
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TurboDOS is a registered Trade Mark of Software 2000 Inc.

(continued from page 4)

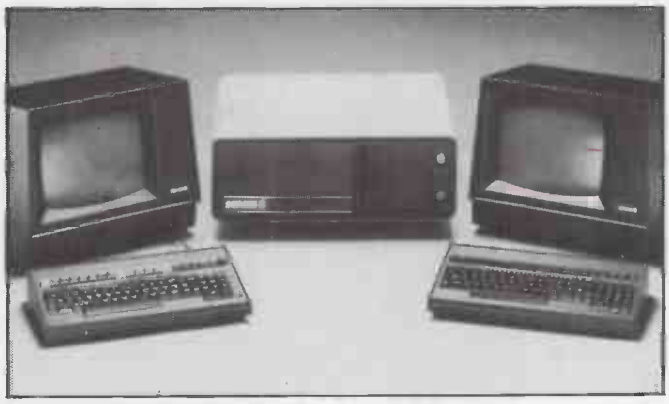
The Apricot is a small, semi-portable micro which ACT is manufacturing in its factory in Glenrothes, Scotland. It uses an Intel 8086 16-bit chip and offers 256K of RAM, plus 315K of disc storage on 3.5in. drives.

For portable use the keyboard includes a two-line 40-character LCD which also functions as a calculator display and clock face. The Apricot is claimed to be 99 percent software compatible with the popular Sirius 1, which ACT distribute through 470 dealers. While ACT currently import the Sirius from the U.S., it is possible this will be made in Scotland.

ALMARC DATA SYSTEMS

Address: Great Freeman Street, Nottingham NG3 1FR
Telephone:(0602) 52657
Telex: 37407
Company founded: 1978
Number of employees: 25
Origin of company name: ALan Hood, MARCus Mazure
Turnover in 1982: £1.2 million

Almarc designs and manufactures microcomputer systems in the Nottingham area. It has concentrated on S-100 bus systems to provide users with a logical upgrade path from entry-level systems to multi-user networks. For the last five years Almarc has also imported Vector Graphic systems from the U.S.



Introduced earlier this year Almarc's Spirit range includes four models. Prices range from £2,355 for a single user eight-bit twin floppy-disc system with 1.6Mbytes of memory, to £25,000 for a Winchester system capable of supporting up to 10 users and built around Intel's 8086 16-bit microprocessor.

Manufactured in Nottingham, the systems feature processor-independence allowing an eight-bit Z-80 or 16-bit 8086 or 68000 chips to be incorporated. The micros S-100 format means that the selected processor board can be slotted into its chassis, while the system can be upgraded or expanded by simply adding or changing boards.

Operating systems available for the Spirit are CP/M-80, DPC/OS and MP/M for the eight-bit systems and CP/M-86, MS-DOS, DPC/ OS and Concurrent CP/M-86 for 16-bit models. A wide range of programming languages and applications packages are also offered, while disc options range from twin 800K floppy discs up to 120Mbytes using an expansion chassis and three Winchester disc drives.

The company sells its products through 35 dealers as well as directly to large corporations.

BLEASDALE COMPUTER SYSTEMS

Address: Francis House, Francis Street, London SW1
Telephone: 01-828 6661
Telex: 28905
Company founded: 1975
Number of employees: 25
Turnover in 1982: £0.5 million

The company started as a consultancy specialising in the design of high reliability microprocessor-based industrial control systems. As a basis for its projects, it designed a highly-flexible computer which could be configured to meet each user's specific requirements. The company recognised the importance of Unix, a software system, and was the first European company to develop and install Unix computers. It now specialises entirely in building 68000-based Unix systems and configuring these systems to meet the user's specific requirements.

Built around Motorola's 68000 16/32-bit processor, Bleasdale Computer Systems' BDC-680 family of micros run under the Unix operating system.

At the bottom of the range is the BDC-680A with 256K or 512K of no wait-state memory, 256K of multibus RAM expandable to 2Mbytes, plus 20,33 or 46Mbytes of 5in. Winchester disc storage. Data back-up is to either 1Mbyte floppy disc or to 5Mbyte exchangeable cartridge discs. The BDC-680A costs £7,900, while Bleasdale's fully configured 68000 Unix machine, the BDC-680X carries a £20,000 price tag.

The use of the Unix operating system coupled with the availability of programming languages including C, Pascal, Fortran 77, RM-Cobol, Level II Cobol, Basic +, SMC Basic and APL make the micros particularly suitable for the system development, university and OEM markets as well as the commercial sector. Made by the company in Leicestershire, the systems are sold through five U.K. dealers.

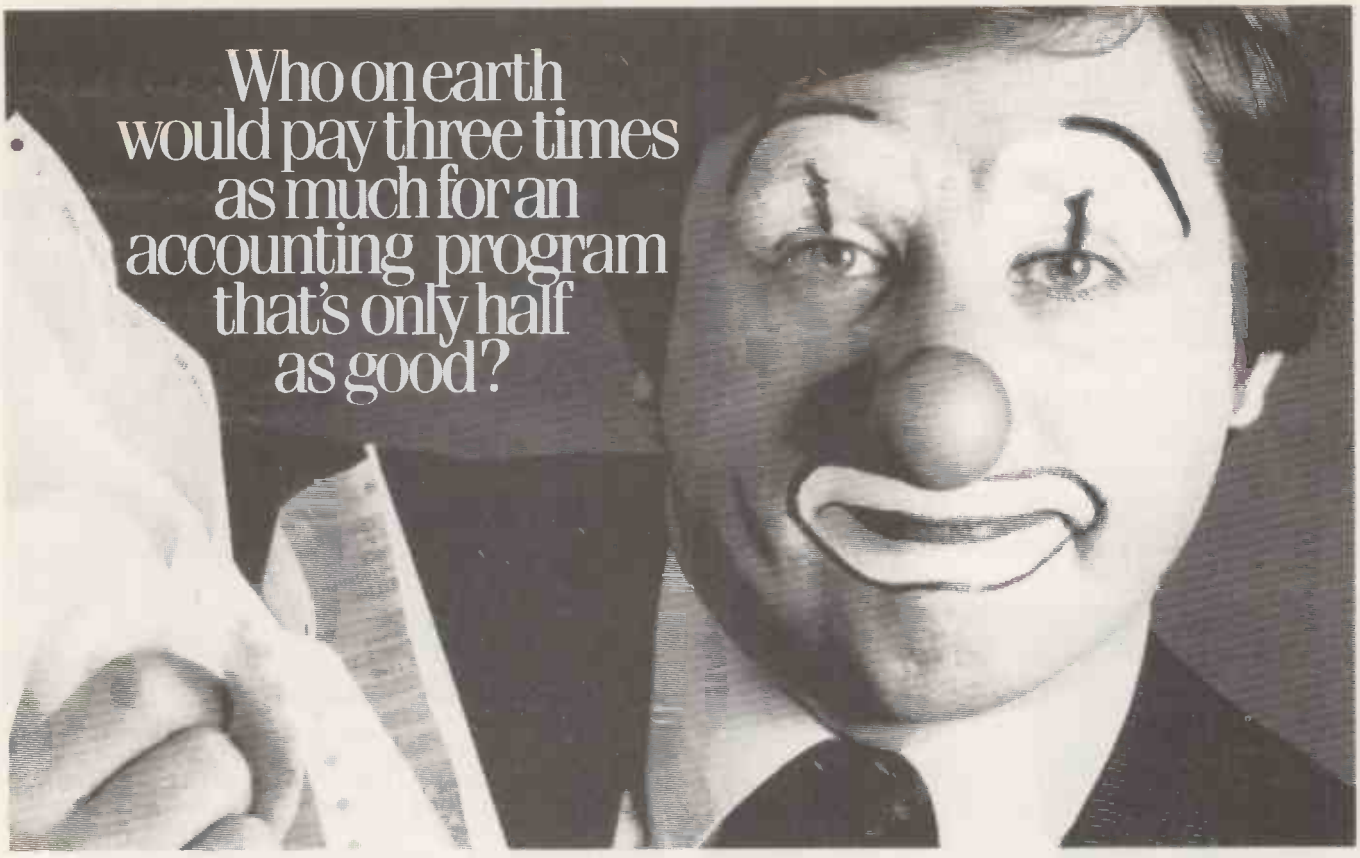
BRITANNIA COMPUTERS

Address: 12 Castle Hill, Dudley, West Midland DY1 4QQ.
Telephone: (0384) 233433
Company founded: 1971
Turnover in 1982: Over £1 million

In its early days Britainnia Computers' major concen was the sale of refurbished Singer-Freedom equipment. In 1975 Britannia initiated the development of its own range of microprocessor-based word processors and business computers. The second generation of these machines was launched in 1980.

Britannia calls its micro the Baby, but in fact the S3 Model 5-10 is more like a 16-bit minicomputer. It uses the Motorola 68000 chip in an S-100 bus compatible construction, with a minimum of 256K of RAM. Disc storage comprises a 5.25in. floppy with 1Mbyte of unformatted storage, plus a 10Mbyte hard disc. The operating system is Whitesmith's Idris, which is a multi-user multi-tasking o/s compatible with version 6 of Unix.

(continued on page 10)



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It's complete and self-contained – no expensive modules to buy every time you need an extra function.

It's suitable for use on CP/M or MS–DOS machines and has so far been implemented on Osborne, Superbrain, Epson QX–10, Sirius, Victor 9000, IBM PC, BBC/Torch Z80 and ITT with others in the pipeline.

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(continued from page 8)

BRITISH MICRO

Address: Unit Q2, Penfold Works, Imperial Way Watford, Hertfordshire WD2 4YY
Telephone: (0923) 48222/43956
Telex: 946024
Company founded: 1980
Number of employees: 65
Origin of company name: Hegotron Microcomputers Ltd
Turnover in 1982: £1.5 million
Parent company: Hegotron Holdings

Hegotron group is a vertically integrated group of companies. Its computers are manufactured by British Micro, Watford. Its software is created by Scifax, in Basingstoke. Electronic assembly and testing is at Compact Business Machines in Brighton and printed circuit boards are manufactured by Hegotron PC in Herefordshire. Research and development in the fields of micro computing and robotics is by Hegotron Robotics, also in Watford.

British Micro offers the Mimi range of micros and Grafpad, a £99.95 tablet digitiser. In the micro family are the Mimi 803 based on the eight-bit Z-80A microprocessor with 800K of floppy-disc storage plus 64K of RAM, and the Mimi 803W with the same processor and RAM capacity but with 10Mbytes of floppy-disc storage. The 803 is priced at £1,495, while the larger system comes in at £2,750.

Made in Watford, the company's product range is sold through a 45-strong dealer network with most of the micros sold into the business market. Special features of the Mimi range include Trojan, an integrated software system which combines both an operating system and high-level programming language.

BROMLEY COMPUTER CONSULTANCY

Address: 417-421 Bromley Road, Bromley, Kent BR1 4PJ
Telephone: 01-697 8933
Telex: 896691
Company founded: 1978
Number of employees: 18
Origin of company name: Founded in Bromley, Kent
Turnover in 1982: £0.5 million

Bromcom is a company of consultants, each fully qualified in a branch of microsystems — both hardware and software — formed to help businesses choose the best available. The company developed the software packages followed by the hardware, which resulted in the Bromcom multi-user Superstar computer system. However, the software can also run any normal CP/M software.

Bromley Computer Consultancy manufacture and market the Superstar system, which can support one to 16 users. The system is based around a central unit containing disc drives and an S-100 card frame. Each user on the system has a dedicated processor card with either an eight-bit Z-80A and 64K of RAM on it, or alternatively a 16-bit 8086 with 128K memory.

Users therefore do not have to compete for processor time and can work independently, but they have the advantage of sharing system resources like discs and printers. Eight-bit cards running eight-bit CP/M and 16-bit cards running CP/M-86 can be mixed in any combination. Superstar prices start at £1,750 for a single-user system with two floppy drives. A fully expanded system with 80Mbyte of hard disc storage and 16 terminals attached would cost about £30,000.

CAMPUTERS

Address: 33a Bridge Street, Cambridge CB2 1UW
Telephone: (0223) 315063
Telex: 817207
Company founded: Started design work March 1983
Number of employees: 40
Origin of company name: To reflect origin in Cambridge and building computers
Turonver in 1982: Only started manufacturing this year
Parent company: Camputer Holdings plc

Camputers, the Cambridge-based manufacturer of Lynx microcomputers, was formed in 1981. The first project was the development of the Lynx 48K, designed by Camputers' sister company GW Design Services, and launched at the 1982 *PCW* Show. This year the company has launched the Lynx 96K and a range of peripheral equipment including disc drives. The 128K professional version of the Lynx is due for launch at this year's *PCW* Show. Camputers' software subsidiary Camsoft was formed earlier this year and now markets a growing range of games, educational and business programs. Camputers went public in June this year. It is now an established force in the U.K. market, and its products are exported to Europe and the Middle East.

The Lynx, Camputers' first product, is a small cassette-based home micro built around the popular Z-80 CPU. It has high-resolution colour graphics and a real keyboard, though the Return key is bizarrely positioned. The basic model costs £225

(continued on page 13)

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Storage:	390K or 790K byte diskettes 5M or 20M byte hard disks	390K or 790K byte diskettes 5M or 20M byte hard disks
Operating Systems:	CP/M, MP/M11 & CP/NET, multi-processor 1 to 5 users	CP/M86, MP/M86, MS-DOS, 1 to 8 users

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Keyboard/Display: 105 Key, detached 14" green screen, swivel/tilt,
Expansion: Internal – S100 cards, mainframe communications & protocols,
Expansion: External – stackable modules inc. cartridge tape & 8" floppy & hard disks.

CP/M, MP/M11, CP/M86, MP/M86 & CP/Net are trademarks of Digital Research Inc. Z80A is a trademark of Zilog Corp. MS-DOS is a trademark of Microsoft Corp. Comart and the Comart logo are trademarks of Comart Ltd.

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Cardiac Services Co
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Westcom
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CHANNEL ISLES
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Eurotec Consultants
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DONCASTER
Spot Computers
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EDINBURGH
Holdene Microsystems
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Computer Services Scotland
Tel 0592 773710

LEEDS
Holdene
Tel: 0532 459459

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Jarogate
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LONDON (COVENT GARDEN)
Digitus
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LONDON (EC4)
Zygal Dynamics
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LONDON (NW1)
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Data One
Tel: 0509 37281

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The Byte Shop
Tel: 061-236 4737

MANCHESTER
NSC Computers
Tel: 061-832 2269

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Eastern Bus & Accounting Systems Tel: 0603 27460

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Tel: 0625 529486

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Tel: 075-35 51550

WORTHING
Ace Computing Services
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● Circle No. 305

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and has 16K of ROM and 48K of RAM, of which around 13K is free to the built-in Basic.

The 96K model costs £299 and has a 20K ROM, with some extra oommands and firmware to drive a printer. Around 37K of the 96K RAM is available for Basic programming. The 48K version is upgradeable, and it is hoped that a further upgrade will provide access to CP/M. The Lynx is sold mainly through Lasky's and the Spectrum chain of shops.

CASU ELECTRONICS

Address: Arundel Road, Uxbridge Industrial Estate, Uxbridge, Middlesex
Telephone: 01-561 6820
Telex: 296753
Company founded: 1977
Number of employees: 67
Origin of company name: CArolyn and SUzanne — founder director's two daughters
Turnover in 1982: £5.2 million

Casu markets eight- and 16-bit microcomputers and communications systems to the business sector and government departments. It manufactures all products in a modern production facility based in Uxbridge. It provides a network of hardware and software support centres throughout the U.K.

Casu manufactures a range of eight and 16-bit systems all designed to give a wide degree of choice of different hardware configurations in a neat package. The C-Max is a single-user eight-bit Z-80A, S-100 system with a range of disc options starting from £1,750. The MC-Max is an eight-bit, Z-80A, multi-user system with a range of hard-disc options priced from £5,495, running the Digital Research family of operating systems, CP/M, MP/M and CP/Net.

Casu's 16-bit system is the Super PC, based around the Intel 8088, running either MS-DOS or CP/M-86. Prices start from £1,800 for the entry level floppy-based system, with several hard-disc options available. By micro standards Casu offers high-capacity disc options with its systems, including a 40Mbyte 5.25in. Winchester drive with 17Mbyte tape cartridge back-up.

CIFER

Address: Avro Way, Bowerhill, Melksham, Wiltshire SN12 6TP
Telephone: (0225) 706361
Telex: 449872
Company founded: 1972
Number of employees: 250+
Origin of company name: Computer InterFace
Turnover in 1982: £5.3 million

Cifer started in 1972, designing and constructing specialised computer interfaces. VDU manufacture commenced in 1974, and since then Cifer has become the major U.K. supplier of micro-based intelligent terminals. From intelligent terminals to stand-alone microcomputers was a logical step, and Cifer now produces a wide range of high performance desktop microcomputers.

The Wiltshire-based company Cifer manufacturers a range of micros in its Melksham facilities, including the flagship of its products the Cifer Club. The Club sells at £3,395 and incorporates a Z-80A processor with 64K RAM, and a Z-80A display processor with 64K RAM. The machine has a 5Mbyte Winchester drive and a 800K floppy-disc drive. It supports the CP/M operating system, with MP/M and Unix as extras.

At the bottom of Cifer's range is the series 2880, with prices starting at around £2,295 The multi-processor workstations have three RS-232/V24 ports and parallel and IEEE-488 interfaces. The five models in the series have various disc capacities from a single floppy to a Winchester drive plus floppy, CP/M is standard on the range and application packages available include word processing, the various accounts packages, and payroll.

Also on offer is Cifer's Series One, a range of four micros with built-in disc storage either floppy or Winchester 21Mbyte. The 16-bit processor systems have a detachable keyboard, three serial interfaces, and one parallel one.

All Cifer's machines are sold through a network of 14 dealers and numerous OEMs, and are used mainly in business, science and engineering applications.

CLENLO COMPUTING SYSTEMS

Address: Crown House, 18 Gypsy Hill, London SE19 1NL.
Telephone: 01-670 4202/3
Telex: 8954102
Company founded: 1980
Origin of company name: Family initials

Clenlo S-100 bus systems are assembled in the U.K. to suit the needs of individual customers. It has a range of chassis, of which the most popular is the floor-standing 20-slot model the Pronto. Into the bus Clenlo can fit a range of options. Processors offered are Z-80A, Z-80B, 5MHz 8086 and 8MHz 8086. Each eight-bit processor has 64K of RAM and each 16-bit from 128K to 1Mbyte. A 4Mbyte RAM-disc is also available.

Multi-processor systems are a popular option, with each user having a dedicated CPU board and RAM. Depending on requirements, the operating system can be CP/M-80, CP/M Plus, CP/M-86, DPC-DOS and Turbodos. Floppy and hard discs cover most possibilities from 350K to 360Mbyte, with tape drives for back-up.

(continued on page 15)

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(continued from page 13)

COMART

Address: Little End Road, Eaton Socon, St Neots, Cambridge PE19 3JG
Telephone: (0480) 215005
Telex: 32514
Company founded: 1977
Number of employees: 120
Origin of company name: Computer Mall Order and Retail
Parent company: Comart Group of Companies

Comart has developed into a major U.K. microcomputer manufacturer with a specialist subsidiary, Xitan Systems in Southampton, providing the operating systems and packaged application software. Six regional Byte shops and Microserve centres provide local support and service from six major cities in the U.K. Comart also supports a nationwide network of dealers and OEMs, comprehensively backed by Comart's technical support, training and customer service departments. Future plans include a major extension of manufacturing facilities and an export thrust into Western Europe and the U.S.

Comart has both eight- and 16-bit models in its Communicator range of microcomputers manufactured in St Neots, Cambridgeshire. Of the six Z-80A eight-bit models the latest is the CP-52OMP, a multi-user, multi-processing micro with five Z-80A processors, each with 64K RAM, and a 20Mbyte hard disc. Others in the series are the CP-100, the CP-200, the CP-500, the CP-520, and the CP-520M. The CP-520M and CP-520MP have multiprocessing software for up to three users as standard. All the eight-bit models run under CP/M and MP/MII.

The three 8086 models run under CP/M-86, MP/M-86, and MS-DOS and handle up to eight users.

Comart also offers CP/Net, an entry level micro networking system which can be configured in a number of ways.

COMMODORE BUSINESS MACHINES (U.K.)

Address: 675 Ajax Avenue, Trading Estate, Slough, Berkshire SL1 4BG
Telephone: Slough (0753) 74111
Telex: 848403
Company founded: 1958
Number of employees: 3,000
Turnover in 1982/83: $650 million
Parent company: Commodore International Inc.

Commodore began as an assembler of hand-held calculators and in 1974 bought into MOS Technology, the semiconductor research and manufacturing company. Its improvements on the Motorola 6800 led to the production of the 6502 microprocessor, and hence the Pet was born. The first model was unveiled in 1977 and was a huge success. Later models and new micros such as the Vic-20 and Commodore 64 have made Commodore one of the most successful micro companies in the world. This year Commodore opened a manufacturing plant In the former steel town of Corby, which qualifies them for inclusion in British Micro supplement.

Commodore Business Systems has four types of business systems starting at around £550, plus the Commodore 64 and Vic-20 home computers starting at £139.

Both the larger business systems, the 8000 range and the 4000 range, and the smaller business systems, the 500 and 700 series, are manufactured in West Germany. The two personal computers are produced in Corby in Northamptonshire.

The Commodore 64, which has a base price of £299, has a MOS-6510 main processor, 64K RAM and a Z-80 processor option. It incorporates a dedicated video chip, sprite graphics, a music synthesizer, a Prestel link and 320 by 200 high-resolution graphics. It also has the option of CP/M and an external ROM cartrdge slot.

The Vic-20 home computer has 5K RAM, expandable up to 29K, RS-232C interface ability and eight programmable special functions accessed through four special function keys.

CONTROL UNIVERSAL

Address: Unit 2, Andersons Court, Newnham Road, Cambridge CB3 9EZ
Telephone: (0223) 358757
Company founded: 1958
Number of employees: 23
Origin of company name: To indicate company is in the business of supplying computers for general control purposes
Turnover in 1982: £0.5 million

The company started selling the Rockwell Aim in 1965 when it found a need for additional equipment, such as, power supplies and additional memory which it started to manufacture. The need to provide a disc drive for the Aim-65 led to co-operation with Acorn in 1979 in order to use its standard Eurocard floppy disc controller: After acquiring a dealership for all Acorn products, the company complimented Acorn's product range by bringing out its own range of additional Eurocards including the Cubit CPU cards and the Cu-mem memory card which have been extremely successful. Control Universal is now the leading U.K. supplier of Industrial eurocard computers and in July 1983 launched the complete Cube range of industrial microcomputer cards. The links with Acorn continue through the Beebex hardware extension unit for the BBC microcomputer which permits the use of the entire Cube range of modules.

Control Universal's micro is the Eurocube, a £100 single-board computer with a 6502 or 6809 CPU according to choice. Together with a further range of about 30 standard Eurocard boards and software tools these form a microcomputer development system aimed mainly at industrial process control applications. Also the cards are Acorn compatible and can be used as extensions to the BBC Microcomputer.

(continued on next page)

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COUNTRY COMPUTERS

Address: Pipers Road, Park Farm Industrial Estate, Redditch, Worcester B98 0HU
Telephone: (0527) 29826
Telex: 337497
Company founded: 1981
Number of employees: 25
Origin of company name: Based on Countrywide Service Company
Turnover in 1982: £0.3 million

Country Computers was established to sell to and service the growing computer industry. With a country-wide maintenance organisation already established its first manufacturing venture was the highly successful Acclaim microcomputer running all Apple and CP/M software. Large sales volumes into the CP/M market and Country's ability to launch a new product within a short space of time, led to the introduction of the C-3000 with price being a major consideration. Some 90 plus orders were received and satisfied within the first two months of its launch in the U.K. — customers include British Telecom, BMA and MoD — the C-3000 has all the ingredients for today's low-cost CP/M market.

The C-3000 is an eight-bit Z-80 system designed to allow the user access to the huge quantity of CP/M 2.2 software with all the benefits of a 10Mbyte hard disc but at a very low price. In fact the 10Mbyte version with a 500K floppy disc thrown in costs only £2,450, though of course it also needs a terminal.

The C-3000 actually uses five Z-80s plus a Western Digital WD-1797 disc controller. There is 64K of RAM and up to 32K of ROM. Hard disc options are offered from 5Mbyte to 21Mbyte, and the CP/M can be upgraded to MP/M-II for multi-user operation.

The C-3000 is made in Redditch, using Rodime hard discs which are manufactured in Scotland. It is sold through some 25 dealers, mainly into vertical markets to meet specific end-user requirements.

DIGICO COMPUTERS

Address: Wedgwood Way, Stevenage, Hertfordshire SG1 4PY
Telephone: 314381
Telex: 825508
Company founded: 1966
Number of employees: 100
Origin of company name: Digital Company
Turnover in 1982: £5.5 million
Parent company: Spanverne Investments

Having commenced as a mini manufacturer in 1966, Digico launched its first CP/M-based microcomputer, the Prince, early in 1981. Very quickly the Prince was followed by a sophisticated microcomputer network called the Vision which catered for up to eight microcomputers sharing into a common Winchester database with standard CP/M application packages. The whole micro network then will link into Digico's 7800 series mini-micro network catering for up to 30 terminals, each terminal capable of being developed as a micro cluster or even linking to an ICL, IBM or Honeywell mainframe.

Digico's Prince micro can be used as a stand-alone system or an intellingent terminal in a computer network. Priced from £2,950, the system has three Z-80A microprocessors, 64K of RAM as standard and can support both Winchester and floppy-disc drives for data storage.

Running under the CP/M operating system, the Prince offers Basic, Fortran, Cobol and Pascal programming languages plus a range of high-resolution graphics facilities. Users wanting a multi-terminal micro network can be linked using Digico's Vision product which provides 20 or 40Mbytes of shared disc storage supporting up to eight micros. Each micro connected to the central Vision unit may have its own storage, otherwise Digico's 3807 terminal without local storage but with a large 15in. screen can be used as a node on the network. As a stand-alone device the 3807 can be used in conjunction with on-line floppy or Winchester storage standing alongside the terminal.

Digico sells its Leeds-built products through 50 U.K. dealers. Major end-user applications of the micro and terminals include production control, integrated business systems, word processing and use of the systems as mainframe terminals.

DRAGON DATA

Address: Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan SA13 2PE
Telephone: (0656) 744700
Telex: 498934
Company founded: 1982
Number of employees: 180
Origin of company name: Name connected with Wales — Dragon
Turnover in 1982: Not yet completed full year's trading

Dragon Data began life as a subsidiary of Mettoy, the Welsh toy-manufacturing giant, In the Spring of 1982. In August of that year the Dragon 32 was launched and rapidly became a best-seller. In November 1982 a six-partner consortium was formed to purchase the company from Mettoy and help Dragon Data into a new factory in Port Talbot, a move which helped treble the company's production capacity. Between August and Christmas 1982 over 32,000 units were sold in the U.K. By the end of 1983 it is estimated that over 300,000 will have been sold world-wide.

(continued on page 20)

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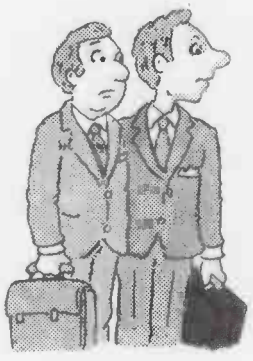

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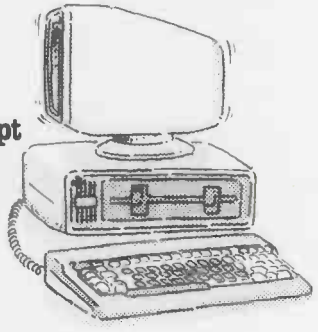

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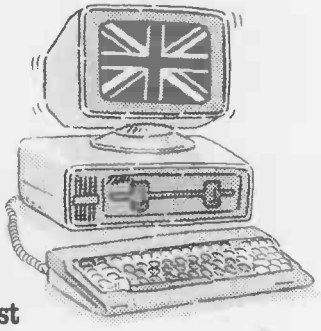

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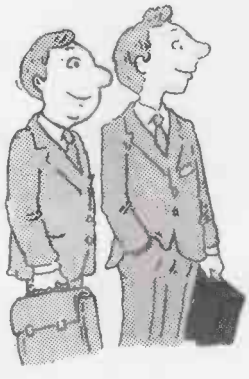

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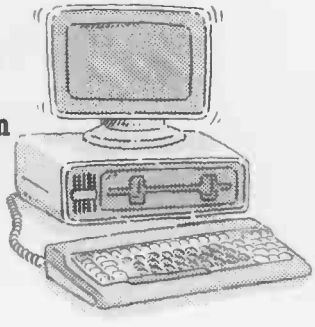

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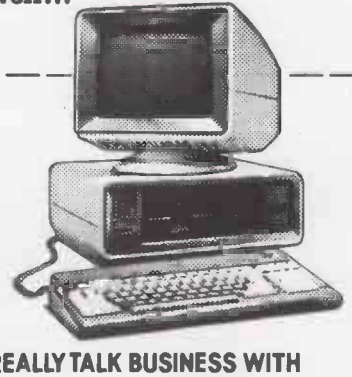

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The MIMI 802 is a supreme example of high quality British engineering. It is a truly professional microcomputer that really does meet all the criteria of a sophisticated business machine - at a price you can afford.

Our competitors expect you to make do with the basics and then buy expensive extras in order to fulfil your needs. The MIMI 802 has all the 'extras' as standard - so when you buy a MIMI you really are getting a microcomputer that will do the job from the outset.

The MIMI's operating system OS/M† is fully CP/M‡ compatible so you have access to a very comprehensive range of software, extending from word processing to accounting.

During the next few months we will be announcing the availability of TROJAN - a major software innovation that totally simplifies the learning process and use of micros, and dramatically eases the creation of new applications programs. We are using it and generating applications software in record time - so we can guarantee its performance.

Don't settle for less... contact us or one of our dealers now.

Features include:

- Z80A at 4MHz
- 64K Dynamic RAM
- Integral D/S - D/D 5¼ ins floppy discs - 700Kb.
- Full RS232C and Centronics parallel ports.
- 96 Key ASCII keyboard - colour coded.
- 17 programmed function keys.
- Light pen socket.
- Elegant compact and light - 24 lbs.
- OS/M operating system - fully CP/M compatible.
- Disc format conversion facility.
- Wide range of software, utilities and languages.
- Super high resolution graphics (512 x 256 pixels).

And now with:

- Winchester disc option.
- Choice of orange or green display.

MONITOR SUPPLIED BY PHILIPS

NOW ALL OTHER MICROS ARE LESS THAN PERFECT

† OS/M is the trademark of Scifax Microsoftware.
‡ CP/M is the registered trademark of Digital Research Inc.

*Monitor extra, from £132.

TROJAN

With the completion of the TROJAN Operating System and language, Scifax have already produced TROJAN Ledgerfax-Sales Ledgerfax-Purchase and Videofax. Because of the 'English Language' programming these packages are exceptionally user friendly, and being based on existing card systems, any accounts clerk can transfer from the present laborious, manual system to a complete computer system with all its management reports.

TROJAN Videofax is written specifically for the Video type rental business, and handles all membership, rentals, leasing and financial reporting of the Video Market.

This package has met with full approval of the Video Traders Association.

The currently planned releases in TROJAN includes TROJAN Networking and Wordprocessing.

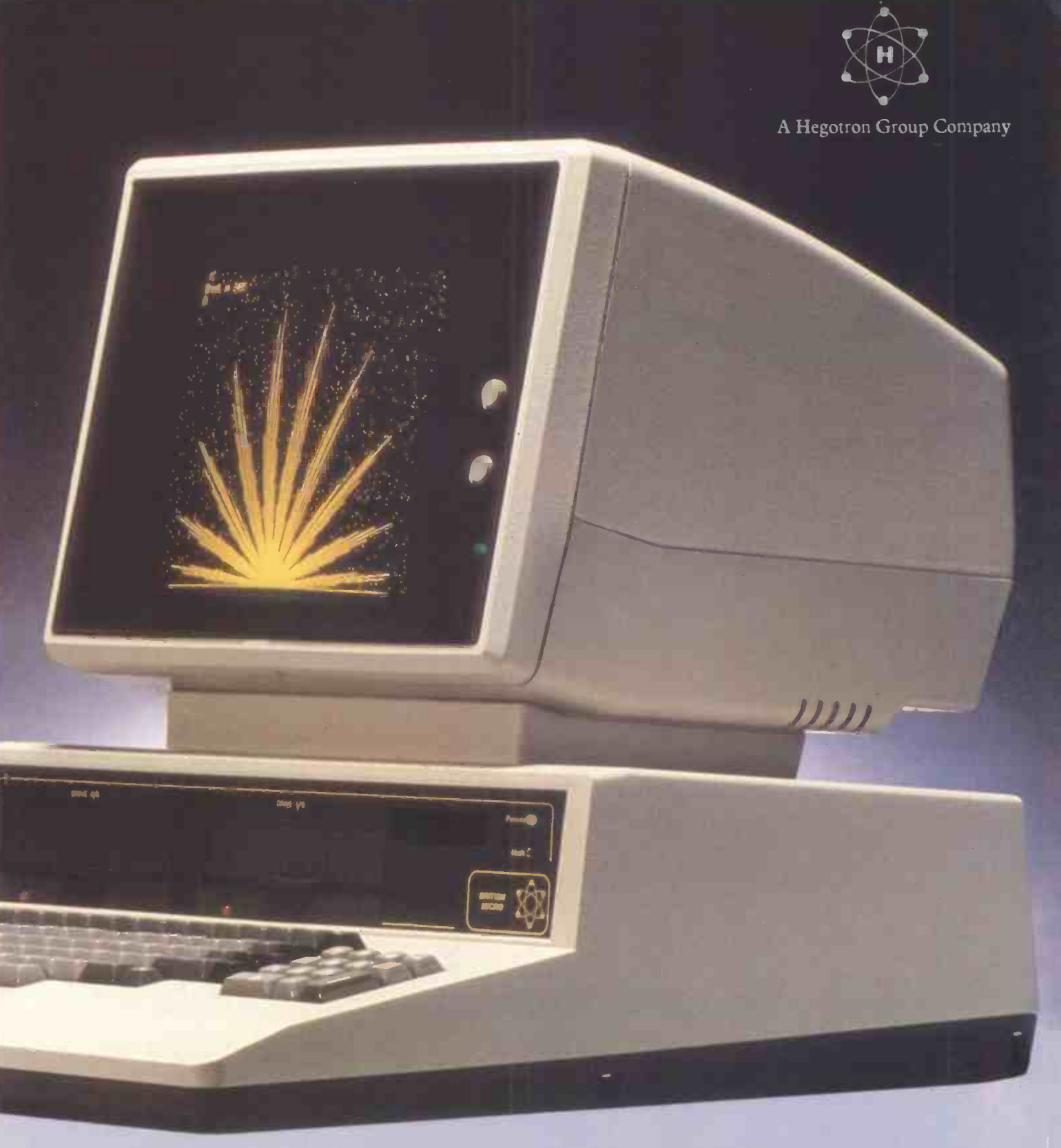
TROJAN Networking will permit up to eight satellite mimi microcomputers to share files via a central disc based system. This system will be demonstrated at Compec '83.

TROJAN Wordfax will be a truly user friendly Wordprocessing package, and will include Merge facilities as standard.

BRITISH MICRO

Penfold Works Imperial Way Watford Herts. WD2 4YY Tel: Watford (0923) 48222/439

A Hegotron Group Company



SOFTWARE DEVELOPMENT ON THE MIMI 803

With the release of NEW OS/M 'a user friendly implementation' of CP/M* compatible operating system, British Micro are pleased to announce synchronous protocols can now be built-in as 'drivers' in the operating system.

Already tested are ICL and IBM protocols, and the availability of this Software means that mainframe users can have intelligent terminals at a cost not much greater than that of the manufacturers Dumb terminals.

The availability of Cobol and Fortran on the British Micro Mimi 803 ensures that users of mainframes have no re-training of programmers to make the best use of this vastly enhanced performance of their terminals.

MIMI 802

Telex: 946024 Contact: Julie Hissey

● Circle No. 308

(continued from page 16)

The Dragon home computer was the smash hit of the pre-Christmas sales scramble in 1982. Mainly because it offered a typewriter-style keyboard and 32K of RAM for under £200. Like the semi-compatible Tandy Color computer, which its design resembles, it uses the powerful 6809 microprocessor.

Unfortunately it has seen little development since its launch. In spite of strong support from Boots the chemist — a major sales outlet, its poor screen display, unfriendly line editor, lack of lower case letters, and lack of good software and peripherals are now beginning to tell against it. Dragon's next development is more likely to be a small business machine.

DVW MICROELECTRONICS

Address: 345 Foleshill Road, Coventry.
Telephone: 668181
Telex: 312171
Company founded: 1977
Number of employees: 40
Origin of company name: Dalton Viewing & Whitsey Ltd. became DVW Microelectronics in 1981
Turnover in 1982: £4.8 million — parent company
Parent company: Aidcom International

Founded as a microporcessor product design consultancy in 1977 DVW merged its interests with the newly formed Aidcom Group in order to finance development of the Husky portable microcomputer. Conceived as a truly utilitarian protable micro, Husky was the world's first truly robust microcomputer and quickly found favour with customers from hotel keepers to the military.

Coventry-based DVW Electronis manufactures the metal-cased Husky microcomputer for use in adverse weather and enviromental conditions. The hand-held micro is available in three versions, the Husky, from £1,200 to £3,000, the Husky IS — intrinsically safe — and the Husky AID with analogue input, from £1,525.

The Husky has up to 144K of RAM with a 32K firmware space for an extended Basic interpreter, and a liquid crystal display with four lines of 32 characters. It supports synchronous and asynchronous communications via a RS-232/V-24 serial port on a standard 25-pin D-type connector.

The Husky is battery operated and gives up to 50 hours of operational use, or twelve months of data retention in the dormant mode. The micro is sold directly to end users in the U.K. and via agents overseas.

EQUINOX COMPUTER SYSTEMS

Address: 16 Anning Street, London EC2A 3HB
Telephone: 01-729 4460
Telex: 27341
Company founded: 1978
Number of employees: 26
Turnover in 1982: £3 million

The company's growth is based on its concentration on top-end multi-user microsystems.

The Equinox 200 is an S-100 bus floor-standing micro that is designed to compete with minicomputers, but at a relatively lower price. The standard machine features a Z-80A with 64K of RAM and a 12-slot bus, dual 8in. floppy-disc drives and a 32Mbyte cartridge disc drive — 16Mbyte fixed, 16Mbyte removable.

With the flexibility of the bus system various options can be offered with an 8088 CPU or up to 14 multiprocessors. The hard disc can be expanded to 96Mbyte. Operating systems available are CP/M, Turbodos and BOS systems start from around £9,950, and are sold through a network of 20 dealers mainly to government and industry.

FERRANTI COMPUTER SYSTEMS

Address: Simonsway, Wythenshawe, Manchester M22 5LA
Telephone: 061-499 3355
Telex: 668084
Company founded: 1975
Number of employees: 6,300
Origin of company name: Founders Ferranti name
Turnover in 1982/83: £124.7 million
Parent company: Ferranti

The company was formed from three trading activities within the Ferranti company: Bracknell dealing with military systems, Cheadle Heath for simulators and military activities, and Wythenshawe division responsible for all civil applications of computer equipment and systems.

Ferranti Computer Systems offers one micro as part of its computer range, the Professional Personal Computer, PPC. The PPC uses a standard PT7 display and keyboard, and incorporates a 16-bit microprocessor with 128K RAM and 0.5Mbyte twin floppy discs.

The PPC can be either a stand-alone model or access a mainframe computer; switching between the two is done by a simple key sequence. The PPC runs under CP/M with a simplified operator interface for first time users. Ferranti sell the micro direct to end users at £2,800.

FUTURE COMPUTERS

Address: PO Box. 306, Purley, Surrey.
Telephone: 01-683 0111
Telex: 947788
Company founded: 1982
Number of employees: 35

Future Computers backed by the British Technology Group and APA, a private venture-capital company, was formed in 1982. The Future Computers range was conceived as a complete product family able to grow and shape to suit a particular customer's needs in the business world. Encotel Systems are the sole U.K. distributors and a nationwide network of 100 dealers sell the range. Units are being produced at a rate of 3,000 per month and the range is now being actively sold in the U.S., Europe and China as well as the U.K.

At the heart of Future Computers' FX range is the FX-20, a stand-alone 16-bit system built around Intel's 8088 microprocessor with a standard 128K of RAM and twin 5.25in. floppy disc drives, which can read IBM formatted floppy discs. Priced at £1,875 the FX-20 has an in-built local area network facility.

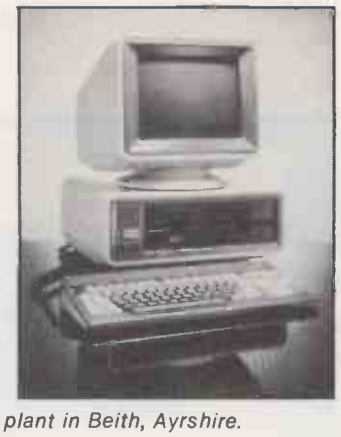
Other members of the FX range are the FX-0 and FX-10 terminals, the FX-21 OEM micro, three network processors capable of supporting eight to 16 terminals with shared Winchester discs, and either floppy disc or cartridge tape back up, and the FX-30 stand-alone micro. The 16-bit FX-30 is priced from £2,800 for a version with integral Winchester discs offering up to 50Mbytes of storage, while a version with cartridge tape back-up costs from £4,150.

The micros all include the CP/M-86 Plus operating system, with Concurrent CP/M and MS-DOS offered as optional extras. A wide range of applications packages are available, although the word-processing package Spellbinder and IMPS financial planning and spread-sheet package are included with the machines.

Future Computers has 100 dealers and sells its British-made systems to both U.K. and overseas business users working in single and multi-user environments.

FUTURE TECHNOLOGY SYSTEMS

Address: Lochview Road, Beith, Ayrshire KA15 1JD
Telephone:05055 3637
Telex: 779247
Company founded: 1981
Number of employees: 130



Future Technology Systems, FTS, was formed in 1979 by Martin Healey, Professor of Microprocessor Engineering at University College, Cardiff, with Peter McHugh and David Sheer. The company chairman is Sir Monty Finniston. The backers include the Norwich Union and the Scottish Development Agency. The first product was the advanced Series 88 multi-funtion office computer. Later FTS designed the Orion desktop micro for Office and Electronic Machines, which it builds at its plant in Beith, Ayrshire.

GEMINI MICROCOMPUTERS

Address: 18 Woodside Road, Amersham, Buckinghamshire HP7 0BH
Telephone: (02403) 28321
Telex: 837788
Company founded: 1980
Number of employees: 25
Origin of company name: Relates to the birth sign of the managing director
Turnover in 1982: £1.2 million

Gemini started life building and marketing peripherals for Nascom systems. The range of products became so wide that the move into selling its own systems was inevitable. Multiboard cards have been in production since 1980 together with disc systems. Galaxy Systems were first shipped in the Spring of 1982, by December 1982 the first Winchester-drive based systems were shipped and in January the Multinet network system was displayed at the *Which* Computer Show.

(continued on next page)

(continued from previous page)

The Galaxy range of micros currently includes three models — 2, 3 and 4. All are based on the industry-standard 80-bus system and use twin Z-80 processors, giving access to the huge range of CP/M 2.2 software. The Model 2 includes three cards in a five-slot bus, and offers 64K of RAM plus two 400K floppy disc drives. With keyboard and monitor it costs £1,495 plus VAT. The Model 3 offers a 5.4Mbyte hard disc plus one 800K floppy and costs £2,500 plus VAT. 10Mbyte and 20Mbyte versions are also available. The Model 4 is a networking version.

The Galaxy systems are made in Amersham and distributed through a network of dealers. The main markets are small businesses, schools, and industrial control systems. Gemini also sell the 80-bus boards separately for this, and so people can configure their own systems.

GLOBE BUSINESS MACHINES

Address: Units 1 and 2, Smith's Forge Industrial Estate, North End Road, Yatton, Avon BS19 4AU
Telephone: (0934) 835222
Number of employees: 10

The company moved into premises during July of 1982. The next two months were spent equipping the factory and recruiting staff. First production units were shipped during late August, early September. Since then 300 plus have been shipped.

The entry-level system in the Globe range is the 101, which features an Intel 8085 eight-bit microprocessor and 64K of RAM. Storage is provided by two 5.25in. floppy disc drives built into the cabinet with the VDU. The detached keyboard has 100 keys including a numeric keypad and 17 function keys dedicated to word processing requirements.

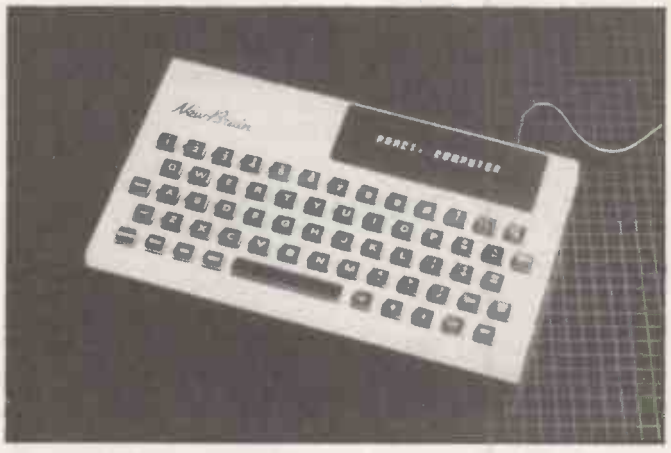
The base price of £1,960 includes CP/M, WordStar and Mailmerge. The 101 can be upgraded to the Model 102, which features two 8in. drives offering 1.2Mbyte of formatted storage each. The £3,395 price includes additional software, Pfannercalc and Financial Director. The Model 103 is a dual-processor version with 128K of RAM and a 5Mbyte hard disc instead of one of the floppies. It costs £4,300, including software.

Globe Systems are made at Yatton in Avon and distributed through about 50 dealers, mainly for word processing and small business use.

GRUNDY BUSINESS SYSTEMS

Address: Somerset Road, Teddington, Middlesex TW11 8TD
Telephone: 01-943 1901
Telex: 929728
Company founded: 1981
Number of employees: 50
Origin of company name: From parent company founded by Stanley Grundy
Turnover in 1982: £21 million
Parent company: Grundy Group

Grundy Business Systems is part of the international Grundy Group. The Newbrain has been in the market place for 18 months and now sells in 10 major European countries. A full CP/M system is now offered. No modification is required to the basic machine which provides an 80-column display as standard. Grundy is the first microcomputer manufacturer to offer CP/M on a machine costing less than £300.



The Newbrain is a very small semi-portable personal micro which is modular in construction and can be built up into a full system. The basic Model AD costs under £300 and has a Z-80A processor, 32K of RAM and 29K of ROM, The built-in Basic is very close to American ANSI standard. The AD has a single-line display built-in, but needs a battery pack to be truly portable. The keyboard has moving keys but is not quite typewriter style, though you can type on it.

The system can be expanded to near its maximum by adding a disc controller and two drives, an expansion interface with 64K of RAM, and a larger power supply. With CP/M the cost is just under £1,000 plus VAT, excluding 80-column monitor. Discs can be 200K or 800K each. With expansion modules the system will handle 1Mbyte of RAM and 1Mbyte of ROM. CP/M software for the Newbrain includes the Peachtree range such as Peachcalc, Peachtext and the Accounting system. Newbrain's can also be networked.

The Newbrain system is made in Feltham, Middlesex, and is sold through around 200 dealers mainly for home use, with some in education and small business use. Some are sold via OEMs, for example, many are used in chemists' shops under one large scheme.

HAYWOOD ELECTRONIC ASSOCIATES

Address: Electron House, Leeway Close, Hatch End, Pinner, Middlesex HA5 4SE
Telephone: 01-428 0111
Telex: 896819
Company founded: 1973

(continued on page 26)

WINCHESTER CP/M SYSTEM BREAKS THE £2000 BARRIER.

THE COUNTRY C3000 SERIES

Whether the requirement is for graphics using the new Tektronix® 4010 emulation under CP/M,* or for use as a powerful Word Processor, the C3010 with 10 MBytes of Winchester disk storage must be one of the most cost effective CP/M systems currently available.

Extensive use has been made of the entire range of Z80 peripheral devices, therefore the chip count is low and with only five major components, reliability is guaranteed.

Background diagnostics continuously run while the processor is idle performing RAM checks and logging disk retries. All status information is stored on files on the Winchester and can be accessed by the user if so desired.

A range of VDU's and printers is available either from Country Computers or it's dealer network, to compliment the C3000 series. And is available NOW!

*CP/M is the Registered Trade Mark of Digital Research.

- 5, 10, 15, MBYTE WINCHESTER
- 500k OR 1 MBYTE FLOPPY
- Z80A 4MHZ PROCESSOR
- 64k RAM (256k RAM OPTIONAL)
- 16k PROM (32k PROM OPTIONAL)
- TWO SERIAL INTERFACE
- CENTRONICS PARALLEL INTERFACE
- BRITISH MADE
- MP/M OPTIONAL
- REMOVEABLE-MEDIA WINCHESTER DRIVES OR INTEGRAL TAPE-BACKUP UNITS OPTIONALLY AVAILABLE

Country Computers

Country Computers Limited
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Tel: 0527 29826. Telex: 337497 Fistex G.C.C.L.

● **Circle No. 306**

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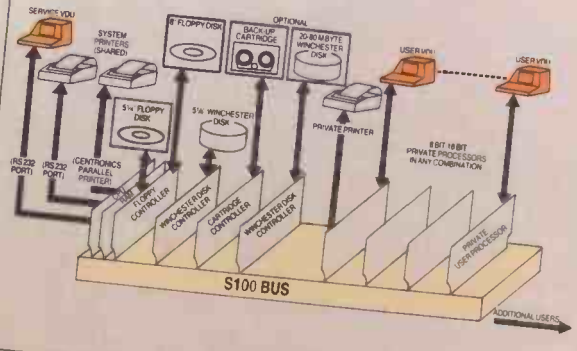
	BROMCOM SuperStar	IBM System 34	DEC PDP11/34	ICL System 25	Olivetti System M40	Burroughs B
Class	Super-Micro (Multi-Processor)	Conventional Mini-Computers				
Processing Power	Up to 16 8 bit (Z80A) or 16 bit (iAPX 186)					
Memory Per User	8 bit up to 128Kbyte 16 bit up to 1Mbyte					
Disc Storage & Backup	From 10Mbyte up to 160Mbyte +40Mbyte tape					
Expandability	Up to 16 users more with networks. Up to 512Mbyte storage					
Lowest Entry Cost	£2450 (including VDU)					
Cost of 2 User 10Mbyte System 2 off VDUs	£5975 (8 bit) £6975 (16 bit)					
Incremental Cost for Each Additional User	£995 (8 bit) £1495 (16 bit) (including VDU)					
Hardware Compatibility	World Standard S100					
Software Compatibility	World Standard CP/M & MS-DOS					

Systems Architecture

Each user has its own processing power each with 16 bit and up to 1Mbyte Memory or 8 bit and up to 128Kbyte.



Available Software

BROMCOM Standard Range	BROMCOM Specialised Packages	Text & Database	Languages
Sales Ledger Purchase Ledger Nominal Ledger Stock Control Order Processing Job Costing Payroll (with SSP)	Property Management Energy Management Membership M'gement Betting Office Chain Insurance Brokers Wholesale/Retail Automatic Invoicing Planned Maintenance Garment Trade	WordStar SpellStar Mailmerge DataStar ReportStar Spellbinder SuperCalc dBaseII Rescue Microplan	BASIC COBOL FORTRAN PASCAL C PL/I APL

BROMCOM Bespoke Programming – Can be carried out by BROMCOM or a growing number of OEMs and Dealers in all areas.

All CP/M and MS-DOS software will run without any modification at all.

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Some installations are a little more difficult than others!

Such as the one at Banham Patent Locks, Limited, in London.

BROMCOM® supplied hardware and software that would have taken a respectable-sized minicomputer from, say, DEC or IBM or Olivetti at twice the price for hardware, three times the price for software and four times as long to implement.

The Hardware – BROMCOM SuperStar™ – is handling six terminals (expandable to 16) and three printers with 20Mbyte disk storage and tape backup. The operators work round the clock, so the speed and reliability demanded of the system are high.

Operators can simultaneously enter Invoices, Payments, etc, while other functions such as word processing and database operations (over 15 000 entries!) are in constant use by other terminals.

- POWERFUL – HIGH PERFORMANCE – FLEXIBLE
- VERY COST-EFFECTIVE WITH LOW ENTRY PRICE
- FULLY MODULAR AND EASILY EXPANDABLE
- WORLD-STANDARD S100 HARDWARE AND OPERATING SYSTEM – CP/M OR MS-DOS
- FULL MULTI-USER CAPABILITY WITH RECORD/FILE LOCKING AND PRINTER SPOOLING
- FIELD-PROVED OVER TWO YEARS WITH A LONG LIST OF SATISFIED CLIENTS
- STYLISH NEW DESIGNS FOR 1984
- MODEL 10 CATERS FOR UP TO 6 USERS, MODEL 20 UP TO 16 USERS

BROMCOM

Bromley Computer Consultancy Ltd
417–421 Bromley Road, Bromley, Kent, BR1 4PJ.
Telephone: 01-697 8933 Telex: 896691

BROMCOM SuperStar

OUTPERFORMING MINICOMPUTERS WITH MICROCOMPUTER ADVANTAGES.

25

● Circle No. 310

(continued from page 22)

Company incorporated in 1973 to provide applications for keyboards marketed in U.K. by associated company, Keytronic. Products included cased keyboards, keyboard PSUs, video terminals and parallel/serial convectors. Haywood then marketed SWTP and vector micros and assembled SWTP from kits. An S-100 micro was added to the range which became a range of micros for specialist applications assembled in U.K. Current range is the good composite range of U.K.-manufactured low-cost desktop business micros.

Haywood's latest range is the 9000 Composite which includes four models, depending on the disc storage offered. The 9000 has two 320K floppy disc drives and costs £1,795. The 9001 has a 5Mbyte hard disc and costs £3,300. The 9002 and 9003 have 15Mbyte and 20Mbyte hard discs and cost £3,800 and £4,200 respectively. All prices exclude VAT.

The 9000 series is built on the proven technology of a Z-80A CPU with 64K of RAM, running CP/M version 2.2. The screen and discs are integral. The separate keyboard has a numeric keypad and up to 34 dedicated function keys. A special keyboard is available with keys dedicated to WordStar. Networking is possible for up to 30 users under Turbodos, or using the Hi-Net system. Haywood can also provide full word processor training.

The computers are made in Hatch End, Middlesex, and sold via 14 dealers. The main uses are word processing and small business systems, especially for vertical markets such as solicitors and estate agents.

HH MICROCOMPUTERS

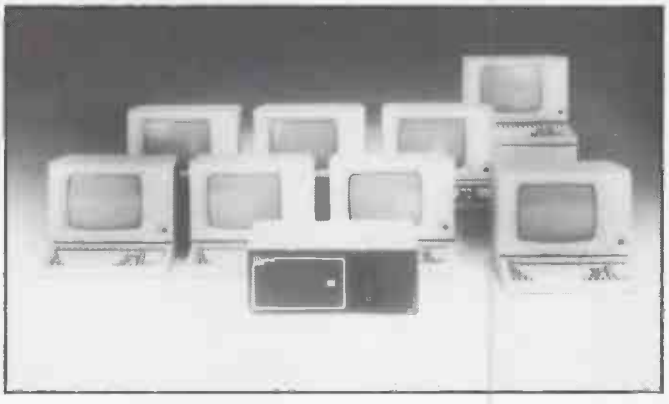
Address: Viking Way, Bar Hill, Cambridge.
Telephone: (0954) 81140
Telex: 817515
Company founded: 1983
Origin of company name: Founding partners surnames — Harrison and Heald

H H brings to the market place a range of microcomputer products which incorporates innovation, quality and service. Progress to date has been exceptionally good as can be seen by the number of professional dealer outlets already established.

HOTEL MICROSYSTEMS

Address: 69 Loudoun Road, London NW8 0DB
Telephone: 01-328 8737
Telex: 266828
Company founded: 1979
Number of employees: 11
Origin of company name: System developed for hotel administration
Turnover in 1982: £0.8 million

Hotel Microsystems, now known as HMS, originally developed systems for the hotel trade using North Star Horizon machines. The company has expanded rapidly over the last four years diversifying into a wide variety of other markets, selling its latest computer, the Minstrel, into colleges, hospitals, universities and blue-chip companies throughout the U.K. HMS now specialise in low-cost, multi-user systems, with built-in telecommunications and telex facilities if required. Tony Harris, the company's director, stresses that "customers come to us when they need a system with full service and back-up, not when they want an armful of boxes."



Hotel Microsystems, HMS, manufacturers its Minstrel range of micros in a warehouse behind Kings Cross Station. The machine is available in several different configurations, from single-user Z-80A-based CP/M systems through Turbodos multi-processor systems to the top of the range 68000-based Cromix and CP/M-68K version.

The Minstrel uses the S-100 bus, to give access to a wide range of interfaces, displays, functions and facilities. The Minstrel Turbo, the basic machine, costs between £1,800 and £7,000; the Minstrel 86, a 8086-based micro with MS-DOS and CP/M-86, ranges from £3,100 to £5,000; and the Minstrel 68K, a 68000-based micro with Unix, costs from £4,000 to £7,000, VDUs and printers are extra. Storage ranges from one or two 400K or 800K 5.25in. floppy discs to 5, 10, 15 or 20Mbyte Winchester discs. The Minstrel is being sold via a network of 20 dealers in the U.K. and Europe.

HYTEC MICROSYSTEMS

Address: Sandy Lane West, Oxford OX4 5JX
Telephone: (0865) 714545
Telex: 837875
Company founded: 1980
Number of employees: 80
Turnover in 1981/82: £2 million
Parent company: H D Holdings

In three years Hytec Microsystems has grown into one of the most successful computer companies in Britain today. In 1980 it introduced one of the first microcomputers with mainframe communications and later became the first to offer all three ICL communications protocols on a single machine. Its reputation for innovation continued with the C Series, the first microcomputer to

perform stand-alone and communications tasks concurrently. Now in 1983 Hytec has consolidated its considerable expertise in the launch of the Prelude, a range of terminals and network microcomputers designed, built, assembled and tested in the U.K. at Hytec's Oxford factory. With its commitment to quality, service and innovation Hytec has become the U.K. company synonymous with British high technology success in the 1980s.

Built around the Z-80B eight-bit processor Hytec Microsystems' Prelude range includes two microcomputers as well as a mainframe terminal.

The smaller micro, Prelude 15, has 192K of RAM, a 5.25in. floppy disc drive with 946K of storage, and can be connected to an external hard disc system offering up to 50Mbytes of storage. At the top of the range the Prelude 20 can accommodate integrated floppy, hard and exchangeable hard disc devices giving a maximum storage potential of 50Mbytes.

The Prelude, which has communications protocols for ICL, Honeywell, Burroughs and IBM mainframes, runs under the CP/M operating system and is offered with Hytec's Hytext word processing and H-base database management software as part of the standard package. The system also has its own local area networking facility called Tecnet, which allows the micros to be linked together sharing processing power and peripherals.

Manufactured at Hytec's Oxford factory, the range is modular and compatible allowing a basic terminal system to be upgraded to a fully-fledged Prelude 20.

IBM UNITED KINGDOM LTD

Address: PO Box 41, North Harbour, Baltic House, Portsmouth, Hampshire PO6 3AU
Telephone: (0705) 321212
Telex: 86741
Company founded: 1951
Number of employees: 15,000
Origin of company name: In 1924 the name International Business Machines Corporation was adopted from the Computing-Tabulating-Recording Company
Turnover in 1982: £1.2 billion
Parent company: International Business Machines Corporation

IBM's operations, with very minor exceptions, are in the field of information-handling systems, equipment and services to solve the increasingly complex problems of business, government, science, space exploration, defence, education, medicine and many other areas of human acticity. IBM's products include data processing machines and systems, telecommunications systems and products, information distributors, office systems, typewriters, copies, educational and testing materials, and related supplies and services. Most products are both leased and sold through IBM's worldwide marketing organisations.

The IBM Personal Computer — PC for short — is an eight/16-bit micro which uses the Intel 8088 CPU. It has 40K of ROM, which includes the Basic language, plus from 64K to 544K of RAM. Mass storage is provided by one or two 160K or 320K floppy disc drives. Alternatively there is the XT model with a 360K floppy plus a 10Mbyte hard disc. A further 10Mbyte disc can be added to either machine.

The IBM PC — set to be the best selling small business micro — is manufactured in Greenock and available from over a hundred dealers.

ICL (INTERNATIONAL COMPUTERS LTD)

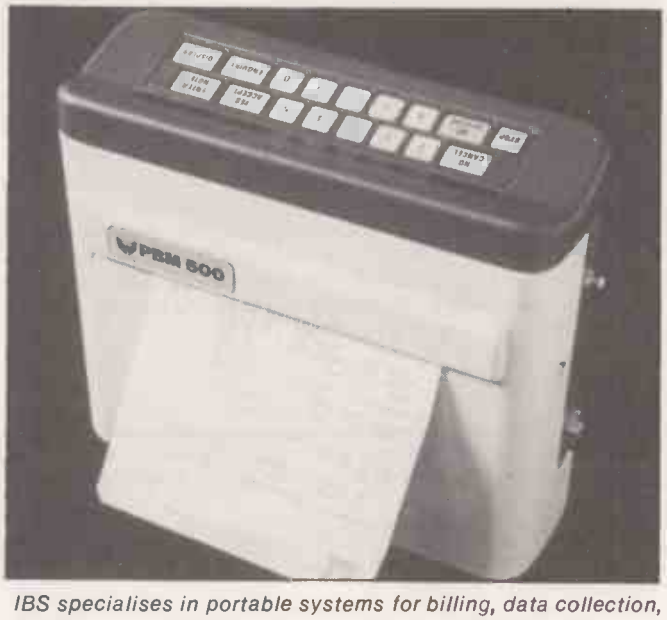
Address: ICL House, Putney, London SW15 1SW
Telephone: 01-788 7272
Telex: 22971
Company founded: 1968
Number of employees: 23,500 worldwide, 16,000 U.K.
Turnover in 1982: £721 million

ICL, Europe's largest indigenous manufacturer of computers, was formed originally from the merger of English Electric and Singer. It manufactures a complete range of computers from micros to mainframes, to satisfy a complete spectrum of needs from the smallest office right up to the largest corporation or government department.

IMMEDIATE BUSINESS SYSTEMS

Address: 3 Clarendon Drive, Wymbush, Milton Keynes MK8 8DA
Telephone: (0908) 568192
Telex: 825256
Company founded: 1982
Number of employees: 120
Origin of company name: From Immediate Billing. The production of a utility bill by the meter reader using a portable computer with integral dot-matrix printer — the Portable Billing Machine, PBM.

Manufacturer of one of the first protable computer and Host data manager system FS-2000, PBMs, first operational with South of Scotland Electricity Board in 1980, contain Z-80 processor and 64K to 256K magnetic bubble memory, 16-character display and keyboard in waterproof and shockproof case weighing 4.5kg. SSEB transferred all non-industrial billing to IBS system. Several other large U.K. and overseas utilities now following SSEB's example.IBS has now introduced data capture and processing unit, fieldwork fifty, identical in CPU and memory capacity to PPM but without printer and with Microsoft M-Basic programming. Latest product is magnetic bubble cassette, a lightweight, 70g. exchangeable memory unaffected by dust, dirt and vibration and with no moving parts.



IBS specialises in portable systems for billing, data collection, and data processing in harsh environments. The portable

(continued on next page)

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billing machine pictured here has a full width built-in printer so that the customer can be billed on the spot after a meter reading is taken.

IBS also produces the Nomad, also called the Fieldwork Fifty, an eight-bit CP/M computer built around a CMOS variant of the Z-80. The 3.3lb. machine is extremely rugged and uses bubble memory in place of the more vulnerable floppy disc as its mass storage device. A Nomad with two line by 40 character LCD display, waterproof keyboard, 32K of RAM and 64K of bubble memory costs £2,236.

INTEGRATED MICRO PRODUCTS — IMP

Address: Unit 17B, Number One Industrial Estate, Medomsley Road, Consett, Co. Durham DH8 6SY
Telephone: (0207) 503481
Telex: 53429
Company founded: 1981
Number of employees: 12

Integrated Micro Products was founded in late 1981 to manufacture the IMP-68, a general purpose multi-user computer based on a MC-68000 CPU card of its own design. A pre-production prototype was launched at Microsystems '82, and full scale production commenced upon moving into its new factory in Autumn 1982. A dealer network is now being established, and based on current production levels alone, 1983 will show multi-million pound turnover.

The IMP-68 is a powerful and compact 68000-based system, with prices starting at £7,950. Inside the compact case is the 68000 processor, 250K of RAM, one slimline 8in. floppy drive, and a 10 or 20Mbyte 5.25in. Winchester drive. The system comes complete with the Unix-like multi-user operating system Idris, C and Pascal compilers, 68000 Assembler and utility software to enable the user to read CP/M, RT-11 and UCSD floppy discs. The UCSD p-system and the BOS operating systems are available as options. Memory can be expanded in 256K increments and more hard discs can be added. The IMP system sells mainly to educational users and specialised OEMs, but business software, for instance the Uniplex office automation package, is available.

ITCS

Address: Information and Technology Computer Services, 16/18 Littleton Road, Ashford, Middlesex TW15 1UQ.
Telephone: (0742) 47186
Company founded: 1981
Number of employees: 37

ITCS was founded to exploit the growing market for portable micros, and after a period of development the Andromeda range was launched in 1982. After initial British manufacture by Information and Technology Services — a separate company from the marketing company ITCS — it is possible that manufacturing will be subcontracted out.

The standard model in the Andromeda range is the Zita P, which uses a Z-80A microprocessor and either two floppy disc drives or one floppy and a hard disc. The latest model is the Portable Executive, which comes in an executive-style briefcase. Again the CPU is a Z-80A.

The machine has 128K of RAM, and 8K of ROM expandable to 12K. Versions are available with two or three 5.25in. floppy discs giving 1Mbyte of storage each. With hard discs storage can range from 5Mbyte to 24Mbyte. £2,500 worth of software is included with the Executive. Zita prices start at just over £1,500.

JAROGATE

Address: 197-213 Lyham Road, Brixton, London SW2 5PY
Telephone: 01-671 6321/2/3
Telex: 8950094
Company founded: 1979
Number of employees: 20
Turnover in 1982: £1 million

Jarogate originated as a high-technology R-and-D company in the mid-seventies with links to university research. Now having built firm technical and commercial foundations, it has a five-strong R-and-D team dedicated to keeping the MP computers as market leaders. For customer back up it has a free telephone support service, and a U.K. field maintenance company. In addition to the MP series systems Jarogate is a maindealer for Comart and Future products; it also manufacturers a wide range of plug compatibles for Cromemco machines. Future plans include an extensive marketing campaign to extend its dealer network with a new product launch in October.

The Jarogate MP-5 is a multi-user system built around the S-100 bus which gives each user a separate processor and at least 64K of dedicated RAM. The 4MHz Z-80, the 6MHz Z-80 or the 16-bit 8086 processor can be used, and mixed eight and 16-bit systems are possible with up to 16 users in total.

Each user has a private CP/M or CP/M-86 environment and an individual S-100 bus, allowing different local I/O and graphics options to be used. Communication between users is handled byCP/NOS, Digital Research's network operating system. Prices start from £4,945. An Ethernet local area network is available to link up to 50 MF-5s together.

Jarogate also make a Z-80B system called the MP-1 and a dual-processor system, MP1-C68, which has both a Motorola 68000 and Z-80A processor. Jarogate's customers are in process control, communications and general business.

(continued on page 32)

CHOOSING A HOME MICRO

WARNING

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

THE PITFALLS

"DON'T LET THE ADD ONS ADD UP"

A number of large companies are offering packages that seem to be good value and low cost.
These offers usually have a hidden sting inasmuch as the essential accessories such as connection leads, peripherals and software often carry very high cost premiums.
e.g. software for low cost hardware usually costs between £29 and £49 for a ROM cartridge!!

CHECK THE QUALITY OF THE PRODUCT.

Raw materials are now an area where corners can be cut, and shoddy workmanship during 'building' can effect the 'up-time' of your unit.
Areas to watch out for are unreliable edge connectors, corrosion and poor quality P.C.B.s. Low quality components and bad design will seriously effect the reliability of the end product, and can lead to false economy.

DON'T BUY A GAMES MACHINE

Unless you want just games and nothing else! With a games computer you are limited.
Some computers, however, have the advantage of both games facility plus the whole world of computing to explore, as your interest and skills develop. A real computer system will allow you to expand your knowledge of the Hi-Technology world, and help earn its keep with its added uses in the field of education, communication and home business use.

SOFTWARE

Make sure the system you choose has a growing library of support software, to enable you to realize the full potential of your machine.

KEY POINTS TO LOOK FOR

● High Resolution Colour

In general most home computers have a poor graphics resolution (or detail). Check on the vertical and horizontal resolution in graphic mode and multiply the two numbers together. If the result is less than 35,000, then the graphics can hardly be considered high resolution.
Without high resolution graphics displays such as those used in games tend to be "Chunky" in appearance.

● High Quality Sound

Some computers claim to provide a sound channel when in reality all that can be found inside the computer is a small buzzer controlled by electronic pulses. At the very least a sound facility should provide more than one channel and a raise channel as well (for gun shot effects in games for example). The best systems also provide envelope control of the sound channels to produce very sophisticated effects; very important for generating music. Also look for the ability to connect to external amplifiers.

● Keyboard

For accurate entry of programs and data into a computer it is important that the keyboard has a good tactile feel in operation. Coupled with acoustic feedback the user is fully aware when the computer has accepted his/her actions. Also of importance in a keyboard is layout. A standard computer keyboard layout will familiarise the user with the vast majority of computers used in the world of business and professional applications; very important if the purpose of purchasing a computer is educational.

● RAM

One of the most important features of a computer is the amount of RAM, or memory, included. In general the more powerful and exciting a computer program is the more RAM it requires. But take care, all computers are advertised quoting the total RAM used in the system. Computers use up a great deal of their own RAM for storing essential data and particularly in supporting the graphics display and the CPU.
If it is less than 32K think again, is it enough?

● Computer Language

It is too dificult to program a computer in its own binary language so high level languages are used, the most popular being BASIC. However, there are a number of BASICs, some being very different from the rest.
A de facto standard in the computer industry is Microsoft BASIC.
Learn this one and you will be able to program in the majority of computer BASICs; such an important point if a home computer is to be used to educate your children to face the technology of the future.

● Expansion

As your interest and knowledge of computing grows, you will need a computer system that will grow with you; able to accommodate Printers, Disk-drives, Joysticks, Communications Modem, and Colour Monitor, as well as produce HI-FI sound effects.

Choosing the right system carefully will save you from throwing your money away. Check full specification, plus peripherals and software prices, before you buy. Preferably choose a Real computer system that can expand to meet your needs.

● Software

The computer you choose should have a growing selection of utility software to make the most of its capability.
Remember, computing is here to stay. You can't learn to compute on a toy, or a device which does not behave like a real computer.
In short, look out for a computer which offers all the points above, and you will be sure of getting the best value for money.

To find out which company offers you the right choice, with:-

- Good value, high specification, quality micros.
- A quality, 4 colour, plain paper printer/plotter.
- Communications Modem.
- Micro Disk Drives.
- Comprehensive and growing range of software

TURNOVER... →

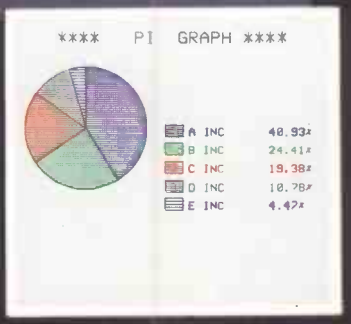
The Growing System

ORIC 3" MICRO FLOPPY DISK DRIVE

Coming soon the incredible new 3" Oric Micro Drives. Small size, Compact, High precision disks with storage capabilities from 100K Bytes to in excess of 1 Megabyte unformatted. With their own built-in power supply, these easy to use units will add big system capability to your home micro.

ORIC MCP 40 COLOUR PRINTER/PLOTTER

The Oric Colour Printer is quality engineered to provide 4 colour hard copy on plain paper, with superb graphics and text capability, printing either 40 columns or 80 columns. It prints in red, green, black and blue, onto a 4½" width standard paper roll. With a print speed of 12 characters a second, the MCP 40 comes with its own power supply and all necessary leads to connect straight into your Oric or to any standard Centronics interface.



This superb printer represents excellent value at just £169.95 including VAT.

ORIC PRODUCTS INTERNATIONAL LTD. COWORTH PARK, LONDON ROAD, ASCOT, BERKS.

The right choice for real computing

ORIC-1

Before making your final choice, check any other home micro in the same price bracket, against the incredible specification of the ORIC-1.

Quality of build and materials	Real computer keyboard layout and moving keys
Superb styling / Full colour display	High Resolution colour graphics 240 x 200 pixels
Choice of 16K or 48K RAM	Real computer language programming – Basic / Forth
Latest design technology and circuitry	Teletext/Viewdata compatible graphics (28 rows x 40 characters)
Real sound – 8 octaves plus Hi-Fi output	Cassette Port & R.G.B. output.
Centronics printer interface	Fully supported and growing software library
Colour printer / Disk Drives	A fully expandable system for home, education & small business use
Communications Modem	Full range of peripherals to support your system...

ORIC-1 Setting todays standard in Quality and Price.

ORIC-1 48K £139.95 inc.VAT **ORIC-1 16K £99.95 inc.VAT**

All ORIC computers purchased before 31st December 1983 come with a £40 voucher off the M.R.P. of the MCP 40 Colour Printer.

MCP 40 COLOUR PRINTER £169.95.
OFFER PRICE £129.95

TANSOFT ORIC Software

NEWS FLASH
LATEST RELEASE
THE HOBBIT

The fast growing success of ORIC-1 means that an incredible number of software titles are becoming available for your Oric. With many well known titles from independent software houses. plus exclusive ORIC SOFTWARE from TANSOFT. you can now drive your Oric towards its full potential.
Below is a small selection from Tansoft's range. all of which offer superb value.

BUSINESS
ORIC BASE. ORIC CALC. AUTHOR.

MACHINE LANGUAGES
FORTH. ORIC MON.

COMPUTER GAMES
ZODIAC, HOUSE OF DEATH, ORIC MUNCH, SUPER BREAKOUT, ULTIMA ZONE, DEFENCE FORCE.

TOURING LANGUAGES
GERMAN. SPANISH. ITALIAN. FRENCH.

GENERAL INTEREST
ORIC CHESS. MULTIGAMES 1. MULTIGAMES 2. ORIC CAD. THE NOWOTNIK PUZZLE.

TANSOFT ORIC SOFTWARE available from your ORIC supplier and all good software dealers. For full list of further information contact:-

TANSOFT LIMITED – 3 CLUB MEWS. ELY. CAMBS CB7 4NW TEL (0353) 2271/2/3/4

(continued from page 28)

JUPITER CANTAB

Address: Cheshunt Buildings, Bateman Street, Cambridge CB2 1LZ
Telephone: (0223) 313479
Telex: 81546
Company founded: 1982
Number of employees: 5
Origin of company name: To pinpoint location of Cambridge
Turnover in 1982: Not yet traded for a full year

Jupiter Cantab was founded to market Jupiter Ace, the first low-cost microcomputer to run in Forth rather than the usual Basic. After selling several thousand machines by mail order the company moved out into the open market, both at home and overseas. Initially it followed the market, concentrating primarily on games playing applications, but during the last few months it has become clear that the real future for the machine lies in serious control applications and educational functions. It is to this end that present and future developments will primarily be dedicated. Several such projects are already being underaken.

The Jupiter Ace is a tiny machine which in some respects resembles the Sinclair ZX-81, but there are some major differences. First, the keyboard is moving key, not the membrane type. Second, the Ace uses not Basic but Forth as its native language. Third, it comes with 19K of RAM, though 16K of this is in a separate Sinclair-style pack which plugs into the expansion bus on the back.

At around £90 the Ace offers one way of learning Forth. As Forth is a powerful control language — it was invented to drive an astronomical telescope — the Ace could also be used for industrial control operations such as driving robots, which the picture shows. The Jupiter Ace is in the bottom left-hand corner.

KALAMAZOO

Address: Northfield, Birmingham B31 2RW
Telephone: 021-475 2191
Telex: 336700
Company founded: 1908
Number of employees: 2015
Origin of company name: City of Kalamazoo, Michigan, U.S.
Turnover in 1982: £35.8 million

Despite its name, Kalamazoo plc is a wholly British company. For many years it has been the market leader in hand-written business systems in the U.K. It has been increasingly involved in computer systems since 1967, first offering batch services to the motor trade. Today Kalamazoo is selling a wide range of micro systems, mainly to small businesses and based on its own range of micro computers which are made at the company's factory in Birmingham and sold by the 250-strong Kalamazoo sales force.

Kalamazoo, the originators of the paper-filing systems for office records, offer three micros for use in small businesses and specific trades such as the motor trade, the construction industry, hotels, clubs, schools and insurance brokers.

The smallest system is the Kalamazoo K-1050 single station, single board computer with integral floppy disc controller and communications. It incorporates an Intel 8085A microprocessor with 64K dynamic RAM and 4K EPROM, and has dual 5.25in. floppy disc drives, with a capacity of half a megabyte of storage in total. The K-1050 costs £3,400.

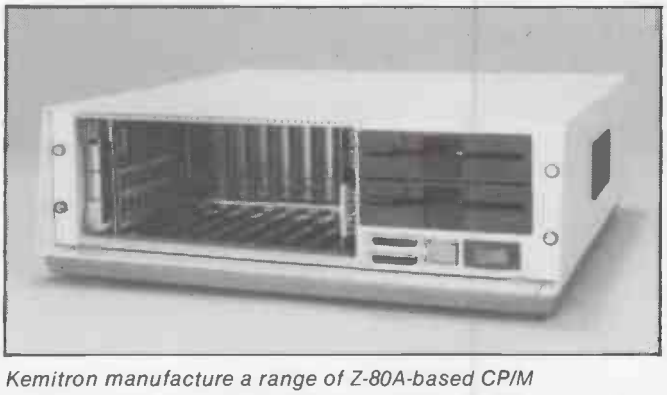
In the middle of the Kalamazoo range is the 1500, again a single station 8085 computer, with 10K EPROM and 48K RAM. The dual 8in. floppy disc drives provide 1Mbyte of memory in total, and the system costs £5,115.

The top of the range model is the K-1600, with 10K EPROM and 48K RAM, and 2Mbytes of memory on dual 8in. floppy discs. The system sells at £6,095. All the systems are manufactured at Kalamazoo's factory in Northfield, Birmingham.

KEMITRON ELECTRONICS

Address: 21-23 Charles Street, Hoole, Chester CH2 3AY
Telephone: (0244) 21817/8
Company founded: 1976
Number of employees: 17
Origin of company name: CHEMical and elecTRONics — Kemitron
Turnover in 1982: £0.5 million

Kemitron was founded in 1976. Initial development work concentrated on the design of a range of instruments for monitoring and controlling experiments. Increasingly, this control took the form of a central disc-based computer, designed and produced in-house, together with a range of interfaces which gave the equipment its flexibility for industrial as well as scientific use. Kemitron also offer a widely used and proven development service through which dedicated hardware and software may be designed and produced.



Kemitron manufacture a range of Z-80A-based CP/M computers, for industrial and scientific users. The systems are purpose built for the laboratory and shop-floor environment rather than the office and have industry standard 19 rack mounting and fully regulated and suppressed power supply units. The entry level system costs £900 without discs, a twin 5.25in. floppy system costs £2,200, and there are 8in. and hard disc options. Over 30 different analogue and digital interface modules are available for specialised applications.

LIMROSE ELECTRONICS

Address: Aerial Road, Ilay Industrial Estate, Wrexham LL12 0TU
Telephone: (097 883) 5555/6

Limrose is best known for its Logic Tutors and other educational ventures, including training and consultancy. Its Microtutor MPT 8080/K-1 is an 8080-based micro with 1K of RAM and a fully labelled, diagrammatic board. It can be run in single step mode or continuously. The Microplus 1 is a business micro with a Z-80 CPU, 64K of RAM and two 1Mbyte 8in. floppy disc drives. It runs CP/M, and including the VDU and detached keyboard costs £2,695. A 20Mbyte hard disc is an optional extra, as is the Flex operating system.

LOGICA VTS

Address: 86 Newman Street, London W1
Telephone: 01-637 5171
Telex: 27200
Company founded: 1979
Number of employees: 250
Turnover in 1982: £10 million
Parent company: Logica Holding Ltd

Logica VTS has grown in four years to a turnover of £10 million. Its main products are the Vitesse PC, the VTS range of word processors and the Polynet local area network. It is part of the international Logica group of companies. It recently received the Queen's Award for Technological Achievement.

Swindon-based Logica VTS markets three models of its 16-bit Vitesse range via about 20 U.K. dealers. The top of the series model is the 256K version which retails at about £3,800, with the 128K version selling at £2,890, and the 64K version at £2,490.

All three models use the Intel 8086 processor, and have a detachable QWERTY keyboard and 15in. screen display. The micro has two 5.25in. disc drives with a capacity of 1Mbyte, and RS-232 and Centronics ports. Software for the micro includes Logica's Wordsworth word processing package and V-Edit, a screen-editing package.

LSI COMPUTERS

Address: Sherwood House, Copse Road, St Johns, Woking, Surrey
Telephone: (04862) 23411
Company founded: 1976
Number of employees: 100
Turnover in 1982: Approximately £7.5 million
Parent company: CPU Computers Ltd

LSI Computers was formed by its present two managing directors as an independent British micro manufacturer to attack the small business computers market. It has grown as one of CPU Computers' two companies to the point where it now has regional sales/service offices in most major U.K. areas, has a network of dealers for its smaller desktop models and exports via associated companies in France and Germany. The main manufacturing unit is at Woking, the headquarters of the parent company which recently launched successfully into the stock market.

LSI Computers manufacturers all three of its microcomputer offerings at its Woking headquarters. The company's latest product, M-Four, uses both Intel's 8088 16-bit microprocessor and Zilog's Z-80B eight-bit chip, selecting one or the other automatically according to what software is being used. Priced from £2,390 this multi-user desk-top machine runs under CP/M-86, MS-DOS or CP/M and can support both floppy disc drives or Winchester systems providing up to 10Mbytes of storage.

The company also manufactures the M-Two eight-bit multi-user office system which costs from £8,595, and the M-Three, a single user eight-bit desk-top micro priced from £1,995. An M-Five is being developed for launch later this year. Small businesses and professionals form the bulk of LSI's users who have the advantage of being supplied by a dealer network with excess of 100 outlets.

LUCAS LOGIC

Address: Welton Road, Wedgnock Industrial Estate, Warwick
Telephone: (0926) 497733
Telex: 312333
Company founded: 1977
Number of employees: 80
Parent company: Lucas Industries

Lucas Logic was established in 1977 and has been involved in computerised process control equipment, automatic test equipment and the Lucas Nascom range of microcomputers. The well known Nascom microcomputer has been very popular with the home enthusiast and more recently has gained wide acceptance in schools where the particular features of networking and graphics have put Nascom ahead of its competitors. The new Lucas LX range of business micro-computers offers CP/M with multi-floppy disc and Winchester configurations and is supported by Lucas advanced colour graphics.

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The Z80-based Nascom was one of the earliest British Microcomputers. Lucas Logic now produce and market the system and in its new incarnation as the Nascom 3 the greatly expanded machine is hardly recognisable. The standard cassette-based system now comes with 48K of RAM and costs £549. The addition of 1.5Mbytes of floppy disc storage and CP/M brings the price to £1,850. RAM can be expanded to 256K and the optional Nas-Net allows up to 32 Nascoms to be networked together. Lucas appear to be aiming the Nascom mainly at the educational and scientific markets.

The Lucas Lx is essentially the same machine as the Nascom repackaged to modern business system standards, with a separate numeric keypad, screen and system box. Prices start at £1,795.

MEMOTECH

Address: Station Lane, Witney, Oxfordshire
Telephone: (0993) 2977
Telex: 83372
Company founded: 1982
Number of employees: 140
Origin of company name: Memory technology
Turnover in 1982: Only started trading mid 1982
Parent company: Orchid Computers

The company began the manufacture of peripherals for the Sinclair ZX-81 in 1982, producing the well known Memopaks 16K, 32K and 64K; RS-232 ports; high-resolution graphics; and software packs. The company took advantage of its experience with the Z-80 CPU to design the extremely advanced MTX series of computers, the launch of which in September will accelerate the company's already outstanding growth rate. Unusually, the systems introduced will arrive with a complete range of peripherals and software in the fields of business, education and games playing.

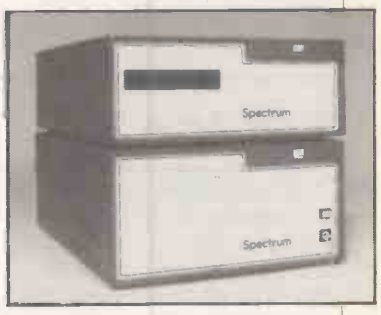
Memotech offers two micros for the home, business and education markets. The £275 MTX-500 is built around a Z-80A processor with 32K of user RAM expandable to 512K, while the £315 MTX-512 has a standard 64K of RAM. The company also sells a disc-based system which can be used with the 64K version plus an optional communications board. This system, running under CP/M, may contain two 5.25in. floppies, a 5.25in. Winchester or four 256K silicon discs, while the smaller system can suport either a 5.25in. or 8in. floppy disc drive.

The systems, manufactured at the company's Oxfordshire site, have joystick, cassette and Centronics ports and are offered with the MTX Basic and Logo languages as standard.

MICROAPL

Address: 1F, Nine Elms Industrial Estate, Kirtling Street, Nine Elms Lane, London SW8 5BP
Telephone: 01-622 0395
Telex: 896885
Company founded: 1979
Number of employees: 15
Turnover in 1982: £1 million

MicroAPL specialises in the application of the powerful programming language APL to microcomputers. In particular, MicroAPL has been at the forefront of the 16-bit technology which provides the power and addressing capacity necessary for the high-level language. Frustrated by the slow progress of microcomputer manufacturers, MicroAPL designed and constructed its own system: the MicroAPL spectrum, first available in 1981, based on the powerful Motorola 68000 processor and using the flexible S-100 bus construction. MicroAPL have since implemented its Mirage/APL software combination on other exceptional Motorola 68000 based hardware: most notably the SAGE II and IV ranges of microcomputers, manufactured in the U.S.



The other Spectrum, from MicroAPL, is manufactured in Vauxhall, South London nd sold via six European distributors. Spectrum is a 16-bit micro using the Motorola 68000 CPU, with 32-bit internal registers and 16-bit data lines. A typical configuration would be a system with 1Mbyte of memory, a 36Mbyte hard disc and a 17Mbyte tape cartridge, which would support a mix of simultaneous APL users with up to 900,000 bytes of user workspace that would fit into two boxes.

Options on the system are available for memory size, disc capacity and RS-232 ports up to the limit of 20 S-100 boards; memory is installed at 64K or 256K per board. Disc options range from floppy discs to 36Mbyte 8 in. Winchester discs, with 17Mbyte tape cartridge for back-up and data interchange. The multi-user system costs between £10,000 and £25,000 depending on the configuration.

OFFICE TECHNOLOGY

Address: Diamond House, Bookham Industrial Estate, Church Road, Bookham, Surrey
Telephone: Bookham 58911
Telex: 892414
Company founded: 1967
Number of employees: 250 +
Parent company: Information Technology

In 1983 Data Recall merged with Office Technology. The company has been at the forefront in Britain in the highly-competitive office automation and word processor market places. Its main products, the Diamond Information Processor and the IMP Office Automation System are both recognised as market leaders in their particular sectors of the industry.

Office Technology is not well known in the micro world but sells CP/M compatible machines like the Diamond 7 to the office equipment, information technology and small business markets.

ORIC PRODUCTS INTERNATIONAL

Address: Coworth Park, London Road, Ascot, Berkshire SL5 7SE
Telephone: (Ascot) 27641
Telex: 847 489
Company founded: 1982
Number of employees: 25
Origin of company name: Derived from Aurac, *Blake Seven's* wonder machine
Turnover in 1982: Did not exist, 1983 projection £25 million

John Tullis and British Car Auctions approached Tangerine Computer Systems to design a low-cost personal computer. The first production unit was completed on 11 December 1982. The ULA was totally designed by Tangerine, the only company to have done so, and worked first time. A forecast of 50,000 sales during 1983 was achieved by the end of May and the target has been revised to 250,000 units worldwide. Joint venture companies have been formed in Singapore and Japan.

Oric offers both 16K and 48K versions of its micro designed for the hobbyist, educational and first-time user markets. Based on the 6502A microprocessor, the Oric-1 has 57 moving keys and uses a TV set as a colour monitor. The Oric Modem allows the system to access Prestel services, while the Oric printer, priced at £169.95 means that hard-copy can be produced. Extended Microsoft Basic and a Centronics interface are included in the Oric-1 as well as six octaves of controllable sound.

The machine, which costs £99.95 for the 16K version and £139.95 for the 48K version, is sold through 180 U.K. outlets as well as to overseas markets. The printed circuit board contained in each system is manufactured in the Far East, although assembly and test of the Oric-1 is carried out in Feltham.

PLESSEY MICROSYSTEMS

Address: Water Lane,Towcester, Northamptonshire NN12 7JN
Telephone: (0327) 50312
Telex: 31628
Company founded: 1925
Number of employees: 41,000
Turnover in 1982: £1,075 million

Plessey is one of the U.K.'s major manufacturers of electronics equipment, though few people have seen the name on the front of a microcomputer. Most of its computers are sold to OEMs, original equipment manufacturers, who distribute and sell to end users. Plessey supplies System 19 computers to such companies as Logitek, Logica and Root Computers.

PORTICO TECHNOLOGY

Address: Southbank House, Black Prince Road, London SE1
Telephone: 01-735 8171
Telex: 295555
Company founded: 1983
Number of employees: 15
Origin of company name: From portable, logo features a doorway.

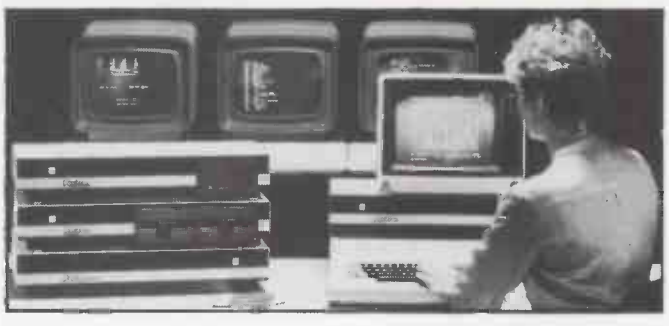
Portico make the Miracle, a 28lb. mains powered transportable which comes with a large amount of CP/M software included in its £1,795 price. The Z-80A based machine has built-in twin 5.25in. floppies providing 800K of disc storage and an unusually large screen for a portable, measuring 10in. diagonally. The Miracle's 128K of RAM includes 64K set aside as a RAM disc.

The software includes Micromodeller, the Profitplan spreadsheet, Memoplan wordprocessor, and Microcache memory-management system.

POSITRON COMPUTERS

Address: Unit 16, Deacon Trading Estate, Newton-le-Willows, Lancashire WA12 9XQ
Telephone: (09252) 29741
Company founded: 1979
Number of employees: 20
Origin of company name: Isaac Asimov's robots had Postronic brains.
Turnover in 1982: £0.5 million

Positron specialises in the design and manufacture of advanced microcomputer systems that utilise the philosophies and techniques more usually found in minicompuer environments. Since the company was founded the range of products has increased to cover multi-user processors, floppy and Winchester disc drives and a networking option to allow the sharing of expensive resources. For users looking for a low-cost start-up system but with the ability to grow as the user's needs expand, Positron's philosophy of expansion without hardware redundancy should be considered.



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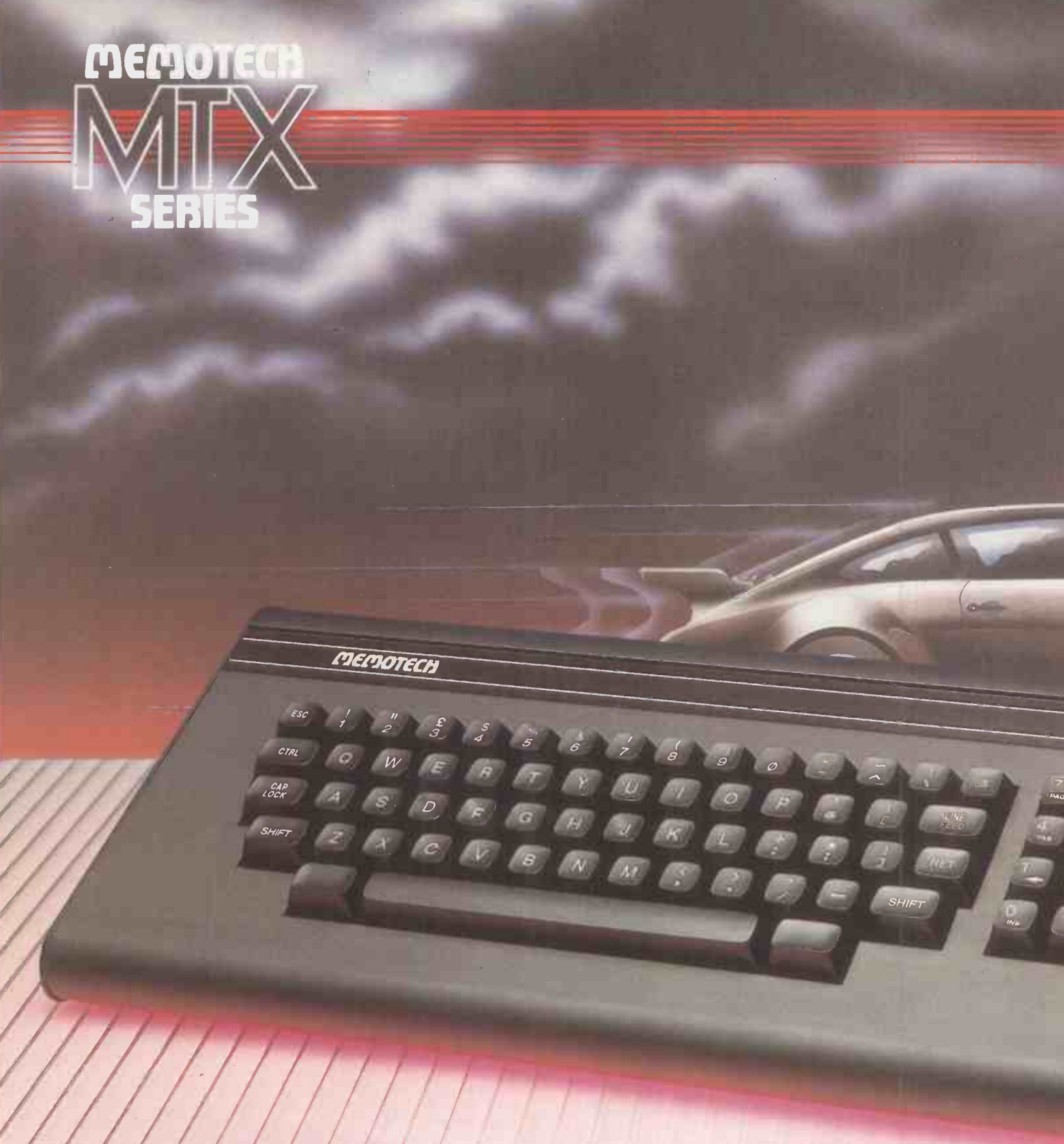
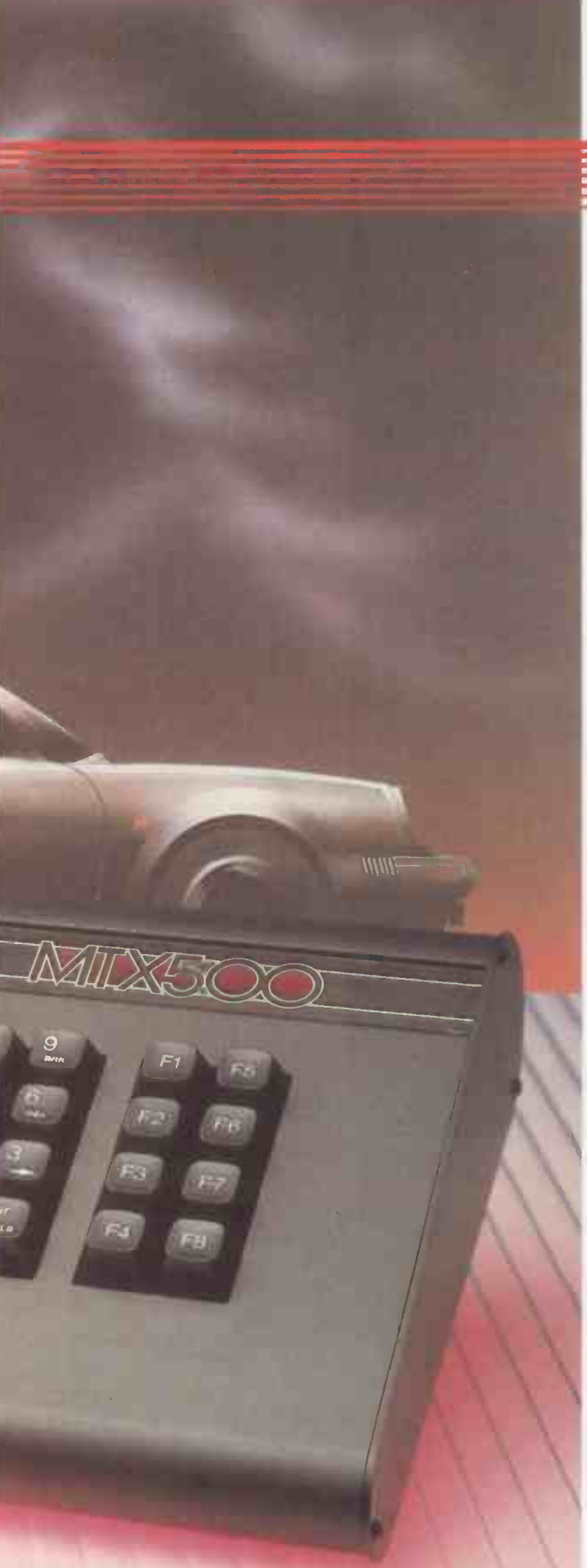
MEMOTECH

MTX SERIES



MTX500 £275 MTX512 £315

Available in September–please phone for sales information
Memotech products are designed and made in Oxford and Witney



The All-Purpose System

The MTX Series

The MTX Series is a new departure in micro-computer technology. Whether your needs as a user are for personal programming, games playing, scientific or process control, educational or business use the MTX Series is already capable or very easily adaptable to almost every application. Glance through the standard features below — you'll see what we mean.

Software

The MTX's 16k ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, LOGO type commands, and NODDY. ROM routines include an ASSEMBLER/ DISASSEMBLER with screen display of the Z80 CPU registers, memory and program, which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to define sections of the screen to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

Hardware

The MTX500 has 32k of user RAM as standard (64k on the 512), expandable to 512k plus 16k of dedicated video RAM. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and easily moveable user defined graphics (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 3 voice sound with hifi output plus a dedicated games cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight function keys and separate numeric pad.

The Disc Based System

The MTX series has been produced with performance and expandability uppermost In the design team's thoughts. When expanded to Disc level the computer supports the following facilities, which will be available in October:

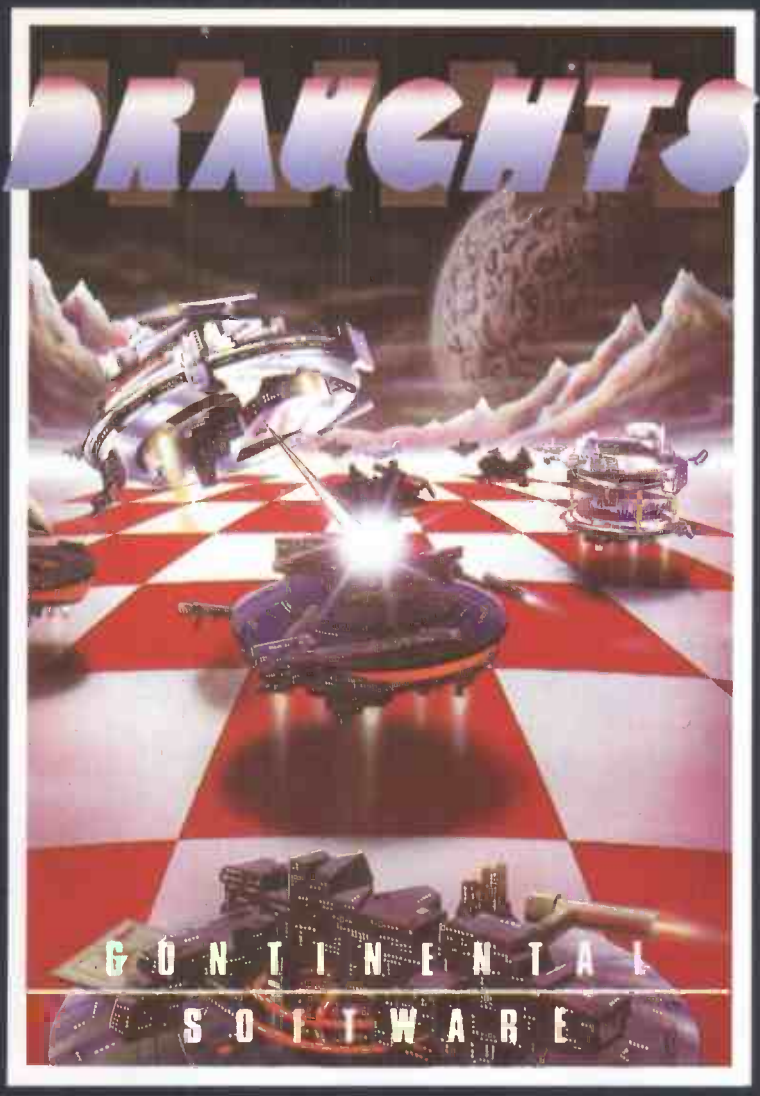
- *80 column video board*
- *5¼" floppy discs*
- *5¼" hard discs*
- *CP/M 2.2, enabling the widely available range of CP/M based software*
- *Memotech Silicon discs — multiples of 256K of fast RAM expandable to 8m bytes*
- *Colour Wordstar*
- *A/D and D/A converters*
- *Networking*

MTX

Memotech Limited,
Station Lane Industrial Estate, Witney, Oxon. OX8 6BX.
Telephone Witney (0993) 2977. Telex 83372 Memtec G

● **Circle No. 313**

CONTINENTAL SOFTWARE



We're not just playing games...

BLOBBO
A fast maze chase with untold perils and hazards.

TOADO
Get the toad back to his nest – but don't get run over or drown on the way.

SUPER MINEFIELD
You may have seen other Minefield games but ours has tanks that lay invisible mines, and spiders that are *very* tricky to avoid.

CONTINENTAL INVADERS
Classic arcade action, with all the features that make this game so popular.

KILOPEDE
This one is very fast – its not easy to get past level two.

RADAR/SONAR
Eliminate submarines with a combination of radar screen and sonar, very realistic.

FLIGHT SIMULATOR
Take off, navigate and land your high powered light aircraft. All the features of true flight.

ALSO AVAILABLE:
RESCUE, BEAVER, CONTINENTAL RAIDERS, PILE UP, SIGNAL MAN and many more.

we mean business too.

MTXCALC
Sophisticated and powerful, the professional spreadsheet program.

MTX WORD PROCESSOR
All necessary features are included to give a powerful business tool.

ACCOUNTING PACKAGE
Sales and Purchase Ledgers, stock control, payroll – the complete business system.

PROJECT PLANNER
Speaks for itself, and helps you achieve deadlines efficiently and effectively.

STRATEGY BOARD GAMES
CHESS, BACKGAMMON, OTHELLO, DRAUGHTS.

EDUCATION PROGRAMS
MATHS 1 PHYSICS 1
The first two programs in a series of specially written software designed to teach at the pace and level best suited to the user.

Software for the MTX SERIES

CONTINENTAL SOFTWARE UNIT 24 STATION LANE WITNEY

(continued from page 35)

The Positron is a modular microcomputer designed around the Motorola MC6809 microprocessor. To the central processor unit, capable of supporting three users, can be added floppy and hard disc controller units and a network controller. For multi-user, multi-tasking operation is uses the powerful, modular Microware OS-9 operating system, which is based on the functional specifications of Unix, including hierarchical directories and a shell.

It offers a Pascal-like structured Basic called Basic-09, with fast execution speed. Flex can be used for single-user operation. The 900 CPU features 64K to 256K of RAM, 36K to 128K of ROM and four RS-232C ports. The 9000 workstation includes the 900 processor, integral keyboard and colour grahics output for a monitor.

POWERTRAN CYBERNETICS

Address: Portway Industrial Estate, Andover, Hampshire SP10 3CT
Telephone: (0264) 64455
Telex: 477407
Company founded: 1972
Number of employees: 12

The Powertran Cortex is a most unusual 16-bit micro built around the Texas Instruments TMS-9995 chip. It has 64K of RAM, with about 34K free to Basic, and features high-resolution colour graphics as standard, with 16K of video RAM. The design was published as a construction project in Electronics Today International *magazine, and the Cortex is available for £295 as a self-assembly kit or for £395 ready built. A machine with two 5.25in. floppy disc drives costs around £900.*

Another computer called the Cortex is an office/small-business machine imported by CWP from the U.S. It is no relation.

QUANTUM COMPUTER SYSTEMS

Address: 55 Wade Lane, Merrion Centre, Leeds, West Yorkshire
Telephone: (0532) 458877
Company founded: 1981
Number of employees: 9
Origin of company name: Quantum levels are used in A-D conversion; subject of our past
Turnover in 1982: £0.5 million

The company was formed by Brian Wingfield of Bits & PC's and John Marshall of Gemini with the intention of designing a highly-flexible microcomputer. This aim was successfully achieved and the Quantum 2000 range offers over 20 different disc drive combinations and a multitude of additional cards for colour, input/output, RAM options, etc. The Quantum has now found its way into many unusual control situations and the introduction of its new network has paved the way for some interesting developments.

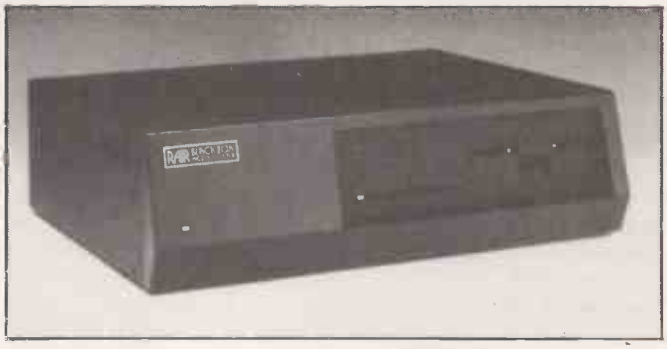
The Quantum 2000 is an eight bit CP/M system built around twin Z-80 processors. It has good ergonomic characteristics with a large 12in. green screen, and a wide range of expansion options. The entry-level system costs £1,510 and comes with a single 400K Micropolis 5.25in. floppy drive and 64K of RAM. Up to three floppy drives and two Rodime 10Mbyte hard discs are available as options, as is up to 1Mbyte of extra RAM configured as a RAM disc. The system uses the Quantum 80 bus.

A networking option allows the Quantum 2000 to be linked into a Local Area Network with up to 32 stations. Other stations can be 2000s or the £860 Quantum Cyclops intelligent terminal, which is identical to the Quantum 2000 screen and keyboard unit.

RAIR

Address: 6-9 Upper St Martins Lane, London WC2
Telephone: 01-836 6921
Telex: 298452
Company founded: 1975
Number of employees: 90
Origin of company name: Random Access Instant Response

Company established 1975 as terminal distributors based on contract with Digital Equipment Company. By 1977 had moved into microcomputer business, but due to lack of suitable products Rair made the decision to manufacture its own products, the U 64K Black Box in 1978 using CP/M, and in 1979 BB2 D/S D/D floppies, multi-input/output for up to 16 terminals.



Rair markets both the eight-bit Black Box range of micros and a dual 16-and eight-bit multi-workstation business system. The company's latest addition to the Black Box range is the S series which has three basic models. The low-cost 3/20S is priced at £1,950 and incorporates two 1Mbyte floppy discs and support for add-on Winchester devices, while the 3/30S has an integral 6 Mbyte 5.25in. Winchester and sells from £3,750 for a single-user system to £5,250 for a four-user configuration. Top of the S range is the 3/50SX with a built-in 19Mbyte Winchester disc which comes in at around £6,500 for a four-user system.

Targetted at the professional user the Rair Business Computer has concurrent 16 and eight-bit processors, up to 1Mbyte of memory and 20Mbytes of disc storage supporting up to four colour workstations. A basic system with a 19Mbyte Winchester, 1Mbyte floppy disc drive, and 256K of RAM lists for £5,250, while workstations are priced at £1,250 each.

REDIFFUSION COMPUTERS

Address: Kelvin Way, Crawley, Sussex RH10 2LY
Telephone: (0293) 31211
Telex: 877369
Number of employees: 600
Parent company: BET, British Electric Traction

Rediffusion Computers, formerly known as Redifon Computers, was formed in the late 1960s out of other companies in the Redif-

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fusion group to market data entry systems in the U.K. and abroad. The company had substantial growth throughout the 1970s and diversified its products during that period so that today Rediffusion Computers is at the forefront of office computing with its R-range of minIcomputers and Teleputer range of microcomputer systems.

While Rediffusion is well known as a £20 million minicomputer company, it has only just entered the microcomputer market with the Teleputer/3. At first sight this looks expensive at £3,595 plus VAT for a Z-80 based micro, but it is actually rather cheap for the power and size of the package. The price includes the operating system, CP/Star, plus a suite of software which share common data files: Startype, Starcalc, Starfile, Startel and Stardata.

The basic machine, which can run CP/M, also includes 128K of RAM, two disc drives, a 14in. colour monitor, and the built-in modem which allows it to act as a powerful videotex terminal. It will also act as a smart terminal to a mini or mainframe computer or run an interactive-video educational program. Its Basic is extremely fast — it runs the standard benchmarks some 30 percent faster than the 16-bit Olivetti M-20.

One of the major packages for the Teleputer/3 is Growlink, which includes access to a videotex database and is aimed at farmers. Other early buyers range from Dudley College of Technology to Banzinol of Bratislava, the Slovak petrol company. The manufacturing plant in Crawley produces special runs of the Teleputer with Cyrillic videotex for use by the Soviet Ministry of Gas on its Siberian pipeline.

RESEARCH MACHINES

Address: PO Box 75, Mill Street, Oxford OX2 0BW
Telephone: (0865) 249866
Telex: 837203
Company founded: 1973
Number of employees: 150
Origin of company name: Originally designing machines for research
Turnover in 1982: £10 million

Company formed in 1973 by Michael Fischer and Michael O'Regan manufacturing electronic equipment. In 1977 developed the 380Z which is now widely used in secondary schools. The 380Z was selected for 50 percent funding under the DoI's Micros in Schools scheme. Towards the end of 1981 Research machines introduced the Link 480Z which acts either as a stand-alone machine — using cassettes, ROM packs and discs — or a station on Research Machines Chain network. The Chain network is currently being used in over 300 schools throughout the U.K.

Research Machines' 380Z is a major force in the education marketplace. Built around the Z-80A processor the system includes either 32K or 56K of RAM, a 55-key keyboard and a 40 column by 24 row display as standard. Running under the CP/M operating system, storage for the system can be provided with either mini discs or 8in. floppy disc drives. A 56K machine with two double-sided mini disc drives giving a total of 288K of storage lists for £1,962.

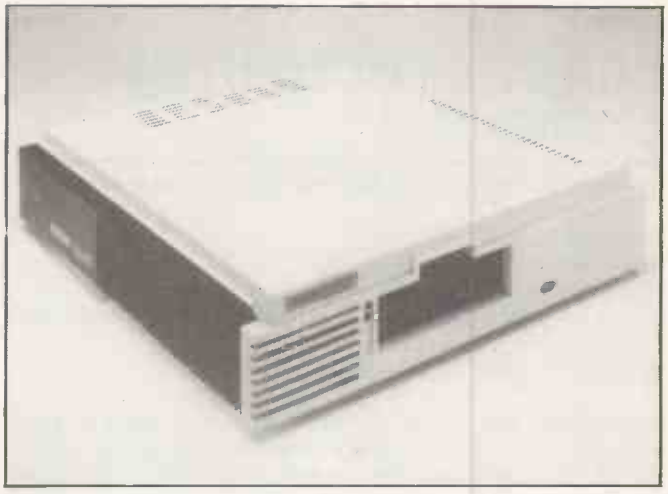
Besides the 380Z, Research Machines also supplies the Link 480Z, a system with 64K of RAM, a network interface, 40/80 character-line lengths and Basic in ROM. This machine comes in two configurations, the less versatile of which costs £596, but only £483 to educational establishments. Up to 16 Link 480Z systems can be networked using the company's Chain Network which has a dedicated network server as its central unit. Education users typically pay £3,717 for a server and four Link stations.

Made in Oxford, the systems are sold direct by Research Machines which, besides educational establishments, numbers government institutions amongst its users.

SHELTON INSTRUMENTS

Address: 74-77 White Lion Street, London N1 9PJ
Telephone: 01-278 6272
Company founded: 896559
Company founded: 1974
Number of employees: 32
Origin of company name: Founder director
Turnover in 1982: £0.8 million

Company founded by Dr Shelton as a hi-tech design group specialising in instrumentation and later, microprocessor applications. In 1981 research work led to low cost, high performance method for interconnection of microprocessors to communicate as a network to exploit low cost Winchester. This work has led to the Sig/Net range being one of the dominant and most successful multi-processor, multi-user systems in the U.K.



Sig/Net 2 is modular Z-80A based CP/M system which can be expanded from a single-user system into a multi-user system. The entry level Sig/Net 2F comes with 64K of RAM and twin floppies for a price of £1,290, not including a terminal. Systems with hard discs start at £2,650. A typical hard disc system with three users would cost £4,595. Here all three users have their own Z-80A and dedicated 64K area of memory inside the system box, so they can operate independently from each other whilst sharing the hard disc and printers.

To expand beyond three users you simply stack up additional boxes, each one capable of supporting a further three users. Where workstations need to be located more than 100 feet away from the central processor the Arcnet local area network is available. This lets you link up to 255 devices, either Sig/Net stations or other systems.

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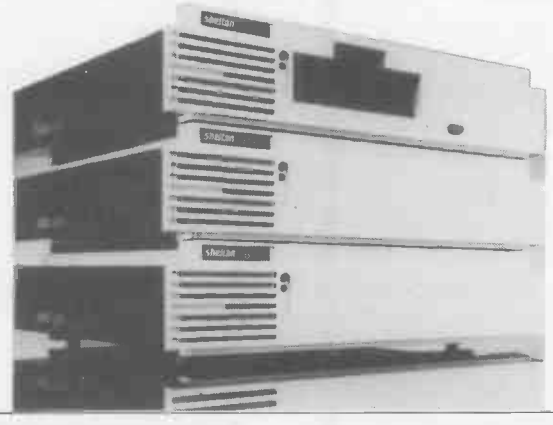
MCNOS – Probably the best multi-user, CP/M compatible, multi-processor operating system in the world



A computer is only as good as its software, so we wrote MCNOS. It makes our Sig/net microcomputers run multi-user software and provides the flexible, fast, powerful and dateless performance you need.

Flexible — because MCNOS manages files centrally, making all the storage available to each user at any time.

Fast — because it is a multi-processor network, with each user having their own processor directly linked by parallel transfers.

Powerful — because MCNOS has valuable additions such as sixteen directories for each user, a unique job control language, automatic time and date and many utilities. Plus, of course, the power of CP/M applications software.

Dateless — because, like our British hardware, it can grow with your needs.

Contact: Shelton Instruments Limited, David Winebloom, 74-77 White Lion Street, London N1 9PJ. Telephone: 01-278 6272.

Please send me further details of Sig/net ☐ I am interested in a Sig/net dealership ☐

Name: _____ Position: _____

Company: _____ Tel No: _____

Address: _____

shelton sig/net

● Circle No. 315

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SINCLAIR RESEARCH

Address: Stanhope Road, Camberley, Surrey GU15 3PS
Telephone: (0276) 685311
Company founded: 1979
Number of employees: 70
Origin of company name: Company founder is Clive Sinclair

Sinclair Research was established to conceive, develop and market new consumer electronics products. It is now the world's largest volume manufacturer of personal computers, with sales of over 1 million units and monthly production of over 100,000 units. Other current Sinclair Research products include a new range of personal computers, computer peripherals, flat-screen televisions and consumer applications of solid-state technology. This excludes Sinclair's electric vehicle, a private project.

Sinclair Research sells its ZX-81 and ZX Spectrum home computers through a wide variety of high street shops and department stores. The ZX-81, priced at £39.95, incorporates a Z-80A microprocessor and 8K Basic ROM. Its standard 1K of RAM can be expanded using an add-on 16K RAM pack. The Spectrum comes in both 16K and 48K versions, the first priced at £99.95 and the latter at £129.95. Both machines use TV sets to provide a colour display and are made by Thorn EMI in London and Timex in Dundee.

Peripherals supplied by Sinclair are the ZX printer which can be used with either machine and the ZX Microdrive which is used in conjunction with the ZX Interface 1 to provide data storage for the Spectrum on tiny cartridges. The Microdrive costs £49.95, while the Interface costs a further £29.95.

SIRTON COMPUTER SYSTEMS

Address: Unit 14, 29 Willow Lane, Mitcham, Surrey CR4 4NA
Telephone: 01-640 6931/2/3
Company founded: 1978
Number of employees: 9
Origin of company name: Company began trading as Sirton Products
Turnover in 1982: £0.8 million
Parent company: Cejam Electronics Ltd

Sirton Computers was formed to produce reliable multi-function computers based on the two corner-stones of CP/M and S-100 bus. By manufacturing computers the company is able to evaluate and choose only those boards that are best for the job rather than being forced to use one particular range. This independence allows it to produce a system to meet the customers exact needs at the best price and delivery and enables it to update its products rapidly as the market changes. As technology and operating systems change the inherent flexibility of the Midas systems is demonstrated by the way in which these advances can be easily incorporated.

Midas 1, 2 and 3 are Z-80 based CP/M systems with varying disc options, while Midas 86 is a 16-bit 8086 system. Sirton sells the range, which are all built around the S-100 bus, mainly to industrial and scientific users and Government departments. Sirton also produces a multi-user system. The entry level Midas 1 comes with a five-slot motherboard, a Z-80A and no drives, and costs £850. The Midas 2 with 64K of RAM and twin 5.25in. discs providing a total of 280K costs £1,790, while the Midas 3 has a 10-slot motherboard and twin 8in. drives for £3,150. A wide range of other disc options and card cages are available, including hard discs. CP/M Plus, the latest version of Digital Research's operating system, is available for these machines.

The 16-bit Midas 86, with 10-slot motherboard, 8MHz 8086 processor, 64K of RAM and twin 8in. discs costs £3,150. Midas also produces a multi-user system, the Midas MPS.

STRUMECH ENGINEERING ELECTRONIC DEVELOPMENTS

Address: Portland House, Coppice Side, Brownhills, Walsall, West Midlands WS8 7EX
Telephone: (0543) 378151 or 34321
Telex: 335243
Company founded: 1977
Number of employees: 13
Origin of company name: A division of Strumech Engineering Ltd.
Turnover in 1982: £0.2 million
Parent company: Associated with Strumech Engineering

SEED was formed in 1977 to provide a service for education, industry and commerce in the area of microprocessors and related software. SEED Systems are based on Motorola's 6800, 6809, 68000 family of eight and 16-bit microprocessors. Its future developments with the 68000 processor reflect its commitment to the Motorola processors. The System 19 is one of the most flexible systems available today with an almost unlimited number of possible configurations to meet its users' needs exactly. The most desirable programming languages are supported: Basic, Pascal, Cobol, C and Assembler. Each language is a super set of the industry standard to assure software portability and gain access to vast libraries of existing applicatlons software.

The SEED System 19 is based around the Motorola 6809 eight-bit processor with 32K of RAM expandable right up to 1Mbyte. The system is built using the SS-50 bus, and is therefore modular and expandable, and is a development of earlier systems from SEED based around the Motorola 6800. Prices start at £1,304.

A wide range of disc options, including hard discs and cartridges are available, and there is a choice of two operating systems. DOS-69 is a compact single user OS particularly suited to assembly level work, while OS-9 is a powerful multi-tasking, multi-programming OS which supports the full range of System 19 disc hardware.

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SWTP (Southwest Technical Products)

Address: 12 Tresham Road, Orton Southgate, Peterborough, Cambridge
Telephone: (0733) 234433
Telex: 32600
Company founded: 1977
Number of employees: 30
Origin of company name: Southwest Technical Products Corporation (U.S.)
Parent company: Imtec Group

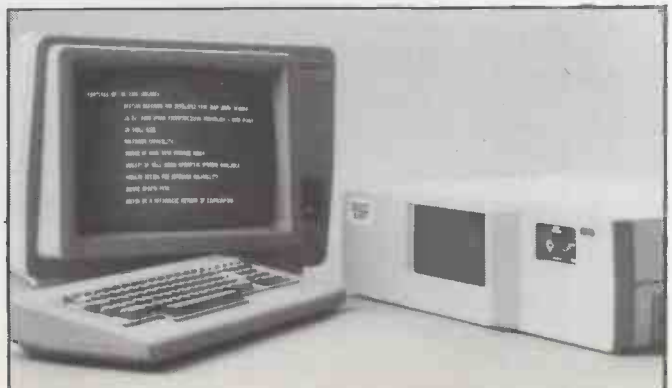
Southwest Technical Products started in the micro computer business as Computer Workshop in Victoria, London over six years ago and was therefore the first microcomputer retail outlet in Europe. From those early pioneering days the company and its product line has grown by several orders of magnitude. No longer do SWTPc supply kit computers or hobbyist machines but full multi-user, multi-tasking business machines. In fact SWTPc was the first company to supply a Unix-type operating system on a micro, an implementation which is in fact faster than any other micro based Unix look-alike it has seen. After selling the first thousand or so machines SWTPc realised that one company could not hope to cover the whole U.K. business market and therefore started to build a nationwide distributor network. Hindsight has shown that this decision was correct and SWTPc has gone from strength to strength with larger more powerful machines, an ever increasing range of software, full on site maintenance policies carried out by our own engineers and a complete range of distributor support. Over three and a half thousand systems in the U.K. alone show that the SWTPc package of technology and support really does work.

SWTP is a Texas-based American company which dates back to the early days of microcomputers, producing systems using the 6800 and 6809 processors. The launch of a U.K. manufactured machine is imminent. The new machine is expected to be an eight/16-bit dual processor multi-user system running the Uniflex operating system. A four-user system with 256K of RAM will probably cost about £5,000.

SYSTIME COMPUTERS

Address: Millshaw Park, Leeds LS11 0LT, West Yorkshire
Telephone: (0532) 702277
Telex: 556283
Company founded: 1972
Number of employees: 1,400
Origin of company name: Suppliers of real time systems, hence Systime
Turnover in 1981/82: £44 million

Originally founded by John Gow, the company operated from the front room of his home and concentrated on the provision of software and DEC hardware for small businesses — an Innovation at that time. Over the last 10 years the company has grown rapidly and expanded into the field of systems manufacture, hardware and software, development and support, training and services. The company recently opened a £20 million headquarters in Leeds which serves as the manufacturing centre of the worldwide operations in the U.K., the Gulf, Europe and Asia.



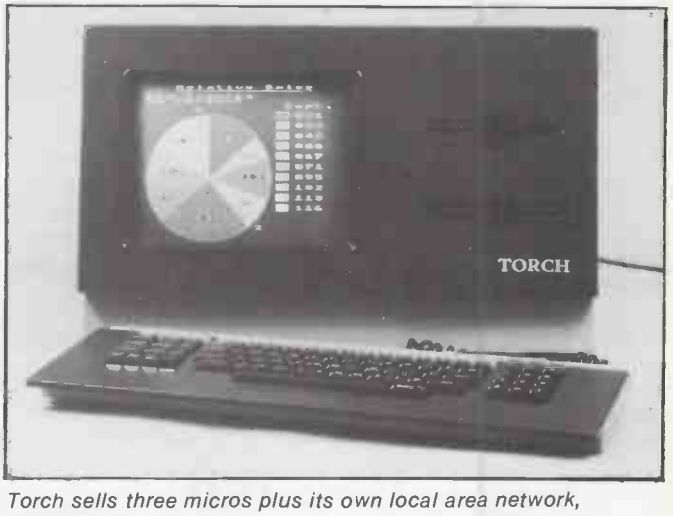
Leeds-based Systime manufactures two micro product ranges at its newly-opened factory in Millshaw Park. The S-500 small business system is available in two versions, the floppy-disc model at £7,250, and the hard disc model which sells at between £12,750 and £21,900. Both are multi-user — they can handle up to nine terminals plus one parallel printer — and run under CP/M-86, MP/M-86, MS-DOS, MBOS-5 and Systime's own operating system, MPS. The systems are sold through a network of 70 dealers.

The S300 series is a range of desktop micros, again using the Intel 8086 processor. The 16-bit machines are available with twin floppy discs at £3,250 or with a single floppy and fixed Winchester at £5.410. The systems run under the multiuser MP/M-86 operating system, and CP/M-86 and MS-DOS are also available. The S-300 range is sold via 40 dealers.

TORCH COMPUTERS

Address: Abberley House, Great Shelford, Cambridge
Telephone: (0223) 841000
Company founded: 1981
Number of employees: 90
Origin of company name: Intends to set the micro world alight
Turnover in 1982: £3 million

The company was started in July 1981 to produce a business version of the BBC micro in collaboration with Acorn. At the end of 1981 Torch produced its own hardware and launched the Torch CF-240 communicating business micro in April 1982. In December 1982 the Torch Z-80 disc pack provided BBC users with the computing power of the Torch, and in July 1982 Torch launched the full Torch range including 300 series workstations, C-Series PCs and 700 series triple processor units capable of running Unix.



Torch sells three micros plus its own local area network, Torchnet. The 300 Series workstation is designed to work on Torchnet, or can be used as an IBM- or ICL-compatible terminal. It has a 6502 peripheral processor and a Z-80 application processor and has up to 16 drives accessible through the Torchnet network. The retail price is £1,245.

The C-Series communicating colour computer uses the same processors as the 300 series and can have either two 400K formatted floppy disc drives or one floppy disc and one 10Mbyte or 20Mbyte hard disc drive. C-Series models have 16-colour high-resolution graphics, a CP/M compatible operating system and comes complete with word processing, database and communications software packages. Using its built-in autodial modem the machine can access Prestel, Telecom Gold, PSS and Torchmail. The system costs £2,795.

At the top of Torch's product line is the 700 series with a 68000 Unix processor, 288K RAM and 64K ROM. Disc storage is twin 400K floppies with an optional 20Mbyte hard disc drive. As the 700 series is compatible with the Torch micro and terminal, the inclusion of a 700 in a network provides Unix to the other terminals. Prices for this series start at £5,500.

TRANSAM COMPONENTS

Address: 59/61 Theobalds Road, London WC1
Telephone: 01-405 5240
Telex: 24224
Company founded: 1978

Originally set up as a distributor of microcomputer-related products, Transam rapidly realised the need for British-designed products for the home market. After the successful launch of the Triton personal computer, which was the first British-produced machine with a Basic resident in ROM, Transam expanded rapidly into the area of general-purpose microcomputers and related software. The second generation machine was another British first, combining the flexibility of the Z-80A with the CP/M operating system and the widely-used S-100 expansion bus. The current range is based around the Tuscan micro, an in-house design concept that, due to its flexibility, can be configured to any customer specification.

TYCOM CORPORATION

Address: 8-12 New Bridge Street, London EC4V 6AL

The main feature of the Tycom Microframe is that it uses a versatile base-bus connect or VBC architecture. The bus is controlled by an Intel 8088 microporcessor, which treats the main CPU as a peripheral. The main CPU may be a Z-80 running CP/M, or a Motorola 68000, or something else, or all three together. This is claimed to make the Tycom future-proof.

The Microframe is available in three sizes, with six, 12 and 22 slots respectively, allowing expansion from a single-user up to a 30-user system. The basic machine with 8088 and one optional processor card, detached keyboard and monochrome monitor, two 720K floppy disc drives, operating system and Microsoft Basic costs £3,335 including VAT. The 8088 has 128K of RAM expandable to 576K, and the optional processor has its own memory. A colour monitor and hard discs from five to 20Mbyte are among the expansion options.

TRANSTEC COMPUTERS

Address: Unit 22, IDA Complex, Macken Street, Dublin 2
Telephone: 718521
Telex: 91229
Company founded: 1981
Number of employees: 35
Turnover in 1982: £1.5 million

TERMINAL SYSTEMS SERVICES

Address: 1 Frognall Parade, Finchley Road, London NW2
Telephone: 01-431 3100
Telex: 378113
Company founded: 1980
Parent company: Visionhire

VIDECOM

Address: Newtown Road, Henley-on-Thames, Oxfordshire RG9 1HG
Telephone: (04912) 78427
Telex: 847953
Company founded: 1972
Number of employees: 120
Turnover in 1982: £4 million

Videcom a manufacturer of terminals and controllers, was started approximately 10 years ago, and made a name for itself in the travel industry. In 1976 it pioneered the concept of multi-access reservations, going on to establish systems in U.K., New Zealand, Bermuda, Hong Kong, Dubai and Eire. The comms side of the business was expanded to provide terminal emulations to mainframes such as Burroughs, IBM, ICL, Dec, etc., and also multi-emulations from one terminal. The Company launched a micro in 1982 and were pleased to be included on the CCTA list earlier this year. The Company is British, privately owned and has its headquarters in Henley-on-Thames, and a manufacturing facility in Reading, Berkshire. Turnover has increased by approximately 50 percent per annum to a projected 1983/84 turnover of £6 million.

Videcom's Appollo range of eight-bit micros comes in three models, the Model 1, Model 2 and Model 2W. All of them have two Zilog Z-80A mainprocessors with 16K RAM and run under CP/M. They also have two RS-232/V-24 asynchronous ports and one RS-232/V-24 synchronous port. The model 1 has two 5.25in. floppy disc drives, giving 64K of usable space, and sells at £1,795. Model 2 has floppy drives which give 1.6Mbytes of usable space and retails at £1,995. The Model 2W has a 20Mbyte Winchester disc.

Videcom has three dealers and is aiming specifically at volume purchase of fifty machines or more. There are optional mainframe communication emulations. The printed circuit boards and basic components are manufactured in Reading, and final assembly carried out in Henley-on-Thames.

(continued on next page)

ADVANCE

Address: 8A Hornsey Street, London N7 8HR.
Telephone: 01-609 0061
Telex: 296701

Advance is a new private company set up to market the two Advance computers, Models A and B. Both feature an Intel 8086 full 16-bit microprocessor, and promise compatibility with the IBM Personal Computer.

The Model A has 128K of RAM in its system box, plus a detached keyboard. The Model B adds another item in the form of an expansion box which includes two 5.25in. disc drives providing 640K of storage. The RAM can be expanded up to 768K. Software includes MS-DOS, Microsoft CW Basic, WordStar, Mailmerge and CalcStar.

Not the least attractive thing about the Advance models is the prices. The Model A is to cost £350 and the Model B only £1,200, a comparable system now costs two to three times as much. It is planned that manufacturing will be done at four sites, of which three are in the U.K. The planned launch date is early September.

ASTON TECHNOLOGY

Address: Aston Science Park, Love Lane, Birmingham B7 4BJ.
Telephone: 021 359-4861
Telex: 334535
Company founded: 1983
Origin of company name: connection with the University of Aston in Birmingham

Aston Technology is a new venture funded by Birmingham Technology, a company formed by the City of Birmingham, Lloyds Bank and the University of Aston.

Aston's new product is the Crystal 68000, which uses the Motorola MC-68000 CPU. There are two basic versions. The Series R uses RS-232C communications to run up to 36 terminals. The Series C is a networking system where the terminals have their own 64K of RAM. Floor-standing and desk-top versions are available. RAM can be from 256K to 4Mbyte. Disc storage can be from two 5.25in. floppy discs with 1Mbyte each up to 420Mbyte of hard discs in the floor-standing model. Operating systems range from CP/M 2.2 through Unix III to Pick. Prices start at £4,795.

The Crystal 68000, due to be launched in September 1983, is assembled in Birmingham and will be sold via a dealer/distributor network.

CEEDATA

Address: Glebe House, Armfield Close, West Molesey Trading Estate, East Molesey, Surrey.
Telephone: 01-941 4889
Telex: 291881
Company founded: 1979
Origin of name: Cee from Ceefax

Ceedata began as components supplier then specialised in providing monitors. It has been selling its own micro into EEC countries for about 18 months, but has only just launched in the U.K. Ceedata is now looking for dealers and OEM customers. Further micros, including a 16-bit machine, are currently under development.

ELAN COMPUTERS

Address: 31-37 Hoxton Street, London N1 6NJ.
Telephone: 01-739 4142
Company founded: 1983
Number of employees: planned to be 90

Elan is a new company which has been formed to design and market a range of Z-80-based home computers. The design and development has been controlled by three directors, David Levy, Kevin O'Connell and Robert Madge, who are also directors of Intelligent Software Ltd — a company with a high reputation for quality software. The new micros are to be launched for the Christmas of 1983 market. It is planned to set up a production facility in the U.K., employing up to 90 people.

LEENSHIRE

Address: Mooreside Road, Winnall, Winchester, Hampshire S023 7RX
Telephone: (0962) 64175
Telex: 477300
Company founded: 1981, from 1970 beginnings
Parent company: Pilkington Brothers plc

Leenshire specialises in colour graphics and industrial control applications and offers a range of terminals, plus the VCT-6930 microcomputer manufactured near Winchester. It uses a 6809 CPU with 64K of RAM plus dual floppy-disc drives. The 14in. screen offers 64 background/foreground colours/intensities with resolution up to 512 by 512 pixels. The system costs £4,500. Users include many leading U.K. companies such as BAC, the BBC, British Leyland, British Steel, EMI, Marconi, Ferranti, and Reed International.

Free reader enquiries

The circle numbers on the advertisments in this supplement refer to the postage-paid card bound into the October issue of *Practical Computing*, facing page 146.

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BM. 5.	10.5	13.6	19.8
BM. 6.	18.7	23.5	35.4
BM. 7.	29.6	37.4	55.9
BM. 8.	5.1	3.5	4.3

These figures are extracted from a recent article in, 'Personal Computer World' Publication.

Micropute Ltd Catherine Street, Macclesfield, Cheshire SK1 6QY Tel: (0625) 615384.

Name _____ Position _____

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