Practical Computing

90p March 1985
Volume 8 Issue 3

Public Networks

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Sanyo 775 transportable
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Symbiotic Computer Systems France	2 Rue Henri Chevreau, 75020 Paris, France. Tel: 349 06 80
Symbiotic Computer Systems A/S	PO Box 354, O. Tryggvassons 4, 7000 Trondheim, Norway. Tel: 07-53 20 27
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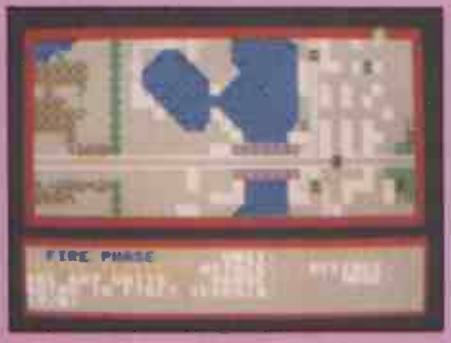

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program.
Every effort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

Basically OK

IT IS 20 YEARS since Basic was born. Since then argument has raged about whether its advent was entirely a good thing.

The initial impulse behind the development of Basic can hardly be faulted. It first appeared on a mainframe of the time, situated at Dartmouth College in the U.S. John Kemeny and Thomas Kurtz, professors at the college, set out to produce a computer language that was easy to use, even for novices. The standard commands were English-like, and did more or less what you expected. So, for example, Print did print something out, and Goto 350 took you to line 350.

Much of this structure was taken from Fortran, widely used then as now for scientific applications. Fortran suffered from the fact that it was designed for punched-card data entry. It was also compiled where Basic was interpreted.

This meant that instead of feeding in an entire program, compiling it, then running it and praying, as in Fortran, you could check each line for errors as the interpreter swept through the program line by line. Instead of a list of unhelpful error statements. Basic told where you went wrong, as you went wrong.

The benefits for the learning process are clear. Instead of being isolated from your program as it was entered and run in batches, you could work directly with the computer — that is, interactively.

The whole structure of Basic pre-figured the micro revolution. This has largely been about distributed computing power, putting a personalised processor on your desk that you can then control and interact with directly. When it came to choosing a language for the new machines, Basic fitted like a glove. Similarly, once the first hobbyist phase was over, Basic became popular with the later waves of users because it was so easy to learn and operate.

But, the price paid for this ready accessibility is lack of control. You can do almost anything with Basic — including things that you probably shouldn't. Perhaps the most infamous example is the dreaded spaghetti syndrome.

One of the most powerful commands of Basic is Goto. If your program throws up an awkward special case, or goes off in a direction you never intended, things can usually be sorted out with a Goto or two. Unfortunately this kind of ad hoc tampering is so easy that many people use it to write entire programs. The result is a mess of intertwining execution paths that are impossible to follow, and therefore to debug or modify.

Critics of Basic insist that what we need is structured programming. This locks programming habits into specific patterns that are thought to be logical and clear. Perhaps the most popular of these evangelical languages is Wirth's Pascal.

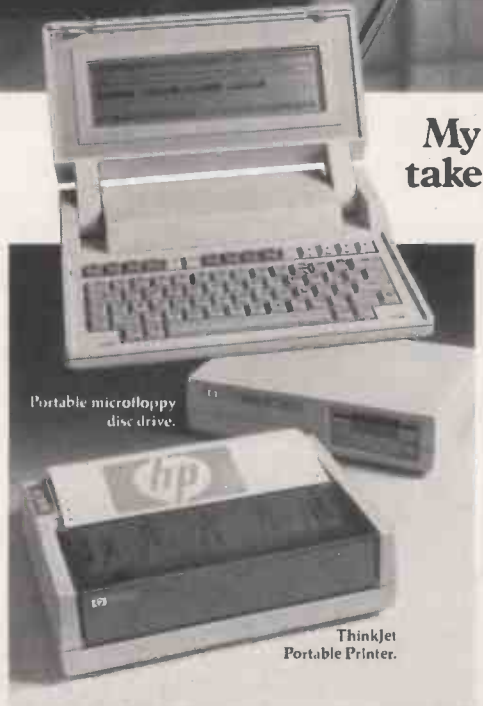
But even Pascal has failed to catch on in a big way. For all that Basic is castigated for being an inefficient solution to programming problems, and likely to inculcate irremediable faults, it just goes from strength to strength.

One positive result of the Basic debate is that new Basics are increasingly becoming more structured. BBC Basic was one of the first, and still one of the best. Recent releases have included the QL's SuperBasic and the Enterprise's IS-Basic. These new versions combine all the manipulative power of old Basics in terms of screen handling, sound production and error-handling routines, with more advanced features like procedures, local variables and While-Wend loops.

As Basic becomes more wonderful there is, though, a correspondingly greater danger that people will come to think of programming as Basic and nothing more.

With the advent of machines like the Sinclair QL with 128K RAM, there is no longer any excuse for other languages not to be seriously considered for programming micros. Apart from standard ones like Fortran, Pascal, Cobol and Logo, more exotic languages like Lisp, Prolog, BCPL and even APL are now coming through. They all have their own particular strengths, just as Basic does.

My job takes me away from my P.C.—but nothing takes me away from my Hewlett Packard Portable.



Working away from the office means working away from the facilities you need to work. Unless you have The Portable.*

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Multi-column text

IF HE WANTS multi-column text, R M Tobin — see Feedback, January 1985 — should use Spellbinder rather than WordStar for preparing text for printing. If his medium is the daisywheel, then Spellbinder's Macro programming language — which is like CP/M's Submit with knobs on — allows for printing in any format and for automatic changes of format every single line if one so wishes. Simple two-column printing is nothing. Three columns? Columns that "walk around" photos, diagrams, or free-shape artwork? Columns shaped like the mouse's tale in *Alice* or like a Christmas tree or an upside-down pyramid? No problem. With a little experiment, you can soon knock out a macro that will achieve any of these formats. Also the macro will store like any other text file, ready to be read back into memory and reused any time you want.

If you are formatting text for a photosetter, as in traditional letterpress or litho printing, the ability to batch any number of commands into one single executable program is an absolute godsend. I have now formatted several novels, each more than a megabyte in length, and could not possibly have managed it with WordStar or any other WP program that lacks this facility.

Commercial programs for formatting WP text for photosetting cost from £5,000 upwards — far beyond the pockets of most writers. Anybody who is in the business of turning ASCII text files into print, whether by daisywheel or by photosetter, and who does not have Spellbinder cannot — to borrow a phrase — possibly be serious.

Malcolm Macdonald,
Offaly,
Ireland.

Dealer for the deaf

I READ David Myers' article in the January 1985 edition of *Practical Computing* and am prepared to take up his challenge to a dealer who is prepared to help the deaf.

We have just prepared a special offer list of equipment for Email. This starts with the Brother EP-44, is followed by the NEC-8200 and then the Epson HX-20 and PX-8. All of these are bundled with all the equipment, cables, and either a modem or coupler.

The prices on the list are already slightly discounted, but I am prepared to offer an extra discount to geniunely deaf people on the condition that they can be established as bona fide. Do you have any suggestions as to how this can be done? I know that the blind are registered; is there any similar system for the deaf?

Leonard Gelblum,
Betos Systems Ltd,
Nottingham.

Atari Type-Ahead

I RECALL having seen and used one or more of Frank O'Dwyer's utilities for the Atari, and his very fine and useful Type-Ahead in the December issue is now another firm favourite in my files.

However, this was only successful after a little disassembly of the program. I suspect that Frank is a cassette-based user because as it stands the program does not seem to work for disc users such as myself. The routine uses the cassette initialisation location on Reset then returns control to the hardware. As set, this returns control to the cassette and after pressing Reset the computer does not know that disc exists.

Fortunately, the answer is quite simple. In Data line 1020 Atari disc users should replace the first number 2 with 3. The effect is to Poke a 3 into location 9 instead of the 2 Poked by the original program. This then sets the routine in the same way as before but returns control either to cassette or disc as may be connected and switched on.

Eric J Nicholson,
Newcastle,
Staffordshire.

8087 software

HERE IS some information to supplement that given in the Ask PC column, November 1984 issue, regarding the 8087 chip. The 8087 can process real numbers, and in addition integers with a length of 16, 32 or 64 bits, and also 80-bit decimal numbers. Microsoft MS-Fortran, Digital Research DR-Fortran 77, Gino and Framework are some of the packages available which can use the 8087 co-processor. For number-crunching programs, the 8087 may speed execution times by a factor of about 10.

H G Trevor,
London.

● **John and Timothy Lee reply:** We have not used the software you mention. We would strongly advise readers to make quite sure that the version they buy will support the 8087, since we heard of a version of DR Pascal bought recently which does not, even though advertisements claim the latest version does.

Further information on the 8087 can be found in two books from Intel, *The 8086 Family User's Manual* and *The iAPX 86,88 User's Manual*, or in *The 8087 Primer* by J F Palmer and S P Morse, published by John Wiley.

NEC user group

WOULD YOU happen to know of a users' group for the NEC PC8201A lap portable computer?

John Laidlaw,
Lytham St. Anne's,
Lancashire.

● **The editor replies:** Any offers?

CP/M file transfer

IN YOUR December issue is a letter from Mr Hayes in which he asks for a method for transferring CP/M programs for his Newbrain system. The answer you give is not the easy way.

There are two far easier ways to solve this problem. First use the Configur program supplied with your CP/M system to reconfigure drive B as an Osborne SSDD drive. Second, use the various utilities which can be obtained from the user group, NBUG, which automatically changes the drive B to act as an Osborne SSDD drive. In that way you can transfer the files from drive B, where your software on Osborne format is, to drive A by using Pip.Com or Sweep.Com. Also, public domain software can be obtained from the CP/M users' group.

You can only try these methods if you have two drives and the expansion interface. Alternatively, you can contact me to change your software from the mentioned format to your Newbrain format — 200K or 400K SS.

The second method also

(continued on next page)

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 previous page)

works on programs in Kaypro, Morrow, Superbrain, IBM CP/M-86 and various other formats. To use the programs simply type SystemXYZ B: and drive B will act as a drive of the SystemXYZ computer. You can also write files to drive B which can then be used on the other computer's system.

Ton Tonies,
Grotestraat 21,
5368 AJ Haren (Gem. Megen)
N.Br.,
Holland.

WE WERE INTERESTED to read the piece called "Transferring Disc Files" in the Ask PC column of December 1984.

For 12 months we have been advertising a file transfer service in your magazine which offers a precise solution to your reader's problem. We can copy files to and from over 250 disc formats. Our charge is £10 plus disc plus VAT.

Iain Rangely,
Grey Matter,
Ashburton,
Devon.

Calendar addition

A HEART TRANSPLANT is needed by S Dimitri's Calendar program — see BBC Open File, — January 1984. The day of the week algorithm PROC-bepaaldag does not work properly.

I would recommend the one given by Knill and Fawcett — see Commodore Open File December 1982 — which, on conversion to BBC Basic, takes the form

```
2000 DEF
  FNweekday(D%,M%,Y%)
2010 IF M%<3 THEN M% =
  M% + 12: Y% = Y% - 1
2020 W% = D% + (13*(M%
  + 1))DIV 5 + (5*Y%)DIV 4
  - Y% DIV 100 + Y% DIV
  400
2030 = W% MOD 7: REM 0 =
  Sat,.....,6 = Fri
```

Another function which operates as a perpetual calendar and enables calculation of number of days between dates is

```
2000 DEF
  FNfactor(d%,m%,y%)
2010 IF m%<3 THEN =
  FNcommon(y% - 1) + 365
2020 = FNcommon(y%) -
  (4*m% + 23)DIV 10
2025 REM weekday =
  FNfactor(D%,M%,Y%) MOD
  7 (0 = Sat...)
2030 DEF FNcommon(y%)
2040 = d% + 31*(m% - 1)
  + 365*y% - (y% - 3*(y%
  DIV 100 + 1))DIV 4
```

Finally, to quote the old saw: "30 days hath September" (line 850).

Andrew M Simpson,
Craigie,
Perth.

Computer mysteries

AS A MEMBER of the Association for the Scientific Study of Anomalous Phenomena I am interested in cases of anomalous computer effects.

Can I appeal to readers for any information, at first or second hand, no matter how bizarre, concerning inexplicable malfunction or unexpected output? All accounts will be treated in strictest confidence.

Roger C Morgan,
15a Kensington Court Gardens,
London W8 5QF.

Newbrain codes

RECENTLY I found that the Newbrain's Graphics key can act as a Shift key similar to that on the ZX-81 and Spectrum to generate Basic language commands within programs. For example, if a line of program is being entered and Graphics-Q is pressed at the start of the line, the normal graphics symbol appears on the screen immediately following the line number. However, on listing the line is reprinted with Dim following the line number thus showing that this command has been entered into the memory. Should Graphics-Q be entered anywhere along the line except immediately following the number, the graphics symbol is changed to Pos on listing. As Dim is always needed at the start of a line and Pos only within a line, this feature can be put to use in entering commands.

In the listing you will find that in all cases the symbols have this same characteristic with respect to their position in the line.

I have not yet found any way of generating the remaining Basic Words, and I have no idea why Goto and Gosub are represented twice but with a space in the second instance, nor why Restore has two possible keyings.

Wilfred Ashworth,
London W5.

		Line start	Line end
1 GRAPHICS Q	:	DIM	POS
2 GRAPHICS W	:	OPEN	LOG
3 GRAPHICS E	:	GOTO	^
4 GRAPHICS R	:	ON	ABS
5 GRAPHICS T	:	SAVE	COS
6 GRAPHICS Y	:	?	SIN
7 GRAPHICS U	:	LOAD	EXP
8 GRAPHICS I	:	IF	<>
9 GRAPHICS O	:	END	RND
10 GRAPHICS P	:	STOP	PI
11 GRAPHICS =	:	LET	NOT
12 GRAPHICS -	:	READ	TRUE
13 GRAPHICS A	:	LIST	+
14 GRAPHICS S	:	OPTION	ATN
15 GRAPHICS D	:	RUN	/
16 GRAPHICS F	:	GO TO	&
17 GRAPHICS G	:	GOSUB	AND
18 GRAPHICS H	:	GO SUB	OR
19 GRAPHICS J	:	INPUT	<=
20 GRAPHICS K	:	FOR	>=
21 GRAPHICS L	:	NEXT	=
22 GRAPHICS +	:	POKE	ASC
23 GRAPHICS Z	:	RET	SQR
24 GRAPHICS X	:	CLOSE	SGN
25 GRAPHICS C	:	PRINT	*
26 GRAPHICS V	:	RANDOMIZE	INT
27 GRAPHICS B	:	NEW	-
28 GRAPHICS N	:	REM	
29 GRAPHICS M	:	RETURN	>
30 GRAPHICS (	:	RESTORE	TAN
31 GRAPHICS)	:	DATA	
32 GRAPHICS ()	:	RESTORE	FALSE

Newbrain codes.

The ZX Spectrum Expansion System. Only £99·95

Sinclair's complete alternative to floppy discs...

The ZX Spectrum Expansion System contains:

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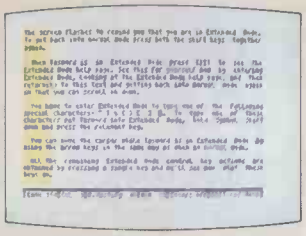
- ZX Net Lead

The new ZX Spectrum +
Fully compatible with all Spectrum software and peripherals, including this Expansion System

Tasword Two word processor

Turns your ZX Spectrum into a high-quality word processor!

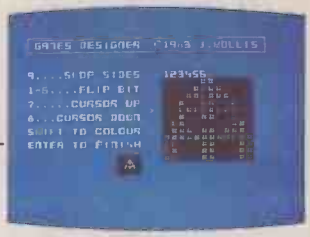
Tasword Two has all the essential features of professional word processing packages – move and copy, insert, margin settings, 'help' pages, find and replace, and much more.
Written by Tasman Software Ltd.
Usual price (RRP): £13.90.



Games Designer

Now, all you need to create original games are original ideas – and Games Designer! It has eight, very different, pre-programmed games for you to play as they are – or modify out of all recognition!

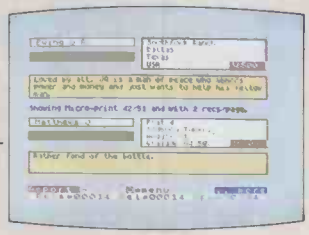
There's never before been an easier, more enjoyable, way into games design.
Written by Quicksilva Ltd.
Usual price (RRP): £14.95.



Masterfile filing system

Address lists...personal files...stock inventories... stamp or album collections...club records...recipes ...if you can file it, you can Masterfile it!

Masterfile is a menu-driven filing and retrieval system of immense power. Display formats are user-defined, so the range of applications is enormous.
Written by Campbell Systems Ltd.
Usual price (RRP): £16.95.



Ant Attack

The all-time classic 3D strategy game. Ant Attack combines stunning Escher-like graphics with fast-moving action and a real tactical challenge.

Your task is to enter the walled city, seek out your captured partner, and escape. At all times you can choose from four angles of view. But beware: the city is patrolled by giant ants...
Written by Quicksilva Ltd. Usual price (RRP): £6.95.

All programs run on a 48K Spectrum or Spectrum +. Recommended retail prices are for each program on cassette.

...includes this great set of Microdrive programs!

The unique ZX Microdrive system sets the Spectrum apart from all other home computers.

It gives you all the advantages of floppy disc drives – at a fraction of the cost. And tests show the Microdrives are faster than some disc drives.

Now, the complete Microdrive system comes in one package – together with four of the best-ever Spectrum programs, on Microdrive cartridges.

This software alone would normally cost you over £50. Yet the Sinclair price for the complete ZX Spectrum Expansion Pack is just £99.95!

You'll find full details of its contents in the panel opposite.

ZX Microdrives–another Sinclair first!

The ZX Microdrive is a revolutionary fast access / mass storage device. And it's the only truly affordable alternative to disc drives ...

- Loads or saves up to 85K of program or data from Microdrive cartridges.
- Just 3.5 seconds to access a typical file.
- Only 9 seconds to load a typical 48K program.

The ZX Microdrive cartridge – a unique storage medium.

Smaller than a matchbox, the ZX Microdrive cartridge packs in a massive amount of data and programs.

Each Microdrive cartridge holds at least 85K bytes of data or programs (that's 30 pages of A4 text). And you can store up to 50 different data files per cartridge, identified by titles of your choice.

Every cartridge comes in its own protective case. Simply remove the cartridge, slot it into the Microdrive, and it's ready to use.

ZX Interface 1–adds powerful new capabilities to your Spectrum.

ZX Interface 1 connects to the back of your Spectrum and controls up to 8 Microdrives. (Additional Microdrives are available for £49.95 each.)

It also gives you:

- An RS 232 interface – to link your Spectrum with full-size printers, other computers using RS 232 (the industry-standard interface) and provide data transmission over telephone lines, via modems.
- ZX Net – lets you set up a local area network of up to 64 Spectrums, for high-speed data communications between you and Spectrum-owning friends.

At your local Sinclair stockist–today!

The ZX Spectrum Expansion System adds an exciting new dimension to Spectrum and Spectrum + computing. At £99.95 it's superb value too.

To find out more, call in at your local Sinclair stockist now!

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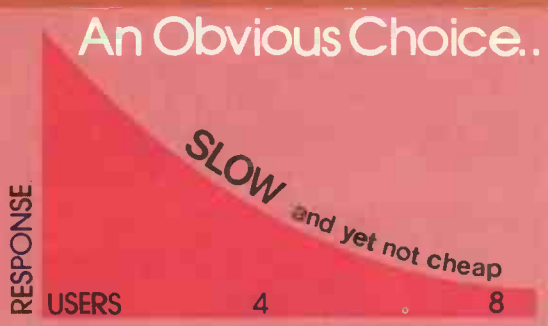
Multi-User Computer

LOOK AT YOUR CHOICE OF TECHNOLOGY BEFORE CHOOSING YOUR MACHINE

STOP PRESS.

IMPOS now supports genuine multi-user MS-DOS as well as Concurrent CP/M 3.1, CP/M 2.2 and CP/M 86 simultaneously in any combination for up to 16 users

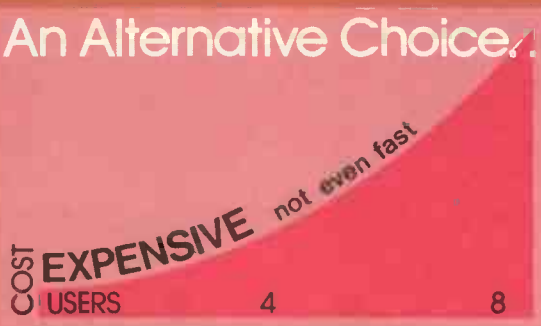
An Obvious Choice...



Time Sharing Micros

Typical multi-user micro machine are doomed by CPU degredation being based on time-sharing principles. Altos, Fortune and IBM PC/AT are in this class.

An Alternative Choice...



Networked PC's

Networks are too expensive and tedious. They do not offer a truly integrated multi-user system or speed. Networked IBM PC's and Apricot are such examples.

The Wise Choice...

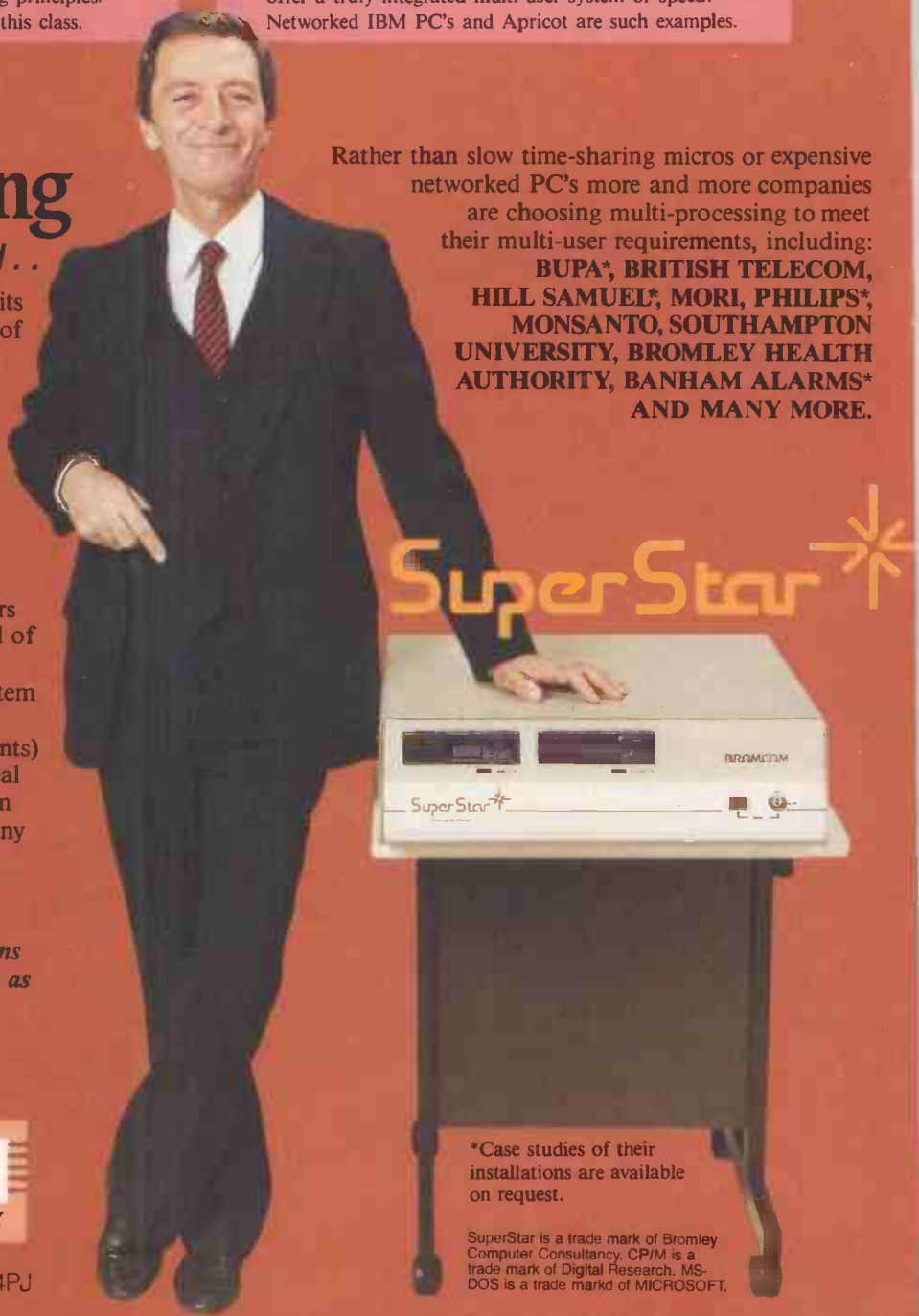
Multi-Processing

The choice you didn't know you had . .

In Multi-processor SuperStar, each user has its own dedicated processor with up to 1Mbyte of RAM each, working at full CPU speed regardless of the number of terminals. The tremendous increase in power resulting from having up to sixteen 16-bit processors compared with time-sharing a single processor must be plain. Because it is a network on an internal bus, it is very much faster than conventional serial networks — yet it is much less expensive because all the processors are integrated into one desk- top unit instead of being distributed among the various PCs

SuperStar is a genuine multi-user system with record/file locking and with printer spooling. All MS-DOS and CP/M (all variants) programs run without modification. It is ideal for a cost-effective Office Automation system for any or all of the following functions in any combination.

- ★ *Word Processing and Spread-sheets*
- ★ *Database and Information Management*
- ★ *Telex, Electronic Mail and Communications*
- ★ *Genuine Multi-user Data Processing, such as Stock Control, Order Processing, and Integrated accounts.*



Rather than slow time-sharing micros or expensive networked PC's more and more companies are choosing multi-processing to meet their multi-user requirements, including:
BUPA*, BRITISH TELECOM, HILL SAMUEL*, MORI, PHILIPS*, MONSANTO, SOUTHAMPTON UNIVERSITY, BROMLEY HEALTH AUTHORITY, BANHAM ALARMS* AND MANY MORE.

*Case studies of their installations are available on request.

SuperStar is a trade mark of Bromley Computer Consultancy. CP/M is a trade mark of Digital Research. MS-DOS is a trade markd of MICROSOFT.

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● Circle No. 119

SuperStar-16 has a 16-bit Master Processor which runs IMPOS (BROMCOM designed true 16-bit controlling operating system). IMPOS supports CP/M, MS-DOS and shortly Xenix In slave processors in any combination and it is fully upward compatable with ACTION DPC/OS, Televideo MmmOST and TurboDOS.

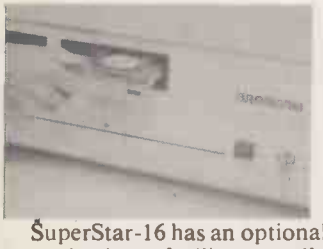
JUST LAUNCHED! MULTI-USER MS-DOS

MS-DOS is an established 16-bit operating system for a single user PC. BROMCOM has incorporated MS-DOS 2.11 into SuperStar-16/MS to offer a genuine multi-user environment through multi-processing. This development opens the door to a tremendous opportunity for exploiting the widely available applications software developed in MicroSoft Basic (MBASIC) which can run only under MS-DOS in 16-bit. Record and file locking are fully upward compatible with Televideo MmmOST, DPC/OS, TurboDOS and MP/M. Floppy disks are compatible with IBM-PC and full PC-DOS compatibility will be available early in 1985.

16-BIT MASTERS/ SLAVES

In a given configuration, say 8-users (maximum 16 — more with networking), SuperStar has eight 16-bit slave processors, each with up to 1Mbyte RAM, and an additional 16-bit Master processor also with up to 1Mbyte RAM. All processors are iAPX186 with optional 8087 co-processors. This demonstrated the immense power and capacity of the system against time-sharing systems where a single processor serves all eight (or more), users. SuperStar's multi-processor architecture also enables each user to choose his own different operating systems environment, e.g. CP/M or MS-DOS — one more of the superior features that cannot be found in other systems.

INTEGRAL 1/4in CARTRIDGE TAPE BACKUP



SuperStar-16 has an optional tape backup facility, totally integrated in the system and built into the desk-top unit.

SuperStar-16 must be one of the most powerful, flexible and complete systems available on the market.

For information see opposite page.

Competition report

Anagram result

NOVEMBER'S competition to win an Ensign NLQ printer was not as easy to enter as we claimed. The main task was to form as many words as possible from the letters of the word "practical". We said we would be checking dubious words in the *Collins English Dictionary,* penalising invalid ones.

A conventional anagram program is hopeless for this task as it will just generate literally hundreds of pages of output, leaving you with the massive job of picking out valid words from the meaningless permutations.

Only one reader, Ken Smith of York, came up with a useful way of employing their machine. His program first extracted a word list for each of the letters occurring in "practical" from his spelling checker, which was Electric Webster running on a Tandy. It then scanned the lists, rejecting all words with letters not occurring in "practical" or using too many of them. This procedure netted him 66 words. Although the technique is sound he was not the winner: Electric Webster does not contain enough words.

In fact entries fell quite neatly into three distinct groups: those claiming around 60 or 70 words, those claiming 100 to 150, and a small group of five maniacal readers claiming over 200 words. The small number of entries falling outside these ranges suggests each group was applying a different method to solve the problem. The 60- to 70-word group appeared to be working with the unaided brain, while the 200-plus group appear to have been using a disciplined dictionary-scanning technique on the right dictionary.

Robin Hamilton from Loughborough, the eventual winner who got all of the 219 words we recognised as valid, explains the technique he used: "Words don't only begin with one letter, they begin with two. There are only 44 possible combinations of two letters to be formed from 'practical', and thus it isn't a matter of going through the whole of *Collins,* but simply checking out a maximum of 44 groups of words, many of these groups are non-existent and others fairly small."

Choice of dictionary in fact is fairly crucial, as having specified no minimum word length we were compelled to accept all sorts of odd, abrupt words found in *Collins.* This of course made the competition fairly arbitrary, but at least many of our readers will have learnt that "ai" is really a variant name for the three-toed sloth, whatever it says elsewhere on this page.

That the winning technique should be purely manual also illustrates the difficulty of applying the power of computers to some problems which at first glance they seem ideally suited to.

For the tie-breaker we asked for a name for a new NLQ — near letter quality — printer. Readers had few good ideas, but the best had a slightly cynical flavour: the Notta Lot Quieter, the Lottadotta, and the NotKwite Riter.

We would like to express our thanks to DRG Ltd for providing the prize.

Spot the Micro

OCTOBER'S Spot the Micro competition drew a large response from readers. It was heartening to see that nearly everyone knew their onions and could spot the micros. For the record, the correct answers are: 1. Sharp PC-5000; 2. Grid Compass; 3. ACT Apricot; 4. HP 110/Gypsy; 5. ABS Orb; 6. Kaypro 10; 7. Wren; 8. IBM PC; 9. Sinclair QL; 10. Osborne Executive.

Consequently the winner was chosen on the basis of the tie-breakers. The first of these, defining artificial intelligence, drew some predictable responses such as Margaret Thatcher, Ronald Reagan, Terry Wogan and so on. Another line was the "AI think therefore AI am" or "I Lisp therefore I am" approach.

Nearer the mark were definitions which suggested AI had arrived when a computer made the same mistakes as a human, only faster or to 15 decimal places. An alternative definition was when computers could con their users into lending them a fiver. A cynic suggested that AI was an expression used by computer scientists to impress their friends and qualify for research funds.

We felt we were getting close to the answer with a definition that AI was "A dolphin that loves Picasso". This was clearly profound, witty and insightful, but had to be disqualified on the grounds that we could not understand it. But it did point in the direction of the final winner.

This was Mr A E Ward, who lives in Clwyd. His design for a second tie-breaker was in the form of an algorithm

```
GOTO SECOND POSITION ON
   RACK
GET TIE
IMMERSE IN LIQUID
   NITROGEN UNTIL STIFF
STRIKE WITH HAMMER
   UNTIL BROKEN
```

This also suggests that a definition of artificial intelligence might be "something a machine would possess if it could produce the above winning solution to the second tie-breaker". After all, it is precisely this capacity for lateral thinking that represents one of the ultimate challenges for AI research.

Practical Computing would like to thank ACT for generously donating the prize, an Apricot F1 system, with printer, colour monitor and software. We would also like to thank everyone who took part for the many witty entries.

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An image scanning system which enables video images to be captured and stored in a micro-computers RAM at a resolution up to 256 x 256 with 255 grey levels. Complete with camera and interface, MicroSight I will store images on disk or output them to a printer.

MICROSCALE II

An image analysis package which enables the user to define windows in the image and derive areas, perimeters, particle counts and size distribution.

MICROSIGHT IIR

A framestore based image acquisition system which can capture a 512 x 512 video picture at 64 grey levels. Complete with camera interface and video output MicroSight IIR can be driven using subroutines supplied.

MICROSCALE IIR

An image analysis package which enables a microcomputer to derive information from a 512 x 512 video frame. Facilities such as enhancing, substracting and averaging are included with optional pseudo colour output.

Systems available for IBM PC/AT, Victor 9000/Sirius, Apricot, Hewlett Packard 9816, BBC Apple, Etc.

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● **Circle No. 139**

Atari–6, Commodore–2

ATARI launched six new micros at the Consumer Electronics show, which was staged at Las Vegas in January.

The two show stoppers were the 130ST and 520ST. Both use the Motorola 68000 chip and run CP/M-68K and the Gem graphics environment manager from Digital Research. This is a system similar to the Apple Macintosh which will also be available on the Apricot and Acorn ABC micros.

The 130ST has 128K of RAM and costs $399. The 520ST has 512K of RAM and costs $699. Both have 198K of ROM. Among the peripherals are 3.5in. microfloppy- and hard-disc drives and a range of printers.

A range of four new machines was also introduced to replace the 800XL, with which they are claimed to be software compatible. These are the 65XE, 65XEM, 65XEP and 130XE.

The 65XE has 64K of RAM and costs about $120. The 65XEM is a music version with eight sound channels instead of four. The 65XEP is a transportable version — rather like the Commodore SX-64 — with 3.5in. microfloppy-disc drive and 5in. monitor, and costs about $400. Top of the XE range is the 130XE with 128K of RAM and a target price of $200.

Commodore launched two new micros at the same show, the C-128 and the LCD Portable. The C-128 is a dual 6502/Z-80 machine with 128K of RAM and a price of about $300. It offers both compatibility with the Commodore 64 and a CP/M-compatible mode.

The LCD Portable is also 6502-based. It features a 16-line by 80-character liquid crystal display. While it has only 32K of RAM, it has 96K of ROM including the usual suite of software provided with lap portables plus a spreadsheet. No price was quoted for this machine.

If the eight new models arrive at the promised times and prices, life is going to become even tougher for the surviving British small micro manufacturers. The XE Ataris could wipe out the Electron, while the Commodore C-128 looks very competitive against the BBC model B. Though they are obviously pitched against the Macintosh, Atari's 68000 models could make the Sinclair QL virtually unsaleable in the U.S.

Meanwhile, Commodore's Amiga and Atari's 32-bit graphics work station are yet to come.

Hardware shorts

- Prism has cut the price of its VTX-5000 viewdata communications system from £99.95 to £69.95. More on 01-253 2277.
- Comart's new CP-2545Y micro offers an 80286 with 512K RAM, and a 40Mbyte Winchester. Up to four users can be accommodated. The cost is from £7,995. Details on (0480) 215005.
- Titan III plus II allows Apple III owners to run Apple II programs. It emulates a 64K Apple II, and allows Prodos programs to be run. More on (0706) 217744.
- Tandata's BT-approved TM-200 multi-baud-rate modem has been reduced in price from £217 to £173, both prices excluding VAT. More on (06845) 68421.
- Telecom Gold is available for the NEC lap portable for a bundled price of about £600. For more information, ring 01-267 7000.
- ACT and Tandy are to form a jointly owned distribution company with 70 retail computer stores throughout Europe. The new stores will trade under the name TA Computerworld.
- Husky has produced a rugged portable cassette recorder to go with its rugged Husky range of computers. The cost is £595 plus VAT. Details on (0203) 668181.
- Rair has introduced a colour-graphics board for its Supermicro, providing a 16-colour high-resolution pixel-mapped display. The price is £1,250. More on 01-836 6921.
- Etherprint allows Ethernet computers to share up to four serial and one parallel printers. It costs £5,400. More information on (0734) 751087.
- Protek offers an ultra-tough Winchester for harsh environments. It is able to withstand accelerations of up to 15G in any direction. The price is a hefty £10,000 for a 10Mbyte disc. More on 01-245 6844.

HP Integral PC

HEWLETT-PACKARD has launched the ultimate portable computer, which boasts a 9in. electroluminescent display, built-in 710K floppy and Thinkjet printer, and runs under Unix. However, the cost is £5,450.

The HP-UX operating system is derived from Unix system III, and provides such facilities as graphics and windowing. The languages available under it are HP-UX Technical Basic and C. The Integral uses the Personal Applications Manager found on the HP 150 and HP 110 as a front end. Application software already available includes Multiplan, Memomaker and dBase III.

The new micro has a 68000 chip and comes with 512K RAM as standard, expandable to 1.5Mbyte internally and 5.5Mbyte externally. There is 256K of ROM which includes the Unix implementation.

The 9in. amber display has 31 lines and 80 characters, and allows multiple adjustable windows. The keyboard is detachable, and the whole unit weighs 25lb. Details on (0344) 773100.

Epson's QX-16 is a dual 8088 and Z-80 processor machine running under MS-DOS and CP/M. There is also an optional IBMulator board. Standard features include 156K RAM expandable to 512K, and dual 5.25in. floppies offering 360K or 720K per disc. The cost has yet to be announced. More on 01-902 8892.

The Goupils are coming

SMT GOUPIL, France's largest micro manufacturer, is launching its range of home-grown machines in Britain. The machine is rather less exciting than the name: 8088-based, with 128K or 256K RAM, and one or two 360K floppies. There is also a hard-disc version.

Goupil was founded in 1979 and claims to command 14 percent of the French micro market; about 20,000 machines have been installed.

(continued on next page)

News: hardware

(continued from previous page)

In addition to MS-DOS and Microsoft Basic, the system also comes bundled with a French Basic, called S-Basic. The price for the systems varies from around £1,900 to £4,000 for the 10Mbyte Winchester version.

MSX music

YAMAHA has finally released details and prices of its MSX-compatible music computer, previewed by *Practical Computing* in April 1984. the CS-5M offers the usual MSX features plus an FM synthesiser

and piano-type keyboard. the cost is £534. A full-scale keyboard version costs £614. Eight octaves and eight voices are available.

Additional software allows you to edit and create FM sounds visually, and there is a music notation package that lets you build up an eight-part musical score on the screen, which the machine will then play back to you. There is also a Midi interfacing facility. Details from Yamaha on (0908) 71771.

Telesoftware exam entries

SECONDARY SCHOOLS can enter their pupils for the 1985 G.C.E. Oxford Local Examinations Board using a computer program transmitted via the BBC telesoftware service. Schools using this method of entry will receive a refund of 25 pence per candidate.

Hitherto, schools have been able to enter pupils' exam entries on floppy discs which were sent to them by the examinations board. Now the necessary software will be available free on suitably adapted televisions.

The programs will be broadcast on Ceefax page 710 until 25 February, and entries must be received by 1 March. There is no copyright on the programs, which can be copied from other sources.

Price cuts

WITH ominous rumblings on the horizon from Atari and others, Sinclair has reduced the unduly high price of the Spectrum Plus to £129.95. The bundled software has been dropped, as has the 48K version in the U.K.

Less expected is the action of Acorn: the Electron now costs £129, neatly matching the new price of the Spectrum. Even more interesting is Acorn's "trade in your used micro" deal. It is prepared to offer a £50 discount on a new BBC model B in return for your old computer; apparently anything from a ZX-80 to an IBM 370 will count.

Beebop

THE BEEBOP INTERFACE allows a BBC Micro to be hooked up to STE-bus systems. The interface is a single Eurocard which sits in an STE card frame, connecting to the BBC Micro's

1MHz bus. A filing system EPROM is also supplied which adds a set of STE-orientated commands to the Basic interpreter. Beebop costs around £120, and is available from Arcom Control Systems on (0223) 242224.

Cheetah pieces

CHEETAH MARKETING is launching a range of products for the Commodore 64 and Spectrum. For the Commodore there is a plug-in speech synthesis module, costing less than £30. For the Spectrum there is a joystick interface, a 56-way extension cable costing less than £10 and a two-way aerial adaptor for computer/TV input for less than £2. Details on 01-833 4909.

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   COLOUR CAPABILITIES: 16 colours and 16 intensities giving 256 different colours (all of the 256 colours can be displayed at the same time).
   OPERATING SYSTEM: 24K ROM including Atari Basic programming language and a self diagnostic test program.
   KEYBOARD: Full stroke design with 62 keys including help key and 4 special function keys, international character set and 29 graphics keys.
   SOUND: 4 independent sound synthesisers each capable of producing music across a 3½ octave range or a wide variety of special sound effects. (Additional programming can achieve an octave range of up to nine octaves!)
   DISPLAY: 11 graphic modes and 5 text modes. Up to 320×192 resolution. Maximum text display 24 lines by 40 columns.
   SPECIAL ATARI INTEGRATED CIRCUITS: GTIA for graphics display. Pokey for sound and controller ports. Antic for screen control and I/O (Input/Output).
   CPU: 6502C microprocessor - 0.50 microsecond cycle and a clock speed of 1.79 MHz.
   EXTENDED GRAPHICS FUNCTIONS: High resolution graphics. Multi-coloured character set. Software screen switching. Multiple redifined character sets. Player missile (sprite) graphics. Fine screen scrolling. Changeable colour registers. Smooth character movement. Simple colour animation facilities.
   PROGRAMMING FEATURES: Built in Atari Basic programming language supporting peek, poke and USR plus at least 8 other languages available. The help key will provide additional information and menu screens with certain software. Full on-screen editing is available as well as syntax checking on entry.
   INPUT/OUTPUT: External processor bus for expansion with memory and peripherals. Composite video monitor output. Peripheral port for direct connection to Atari standard peripherals. Software cartridge slot is included as well as 2 joystick controller ports.
   SOFTWARE: Over 1,500 items of software are available including self teaching programs with unique voice over. The range of programs includes Education, Home Management & Programming aids. There is also APX (Atari Program Exchange) and of course Atari's famous entertainment software now at only £9.95. In addition there is a host of support and help available from specialist Atari magazines like Antic and Analog and from over 75 Atari books/manuals.
2. **ATARI 400 16K GAMES MACHINE - £29:** We have several Atari 400 games consoles/computers with 16K RAM. The price is £29 (for a reconditioned model) or £39 for a new machine. Both come with 12 months guarantee. The Atari 400 can play all 800XL ROM cartridge games and is expandable up to 48K RAM. Computer upgrade with Basic Programming Kit (£30) optional extra.
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4. **ATARI 1050 DUAL DENSITY DISK DRIVE - £199:** 5¼" disks holding 127K randomly accessible bytes provide both expansion and flexibility for your 400/800 or XL system with new 'helpful' DOS 3. All customers who purchase a Disk Drive from Silica Shop will be automatically given a FREE set of 100 programs on 3 Disks recorded on both sides.
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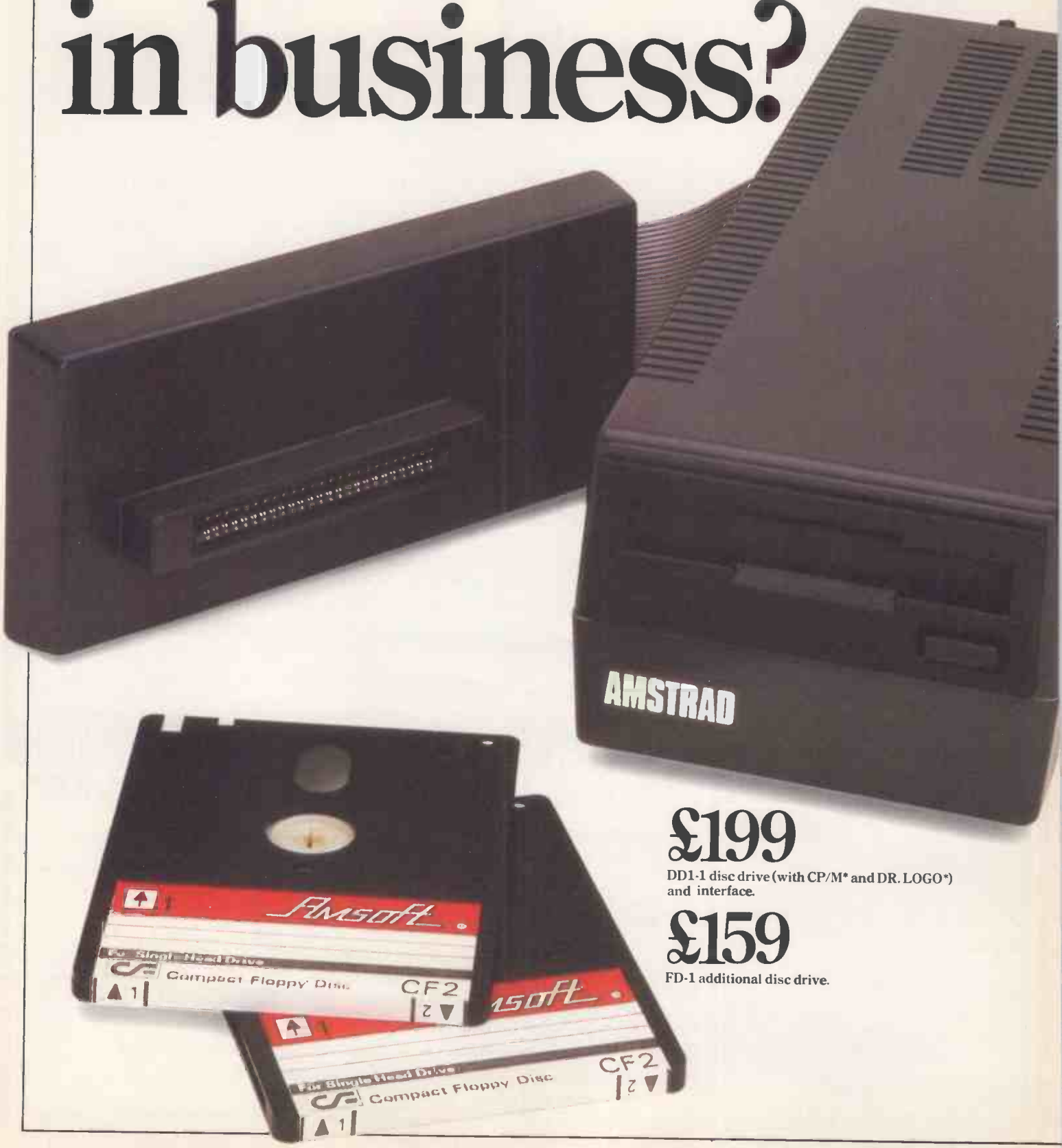

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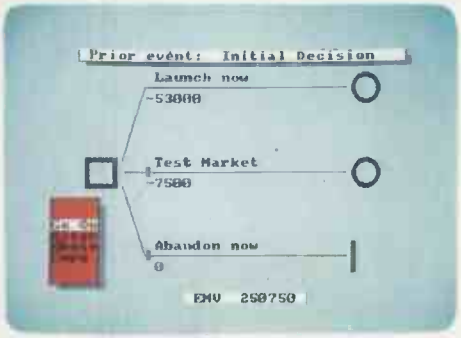

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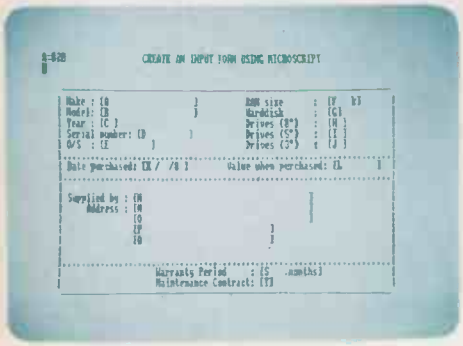

Microscript

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MICROWARE

Superproject

TODAY'S MANAGERS produce immaculate memos thanks to their word processors, and are in instant communication thanks to electronic mail. They have complete financial control thanks to their spreadsheets and, using Lotus 1-2-3 or Supercalc 3, they convert their figures to diagrams that even the directors can understand.

Unfortunately, they are still planning their projects on the backs of old envelopes. But now the software houses are out to persuade every manager that they also need a project-planning package, and the race is on to produce the dBase II or WordStar of the field.

The latest entry is called Superproject, from Sorcim/IUS, which comes from the same stable as the Supercalc spreadsheet. Where most planners only use one or two of the three main techniques for project management, Superproject actually applies all three.

Superproject provides a Pert chart — project evaluation and review technique — to show relationships between one task and another. It provides a Gantt chart — named after Henry Gantt — to show tasks on a time schedule. It also offers CPM, the critical path method, to show what effect delays to a single task will have on the completion of the project.

The program aims to be easy to use and offers a Beginner mode, though you can switch to Expert mode with one keystroke. It makes full use of colour and graphics, and provides on-line help screens. It can also generate reports and can take data from Supercalc if required.

Superproject requires an IBM PC or compatible with 256K of RAM and two disc drives. It costs £395. Contact Sorcim/IUS, St. Mary's House, 16-20 High Street, Maidenhead, Berkshire SL6 1QH. Telephone: (0628) 70911.

Top Class

TOP CLASS is an authoring and presentation package for the IBM PC from a new British company, Format PC.

It enables non-programmers to write tutorial packages that include colour graphics and sound, using a menu-driven system that insulates the programmer from DOS. Answers can be controlled and checked by a number of methods.

Top Class requires 128K of RAM, a colour graphics card and a colour monitor. It will run on a monochrome system, but of course without the colour and graphics. It costs £290 plus VAT.

Contact Format PC at Goods Wharf, Goods Road, Belper, Derbyshire DE5 1UU. Telephone: (0773) 820011.

PC SIG

THE IBM PC Special Interest Group in California is a user group that collects and distributes almost-free software: library discs containing up to 40 programs cost only $6 each. Since we first gave details in our January issue SIG has grown and moved. The library now contains 265 discs. You can buy the top five for $34, the top 10 for $59, or the whole lot for $1,590.

Contact PC SIG at its new address 1125 Stewart Court, Suite G, Sunnyvale, California 94086. The telephone number is unchanged at (U.S area code 408) 730-9291

IBM's results

IBM'S CHAIRMAN John Opel has announced preliminary results for the 12 months ending on 31 December 1984. Sales were just short of $46 billion, up 14.3 percent over 1983. Net earnings were $6.6 billion, an increase of 20 percent.

Income from operations outside the U.S. was only $18.6 billion: a nine percent increase. The main reason for this is the strength of the American dollar. The company estimates that gross income would have been $690 million higher in the fourth quarter alone, had it not been for these adverse movements in the exchange rate.

With similar growth in 1985, IBM's worldwide sales should hit an average of a billion dollars a week, which is $25 million per hour, assuming a 40-hour week.

Shorts

● Mem/DOS, the award-winning French Apple package, is now available in a new version for the IBM PC/XT from International Computer Consultants. ICC has also launched vertical market packages for the hotel trade and insurance brokers. Ring: (0481) 20155.

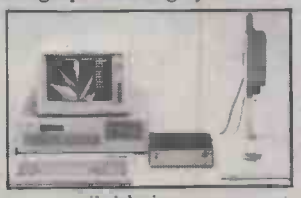
● The Desq multi-windowing software integrator from Quarterdeck

is now available from Softsel. It allows up to nine packages to be run at the same time. Telephone: 01-844 2040.

● Page-based word processing is now possible with the IBM PC, using Workwriter from Data Applications Ltd. It requires 128K of RAM and costs £185 plus VAT. Telephone: (0285) 61828.

● The Venture Development Corporation of Wellesley, Massachusetts has launched a study of 3,000 software packages which run on the IBM PC and compatibles. It costs $795. Telephone: (U.S. area code 617) 237-3000.

● Digithurst's well-known image-processing system is



now available in a new version for the IBM PC/AT. Telephone: (0223) 208926.

● Convertabuffer II is a clever piece of firmware that enables the graphics output from programs such as Lotus 1-2-3 to be printed using almost any daisywheel printer. It comes on a card that includes a 32K print buffer and a parallel printer port. The price is £349 plus VAT. Information from Yorkshire Microcomputers. Telephone: (0904) 642941.

68000 assemblers slug it out

QL 68000 ASSEMBLER fans now have two programs to choose from: Adder has just released QL Assembler costing £29.95 plus VAT to join Metacomco's established QL Assembler, which has dropped in price to £39.95 with VAT. Both products claim to be full macro assemblers. Details from Adder Publishing Ltd, PO Box 148, Cambridge CB1 2EQ, and from Metacomco, 26 Portland Square, Bristol BS2 8RZ, telephone (0272) 428781.

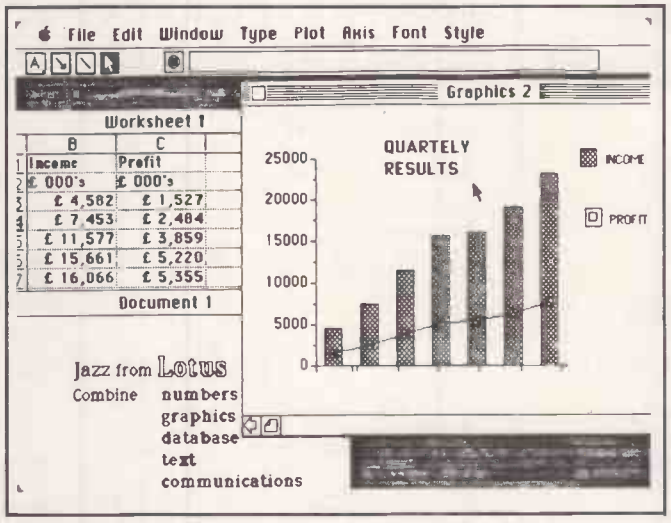
Professional software developers may also be interested in the RTS QL development package, which runs on Vax, PDP-11 and 68000 Unix systems. Costing just under £4,000 it allows Pascal and C programs to be cross compiled and massaged so that they will run under QDOS or CP/M-68K. This should increase the number of established business programs available to run on the QL. Further details available from Real Time Systems on 091-273 3131.

Flood of programs for the Macintosh

APPLE has released the Macintosh Buyers' Guide, a catalogue of over 200 programs and hardware add-ons for the machine. Available from any Apple dealer, price £5.95, it makes interesting reading even though many of the products in it are not easily obtainable outside the U.S.

Among the latest batch of packages that have made it over to the U.K. are a terminal-emulation package and two new databases. Macterminal, £99, emulates VT-100, VT-52, IBM 327X and ICL C-03 terminals. Factfinder, £139 plus VAT from P&P, is a free-form database which lets you search for keywords in relatively unstructured data. 1st Base, £175, is a multi-file relational database. All the packages are available from P&P. Telephone: (0706) 217744.

Micro Planner, price £295, is a British-written project-planning package. It is available from Apple dealers and can be borrowed along with a Mac under Apple's "Test drive a Mac" campaign.



Jazz: spreadsheet, WP, database, graphics and comms.

Meanwhile, Lotus has announced that Jazz, the Macintosh equivalent of Symphony, will be on sale in the U.K. in April. Jazz integrates spreadsheet, word processing, database, graphics and communications. The package will cost £495 plus VAT, requires 512K to run and a second disc drive — so only richer Mac users are likely to be able to run it.

Software shorts

● PFS:File, the popular Apple and IBM database, is now available for the Commodore 64. Price £104 plus VAT, it requires one disc drive. Details from P&P. Tel: (0706) 217744.

● Mini-office, well known on the BBC and Spectrum, is available for the Amstrad and Commodore 64. Linking word processing, spreadsheet, database and graphics-like integrated software, it costs £5.95 and is supplied on cassette. If not in the shops contact Database Software. Telephone: 061-456 8383.

● The Print Shop lets Apple II users exploit to the full the capacities of their dot-matrix printers. It offers

eight typefaces in a variety of sizes, nine border designs and a graphics editor to let you create your own designs. The Print Shop comes on disc and costs £42.75 from P&P.

● Memsoft is offering a £15 version of its Memdos software development tool. Memdos Junior gives disc-based Apple IIs an index sequential filing system and a screen form generator. Fuller versions of Memsoft run on the Apple and also the IBM PC. Contact Memsoft Ltd, 30 Mincing Lane, London EC3R 7DP.

BBC cassette to disc ROM

TD ROM transfers cassette-based BBC software to disc. This task is more difficult on the BBC Micro than on most other machines as Acorn does not publish the information necessary to enable you to do it for yourself.

To stop anyone using the system to pirate software, TD Rom encrypts each disc created in a way that is unique to a small batch of ROMs. Since a disc file can only be loaded through the TD Rom which created it, this should prevent all but legitimate personal use. Because it resides in ROM the utility can get at all of RAM from &400 to &7FFF, copying programs complete with any protection that stops you listing it.

TD Rom costs £18 including VAT and will work on most 40-track drives. Details from Vine Micros, Marshborough, Sandwich, Kent CT13 0PG.

Expressbase II

EXPRESSBASE II is intended to reduce the time it takes experienced dBase II and dBase III users to write applications, and so is best described as a kind as a kind of shorthand utility.

Version 2.0 has just been released and we will be reviewing it, along with other dBase products, in our April issue. Expressbase II costs £125 and is available for MS-DOS, PC-DOS and CP/M-80 machines. Contact Salamanca Software Ltd, 64 More Close, St. Paul's Court, London W14 9BN. Telephone: 01-741 8632

Toe-tapping tutors

PIANO AND GUITAR chord shapes are taught by two programs released for the BBC, Spectrum and Electron. Keyboard Chord Tutor and Guitar Chord Teacher show chord shapes, progressions and inversions. Each program costs £14.95 including VAT, and an optional foot-switch is available for £10. Contact P R Adby Associates Ltd, 40 Broad Street, Seaford, Sussex BN25 1NF. Telephone: (0323) 899202.

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Sage Accounting*	£325
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Please see CP/M listing. All product with an * will also run on MS-DOS and PC-DOS and are priced the same

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Games Workshop

SO FAR most of the programs launched for the QL have been operating systems and languages, while games have been thin on the ground. Now there is D-Day, a war game of the Eastern Front type with scrolling maps. It has previously been available on the Spectrum, and now Games Workshop has launched versions for the QL and the Commodore 64.

The QL version is claimed to be "massively upgraded" and has over 200K of code, providing four separate scenarios, each with a playing area of 127 by 52 units. The game is for one or two players, and comes with a 40-page manual. The QL version costs £24.95, and the Commodore 64 version £8.95.

Games Workshop has also converted its fantasy board game Talisman to run on the Spectrum, and claims it is the first interactive multi-player arcade adventure on a micro and is "the true successor to Valhalla". It has over 50 graphics screens and costs £7.95.

Contact Games Workshop, 27/29 Sunbeam Road, London NW10 6JP. Tel: 01-965 3713.

Top: D-Day on the QL. Bottom: Talisman on the Spectrum.

Screenplay for Las Vegas

SOFTSEL is now importing the Screenplay range of games from the U.S., and is promoting them with a free trip to Las Vegas. To enter, just ask your dealer for a ticket; you do not have to buy a game.

The six Screenplay offerings are Trivia Arcade, Asylum, Institute, Pogo Joe, Dunzhin and Professional Black Jack.

Trivia Arcade includes 3,000 obscure general-knowledge questions and costs £30.20. Asylum and Institute are graphics adventures and cost £25.90. Pogo Joe is a version of Q-Bert and costs £21.55. Dunzhin is a role-playing adventure and costs £25.90.

Professional Black Jack is the pontoon game, and has been written by Ken Uston "who made millions himself in the casinos", says Softsel. It includes an interactive tutorial with practice sessions, and scenarios for over 70 of the most popular American casinos. It costs £60.45.

All six games are available for the Atari micros, and all but Institute for the Commodore 64. Four are available for the Apple II and IBM PC. Trivia Arcade is available for the Macintosh for £34.50.

Contact Softsel, Softsel House, Central Way, Feltham, Middlesex TW14 0XQ. Telephone: 01-844 2040.

Mac-Poker and Mac-Jack

DATAPAK SOFTWARE'S two card games for the Apple Macintosh are now being imported by Pete & Pam.

Mac-Poker is a game of five-card stud where the player plays the computer. Mac-Jack II is a game of blackjack, or pontoon, played with graphics cards using the mouse. Both games cost £44.95 plus VAT.

Contact P&P Micro Distributors, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744.

Blackjack for the Macintosh.

Ghostbusters

ACTIVISION'S smash-hit game of the film is now available for the Sinclair Spectrum. Unfortunately the thing that made the original Commodore 64 version so good was the catchy sound, and the Spectrum is not one of the 1,000 best micros around from that point of view. The Spectrum Ghostbusters does have sound, but nothing like the song. Without it, the game seems somehow thin and feeble.

Reports from the U.S. suggest an Atari version is available. Activision says it should arrive on disc only in March. It will cost £14.99.

Art of War

A NEW STRATEGY GAME has been launched by a Californian software house not living up to its name, Brotherhood. The Ancient Art of War is a real-time game with a scrolling map, which also allows you to zoom in on the battle action. It includes 11 built-in campaigns which pit barbarians, archers and knights against one another.

You have a choice of eight opponents, which means you can, for example, refight Custer's last stand against Genghis Khan. The package also includes a strategy guide based on the teachings of the Chinese philosopher Sun Tzu, after whose 2,500-year old treatise the game is named.

To play it you need an IBM PC or compatible with colour graphics, a double-sided disc drive and PC-DOS 2. It costs $44.95.

Contact Broderbund, 17 Paul Drive, San Rafael, California 9403-2101. Telephone: (U.S. area code 415) 479-1170.

Grand Slam

COMMODORE 64 owners who enjoy bridge but cannot find people to play can now play the computer with Serin Software's Grand Slam. Bidding is the standard Acol system with Stayman and Blackwood conventions recognised. The micro will play either declarer or defender, and can also play rubber bridge.

The program costs £8.95 from Boots and other stores, or contact Serin at PO Box 163, Slough SL2 3YY. Telephone: Farnham Common 3180.

Serin also markets an excellent Spectrum chess tutor written with British Grandmaster Tony Miles.

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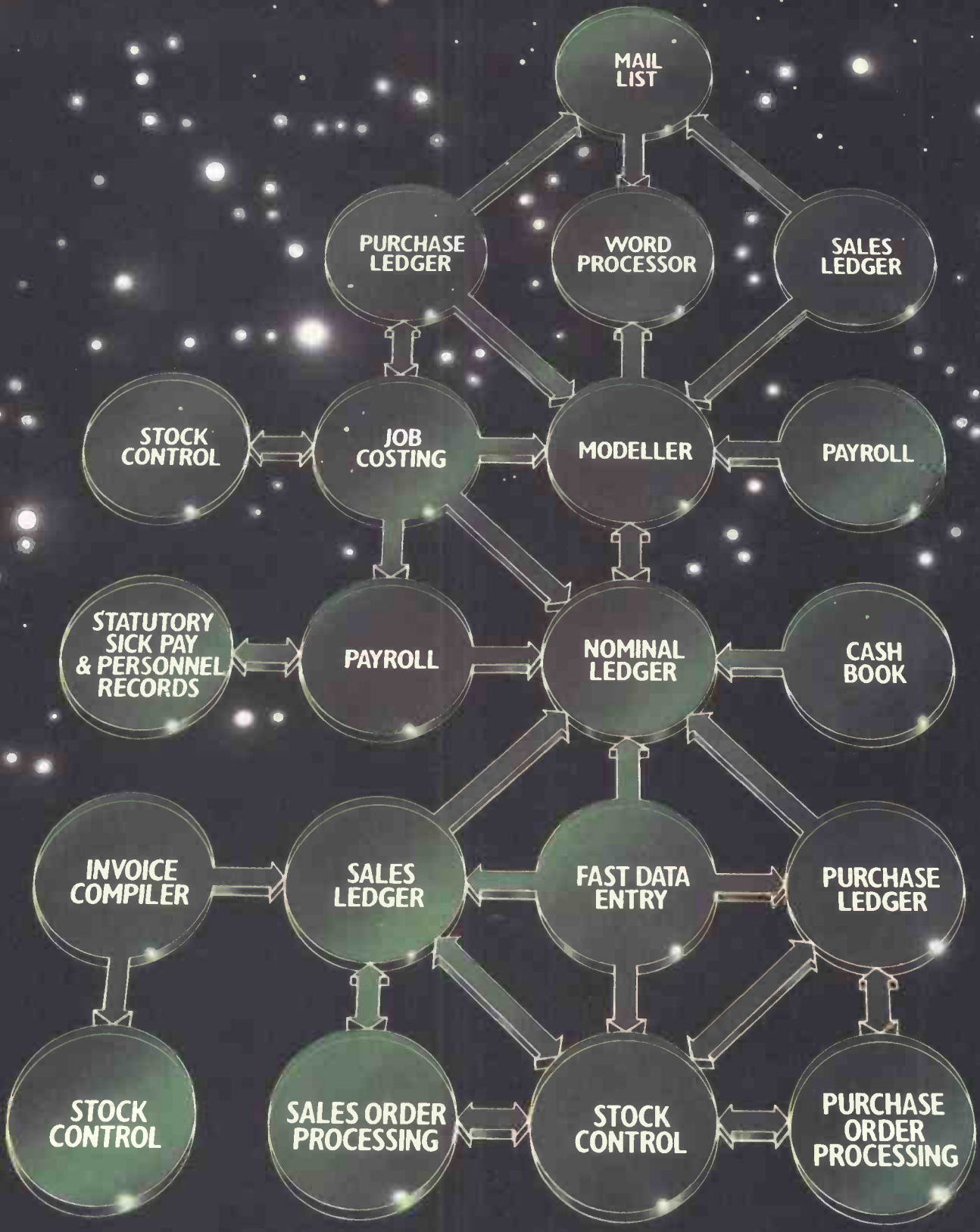

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The M-F-B, made available at prices that 'drives' the opposition away, comes supplied with a six-month free format update service.

So, if you are the head of a Data Processing department seeking a solution to ever increasing incompatibility amongst departmental computers, or the M.D. of a software house looking for a way to prevent further loss of sales due to the fact that you cannot supply software on the required disk format, then look no further...
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Those IBMulators keep on coming

FIVE MORE IBM-compatible micros were launched at the Which Computer? Show in January, to join the 64 or so currently on the market.

The new IBMulators were shown by Commodore, NCR, Tandy, Toshiba and Wyse, with the Tandy 1000 looking the model most likely to succeed.

In addition, two more full-function lap computers were launched to compete with Data General's The One. These were Texas Instruments' Pro-Lite and Toshiba's T-1100.

Tandy 1000

The Tandy 1000 looks like the existing model 2000, but as it uses an 8088 chip it is, of course, much less powerful. Although it is claimed to be fully IBM-compatible, Tandy has introduced a few extras,

Tandy 1000.

such as the facility to use more colours with the built-in graphics, and three sound channels instead of one.

The hardware includes colour graphics, a printer interface, joystick and light-pen ports, all of which cost extra with the IBM PC itself.

The Tandy 1000 comes complete with MS-DOS, GWBasic and an integrated software package, Deskmate, which provides a word processor, spreadsheet and filing together with communications facilities.

It is aggressively priced at only £1,099 plus VAT, for a system with a single disc drive. This does not include a monitor, which costs £139 for monochrome or £399 for colour. A second disc drive can be added for £249, so a 128K green-screen system costs only £1,487 plus VAT, which is very competitive.

For further details, contact your local Tandy store or phone (0922) 648181.

Portables

New portables were launched by Toshiba and Hewlett-Packard, though TI also showed its new Pro-Life. Grid contented itself with a wide-screen versions of the wonderful Compass micro. The electroluminescent display now runs up to 128 characters wide.

The Toshiba T-1100 is an IBM-compatible portable with an 80-column by 25-line LCD display and built-in 3.5in. microfloppy-disc drive. The system includes 256K of RAM and a parallel printer port, and weighs about 3kg. It should be competitive with models like the TI Pro-Lite and Sharp PC-5000.

Hewlett-Packard's The Integral is perhaps the oddest portable of all time. It packs a Unix micro, flat screen, 3.5in. microfloppy disc drive and Thinkjet printer into a 25lb. box measuring only 16in. by 13in. by 8in.

HP says the machine is aimed at the scientific and engineering markets, and also provides an entry-level option for its Unix line-up. However, just how many people want to tote around a Unix engine and are willing to pay £5,450 plus VAT for the privilege, remains to be seen.

Also-rans

Of all the new designs the Wyse PC looked about the most interesting, partly because its low, sleek styling made it look the most original of the bunch.

The Wyse PC has 256K of RAM and two floppy-disc drives. The main board includes two serial ports and a parallel port, and there are two free expansion slots where IBM cards can be fitted horizontally. The system comes complete with MS-DOS 2.11 and GWBasic for £1,995. Both hard-disc and colour versions are also available.

The Wyse PC is made by the famous terminal manufacturer and is imported by both Logitek and RTS Technology.

The Commodore PC was shown running Silicon Office in colour. However, apart from the fact that the keyboard plugs into the front rather than the rear of the system box, there appears to be nothing unusual about it.

Commodore U.K. had only taken delivery of a couple of sample machines just before the show, and had no comment to make on either availability or price.

The NCR PC-4i looks just the same as the current

NCR PC-4i.

Decision Mate V, but of course is IBM compatible. It uses the 8088 chip and comes complete with the 256K of RAM, one parallel port, one serial port, MS-DOS, GWBasic, and three tutorial programs NCR Pal, NCR Help and NCR Tutor. A basic system with a 12in. monochrome screen and a single disc costs £1,799 plus VAT.

The Toshiba T-1500 is a compact system which uses the 8088 and 128K of RAM. Expansion is limited to a further 128K in 64Kbit RAM chips, or to 512K in 256Kbit chips. The main board includes the colour graphics, and a parallel printer port.

Victor announced its PC Plus IBM-compatible upgrade — or should that be downgrade? — for the Victor 9000/Sirius 1, but did not have one on the stand.

Shorts

- Apple showed the amazing Jazz integrated package — an enhanced version of Lotus Symphony — running on the Macintosh.
- British Telecom showed its badge-engineered version of the ICL One Per Desk, called Tonto.
- Brother launched the TC-600, as a kind of big brother to the EP-44. The TC-600 is a portable typewriter, 80-column printer with a 24-character LCD

display and 14K of memory, which makes it very usable for telex and electronic mail. Brother's FB-100 100K battery-powered 3.5in. microfloppy disc can be used for extra storage.
- Corvus showed its networking system with Microsoft's Networks software running on the IBM. The ACT Apricot network naturally uses the Corvus hardware with Microsoft software too.
- Digital Research showed Logo running on the Amstrad and the Tatung Einstein, plus Gem running on the IBM PC and Acorn ABC 32016.
- Epson showed the HI-80 colour plotter which, at around £400, is claimed to be the cheapest of its type.
- Fujitsu showed the FM-16S multi-user version of its IBM-compatible micro, plus the FM-16SX with built-in 11Mbyte or 22Mbyte hard disc.
- Sharp showed its new MZ-800 home/business micro running Personal CP/M. It sports a Z-80A and high-resolution graphics, and is claimed to be data compatible with the IBM PC.

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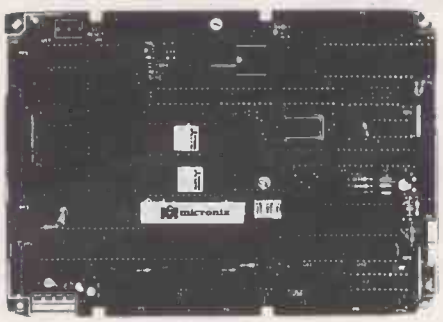

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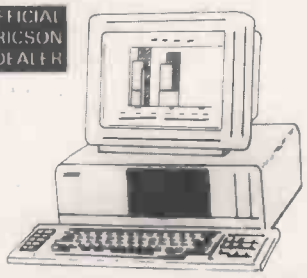

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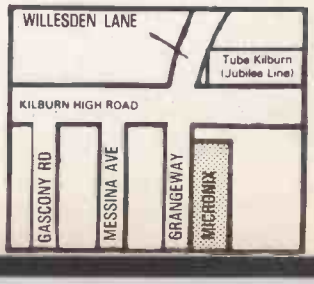

Under the hammer

Chris Bidmead has been to the computer auctions with a sharp eye open for the bargains to be snapped up there.

AUCTIONS are exciting, and can be a good way to snap up a bargain. But the usual rules of "merchandisable quality" and "fitness for the purpose" that cover your ordinary purchases from a dealer do not necessarily apply. In sale at auction you buy on sight, and there is nobody to complain to if the item purchased is faulty.

The first computer auction I attended in the autumn of last year was a new experience for the auctioneers too, and the affair was not sparklingly successful. The prices below which the seller refuses to part with the lot, known as the reserve, were set very high. The buyers were justifiably cautious, particularly as the auctioneer kept reminding us that he knew very little about the products he was selling.

Will it sell?

Lot 10 was an Epson QX-10 computer complete with printer and a selection of software. "Can I sell it at £700?" the man with the raised hammer asked himself, as if in consultation with his conscience — but still loud enough to be overheard by the 100 or so would-be purchasers who fill the auction room, a hired hall in a backwater London hotel.

"Do I hear £750?" asked the auctioneer. He did, and then he heard £800. But then the halting bidding dried up altogether. "No, gentlemen, I will not sell it for £800." Like five of the other lots offered so far, the Epson had failed to reach its reserve. Instead of falling with a definitive bang to mark the sale, the gavel is laid gently to rest on the podium.

In spite of the sale by auction rules that make the evidence of the seller's eyes practically the sole guarantee, during the viewing the lots had been kept away from our hands-on experience. The "new and boxed" lots had remained firmly boxed and new, and the second-hand goods were swathed in polythene. As compensation for not being allowed to prod the products, many of the lots were accompanied by a technician's report that gave a cursory description of the condition and workability. But you would be in a tenuous position legally if you insisted on your money back on the basis of misdescription.

Crocker Computer Auctions of 154 Tottenham Court Road, London W1, hope to hold monthly auctions of office equipment together with computer software and peripherals. For details ring 01-387 5838.

Dealers

Many of the potential bidders at such auctions are dealers who have put in lots themselves. They have come to buy too, but because they already know the problems of selling outdated hardware they will only buy at silly prices. Private individuals are chary of chasing the bidding ever upwards because so much of what you buy in a computer is service and support from the dealer.

Perhaps this was why at one auction an Apple Macintosh failed to sell. Launched only months earlier in a flurry of publicity, the Macintosh took its chances as Lot 214, "Brand new in box inc. software". It received not a single bid, although I subsequently learned that the reserve had been set quite low at £800. A used IBM PC, new retail price around £2,500, was pursued across the £1,000 line by a small posse of bidders, but narrowly failed to make its reserve.

Spares only

Several Sinclair Spectrums, "not working but suitable for spares" fell under the hammer at around £35 each; another in good working order failed to reach its £70-odd reserve. A neat little Hyperion portable, IBM compatible in a leather-look carrying case, changed hands at £1,000 after a short burst of brisk bidding. Lotus 1-2-3, the best-selling software package that costs around £350 from dealers, started at a tenth of that price and was hotly contested until the gavel fell on £100.

It's worth keeping your eye on the faces and trying to sort out the professional dealers from the amateurs since a bid is not always what it seems. At one auction a vendor, eager to inject some electricity into a flagging sale, enthusiastically entered into a duel for what must have been his own lot. There is no other explanation for the fact that although he failed to secure the lot, the same bidder made no bid at all for the identical lot that followed.

Last November, in a return match from the same auction house, vendors seemed to have lowered their expectations and their reserves, and more lots were sold with no reserve at all. Paradoxically, the result in some cases was a higher return. Sundry Apple IIs sold for around £500 and a Macintosh fetched £1,100.

But beware the temptation of the weird and wonderful old bangers with obscure trademarks. In the heat of the auction £30 may seem a snip for a machine with dual disc drives and a screen. But unless you can lay your hands on the documentation and software all you will be lugging home is an oversized paperweight.

Hacking needed

However, if you are prepared to do some post-sale chasing or hacking sometimes you can pick up a serious machine for a song. Typical is the Rair Black Box, which had a price tag of around £2,000 in 1982, that one auctioneer knocked down for £150. It needed a system disc, which would mean cajoling Rair for the CP/M software or getting hold of the software documentation and writing the BIOS yourself. Eight-bit machines complete with system and applications software can sometimes be had for little more. I saw a dual-floppy Panasonic 8in. CP/M machine with some business software sell for £200. At the same auction a Superbrain complete with system went for £250.

The best bargains are often in the sideshows. Poke through that box of oddments described as "Lot 23: sundry connectors". Half the cables will be no use to you, but there will be several you might need. Buy them through a dealer and they could cost you £20 each, but you may be able to pick up a lot like this for £10.

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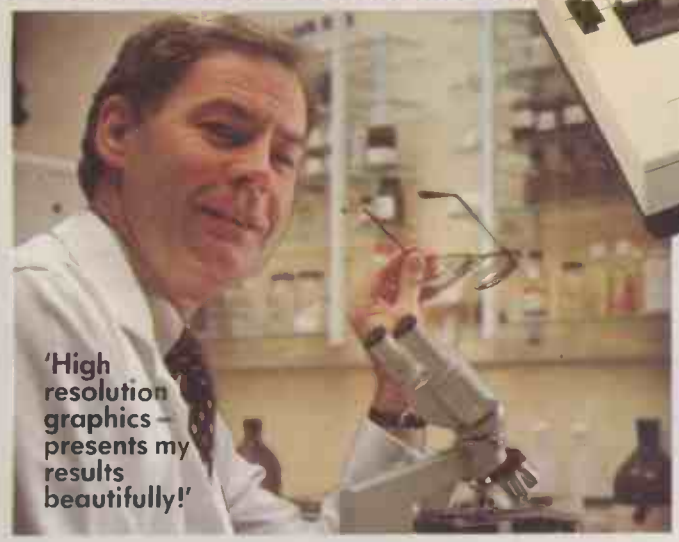

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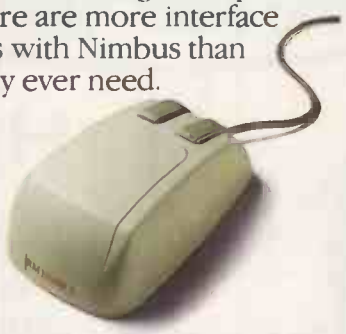
Among the many totally new ideas incorporated in Nimbus is Piconet, a unique input/output system which enables the computer to drive up to thirty peripherals, instruments or devices from a single I/O port. In fact there are more interface options with Nimbus than you may ever need.



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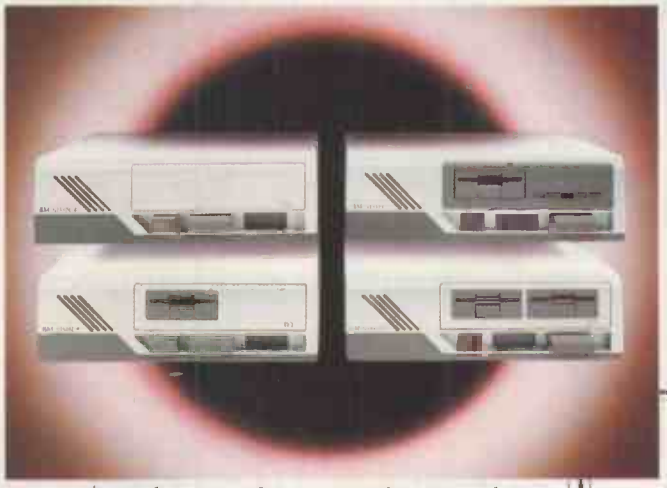

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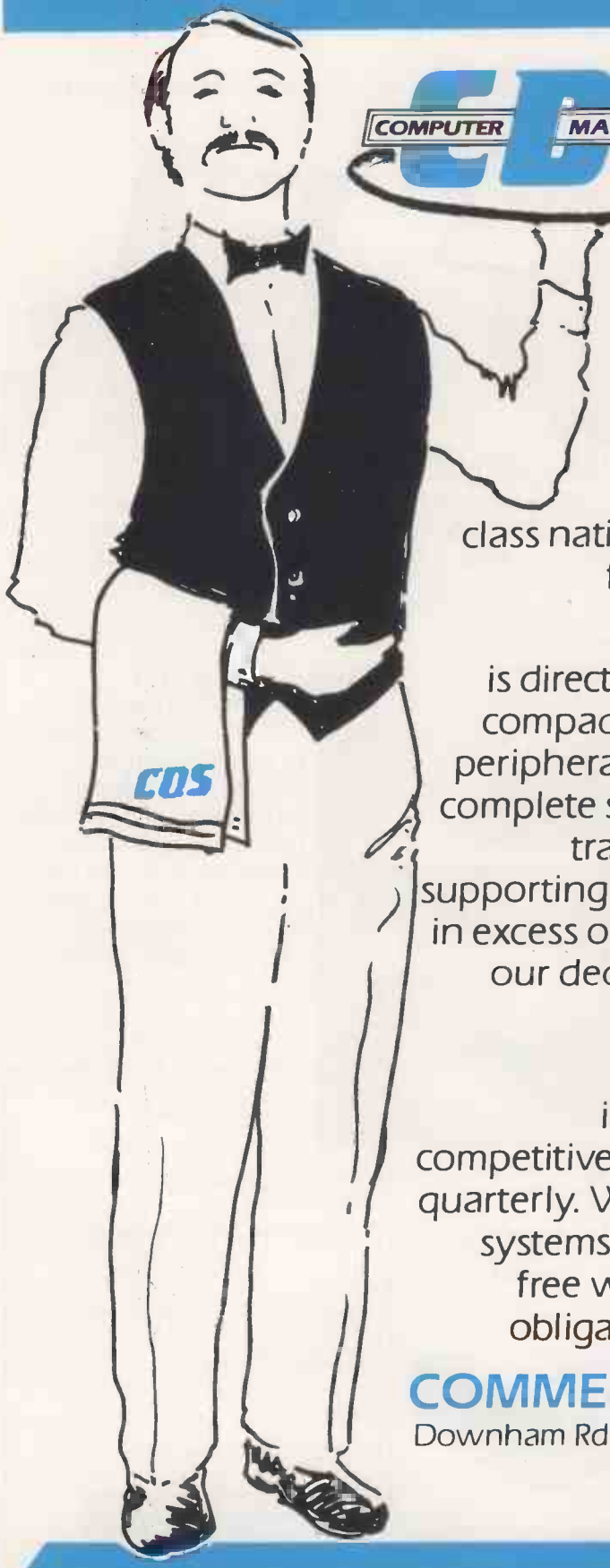

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QL NEWS

News from the world of Sinclair QL computing.

One year old... and look how we've grown!

When we launched the QL last year, we knew we were starting a revolution.

For the first time, the serious computer hobbyist could afford the same power and performance as the professional computer user.

A year later, and the QL is more than a unique computer, it's the heart of a unique system.

And the next 12 months promise even more for QL owners... new software options, extra storage devices, printers, monitors...

Read on, and see how far we've come, and how much further we're going!

Nº1

NIGEL SEARLE

Now it's the quantum leap for QL software and peripherals

Without doubt, the QL was the computer innovation of 1984. Launched to outstanding reviews, it soon gathered thousands of happy owners, and recognition from people like ICL, who have incorporated QL technology and its Microdrives into the new One Per Desk.

The quickest glance at the QL's specification shows what the fuss was all about... 128K RAM, 32-bit processor architecture, 200K built-in mass storage, bundled software, They're features that would normally cost you three or four times as much!

But that's only half the story, because the QL is now the heart of a computer system, with a growing library of software...

As you'll see from these pages, 1985 is the year of the quantum leap for software and peripherals. Already there are no less than five QL languages together with special programs for software developers, a world-beating chess game... and much more on the way!

On the hardware side, there's a special QL monitor to make the most of that high-resolution 512 x 256 pixel display. There are memory expansion boards, Winchester disk drives, printers, and low-cost Microdrive cartridges.

In fact, there's so much going on, we'll be running these regular Newsletters just to keep you in touch!

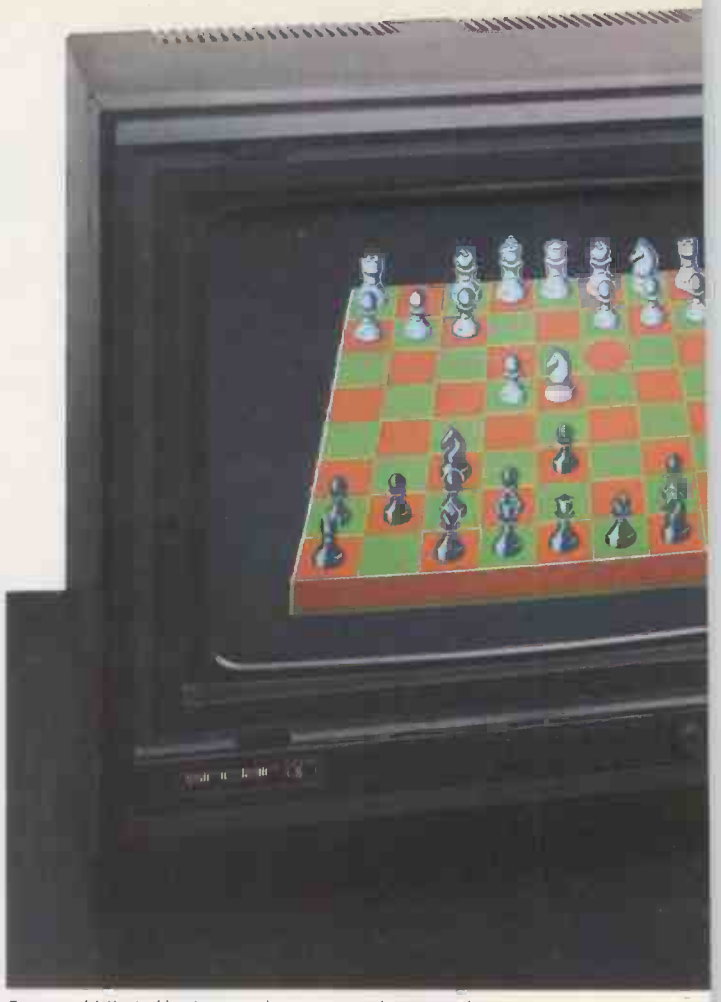
If you already own a QL, the next few pages will give you a taste of the exciting year ahead.

And if you don't . . . take a look at what you're missing. It should be all the persuasion you need!

Now read on...the quantum leap into serious computing starts here.

Nigel Searle

Nigel Searle, Managing Director, Sinclair Research Limited.



From sophisticated business packages to superb animated games... QL software makes the most of the computer's extraordinary specification.

New QL Software

Utilities, languages, games and business packages...with more on the way!

Two things are now certain about QL software. First, there's going to be plenty of it. And second, it's going to set completely new standards for microcomputers...

At the moment, there are well over 100 software programs in development. And the first software releases, shown here, demonstrate how exceptional the best QL software will be.

The QL already has five languages, superb programs for software developers, a top quality accounting package and in QL Chess it has its first game.

QLUB: 10,000 members and growing!

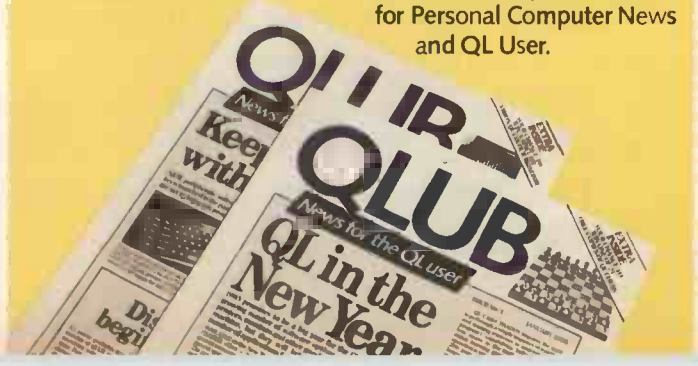
QLUB is the special Users Bureau for Sinclair QL owners. There are now well over 10,000 QLUB members, and membership is growing all the time.

For their annual subscription of £35, QLUB members are enjoying a whole range of information and advisory services, exclusive offers and special discounts.

One of the most important QLUB benefits is the special news magazine, appearing six times a year. The magazine provides a forum for QL owners to exchange views and keep in touch with all the latest developments.

Each issue is packed with updates on QL hardware and software, tips on applying the four QL Programs, and news of how other people are using the QL. QLUB members also receive a range of special discounts, with savings of at least 20% on selected software products.

Current special offers include:
QL Chess for £14.95
QL Toolkit for £19.95
QL Assembler for £31.95
QL Cash Trader for £54.95
Special subscription rates for Personal Computer News and QL User.



The multilingual Sinclair QL

BCPL – a forerunner of C, BCPL has been described as a systems programmer's delight. In the words of QL User, this compiler is a 'brilliant compromise between a high-level language and a low-level systems language'. Whilst not for beginners, this is an essential buy for anyone with a good knowledge of systems programming. Complete with manual.
Available from
Metacomco – £59.95.
Tel: 0272 428781.

LISP – already well-known for its artificial intelligence applications, LISP is a powerful and versatile language. This is a sophisticated implementation of LISP, by one of its leading exponents, Dr Arthur Norman. This package features full QL graphics, and a full manual is supplied.
Available from
Metacomco – £59.95.
Tel: 0272 428781.

Pascal – probably the most popular high-level language of all. Pascal is particularly well-suited to structured programming, sophisticated data manipulation and algorithmic problems. Pascal interpreter complete with 87-page manual.
Available from
Computer One – £39.95.
Tel: 0223 862616.

Forth – this 'new generation' language is proving both popular and easy to learn. The program provides a full implementation of the latest Forth 83 standard with graphics and sound extension.
Available from
Computer One – £29.95.
Tel: 0223 862616.

APL – the compact mathematics-based interpreted language designed for scientists and mathematicians.

APL keyword interpreter complete with manual.
Available from
MicroAPL – £99.95.
Tel: 01-622 0395.

Programmer's packs

QL Assembler – two programs operating in tandem. The first is a full-screen editor for creating and altering program files. The second, a Motorola-format compatible 68000 assembler which converts source files written in M68000 assembly language into machine code files which can run on the QL.

Both assembler and editor are written in machine code and can be multi-tasked with SuperBASIC, so you can switch between editor, assembler and SuperBASIC instantly.
Written by GST Computer Systems – £39.95.*

QL Toolkit – a programmer's toolkit with over 70 programs. and extensions to SuperBASIC. Most are linked to SuperBASIC initially and can then be used from commands or from within a program. Enhancements include printer spooling (print a file while running a SuperBASIC program); improved file access (with full random input/output command); job control (allows management of multi-tasking programs including the ability to display, alter priorities, and delete jobs from the QL); and SuperBASIC screen editor.
Written by Q Jump – £24.95.*

World-beating chess!

QL Chess – fresh from its victory at the World Microcomputer Chess Championship. This program sets a completely new standard for games software.

There's a high resolution display, animated 3-D graphics, and 28 levels of play from novice to champion. Features include an openings book of nearly 4000 moves, HINT and TAKEBACK functions that help you learn from your mistakes, and the option to play a human opponent or the computer.
Written by Psion – £19.95.*

Software at work

QL Touch 'n' Go – a unique approach to learning touch-typing skills. The program is designed to give you mastery of the standard QWERTY keyboard in just 24 hours. With practice, you should soon reach 40 words per minute, with over 95% accuracy.
Written by Harcourt – £24.95.*

QL Cash Trader – a unique computerised book-keeping system for small businesses. The program provides a complete course in the principles of accountancy, and goes on to become an essential aid in the day-to-day running of a business. Complete with comprehensive manual.
Written by Accountancy Software of Torquay – £69.95.*

***This title is available from Sinclair Research on 0276 686100, and selected Sinclair stockists nationwide.**

Psion trouble-shooting service

All QLUB members can obtain special assistance from Psion on using the QL Quill, Abacus, Archive and Easel programs supplied with the computer. Psion will normally answer any queries within 48 hours.

Free updates

QLUB members will also receive one free update of each of the four QL Programs – incorporating many new developments.

New QL Hardware

An industry is born

From the moment of its launch, the revolutionary QL attracted massive interest from all quarters.

In one area, the interest quickly turned to action, as high-tech hardware manufacturers realised the immense potential of the QL for vast expansion, for system development and for widespread networking. Already the list of peripherals for the QL is very exciting – and lengthening by the day!

Here, we've covered many of the latest, most important developments.

As more appear, be sure to keep in touch with QL News!

The dedicated Sinclair Vision QL monitor

Once you see the incredible graphics capabilities of the QL you may decide an ordinary TV just can't do them justice.

If that's the case, a high-resolution monitor is needed. (And if you're creating presentation-quality charts, for example, it's quite essential.)

The new Vision QL monitor is specially designed for the computer by Kaga Electronics, with full support from Sinclair Research.

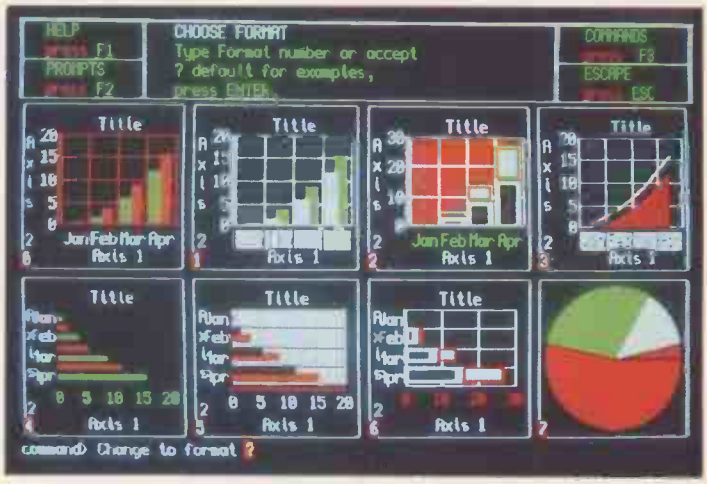
So it exploits the QL's maximum 512 x 256 pixel resolution to the full, with a pin-sharp 85 column display.

It's also specially styled to suit the QL – in looks, and in use. There's a 12" non-glare tube, and etched screen to diffuse reflections.

So the display is bright, sharp, *much* easier to look at . . . and invaluable for those late-night programming sessions!

And like the QL, the Vision monitor is designed with space in mind: it has a compact footprint of just 12½" by 15" – no more than a typical portable typewriter.

It's available from MBS Data Efficiency on 0442 60155 and selected Sinclair stockists.



● Circle No. 134

Microdrive cartridges. Another Sinclair first!

Microdrive cartridges are the QL's own unique storage media. Each stores up to 100K of information, on a cartridge no bigger than a matchbox!

Access is within seconds. And in tests, Microdrive cartridges have made over 50,000 passes without loss of data.

Over 500,000 cartridges are now being used throughout Britain. And QL Microdrives themselves are standard equipment on the new ICL One Per Desk.

Sinclair Microdrive cartridges – up to 100K of programs and data on a medium so compact you can pop it into your pocket.

Powerful hard-disk system

For the QL business user, the new Firefly QL Winchester disk will boost the QL's power in one huge leap.

Designed by Quest, it uses CP/M and offers all the benefits of Winchester technology: fast access, reliability, compact size and quiet operation.

With 7.5 Mb storage, the Quest Firefly is ideal for large databases such as stock or customer lists. And at under £1,200, it represents exceptional value for money.

The Firefly will be available very shortly from Quest on 04215 66488.

Winchester hard disk drives supplement your QL's built-in mass storage.

Interface options

The QL comes complete with two built-in RS-232C interfaces.

In addition, interfaces for Centronics printers are widely available from manufacturers such as CST, Miracle Systems and Sigma Research . . . with prices from only £35.

And that's just the beginning. For attaching scientific and laboratory instruments to the QL, CST even offer an IEEE-488 interface, which can handle up to 16 connected devices simultaneously!

A Centronics interface slips discreetly into place.

Expansion boards for up to 4 times more memory!

Also from Quest, a simple and inexpensive way to expand the QL's RAM: with memory expansion boards.

These compact units connect to the standard QL expansion port, using the QL's internal power source or, for larger boards, an external power source.

The units range from 64K and 128K RAM boards to massively powerful 256K and 512K RAM boards, so there's something for every user.

Compact expansion boards.

Prices start at £117, and the 512K board is a very cost-effective investment at just £587.

With affordable memory like this, the QL is more than a match for any other micro under £2,000!

Where to find the QL. The Sinclair QL is available at selected branches of Dixons, W H Smith, John Lewis Partnership, Currys, Greens in Debenhams and Ultimate, and larger branches of Boots, John Menzies and specialist computer stores nationwide.

● Circle No. 135

The spec behind the spectacle

CPU – Central Processing Unit
Fast, powerful Motorola 68008 chip. A second processor, an Intel 8049, controls the keyboard, generates the sound, and acts as an RS-232C receiver.

RAM
128K. Now expandable to 640K.

ROM
48K.

Operating system
Qdos – revolutionary single-user, multi-tasking, windowing operating system.

Storage
Twin built-in QL Microdrives. Up to 100K storage each – transfer rate, up to 15K per second.

Keyboard
Full moving 65-key QWERTY, five function keys, four cursor keys.

Language
Sinclair structured SuperBASIC.

Application software
QL Quill – word processor
QL Abacus – spreadsheet
QL Easel – graphics
QL Archive – database
All four packages supplied with the QL.

Interfaces
Two serial RS-232C interfaces, Microdrive expansion port (up to 6 may be added), ROM cartridge port, local area network, 2 joystick ports, RGB monitor and TV output.

Text screen
Various modes – up to 85 columns by 25 rows on monitor. On TV, up to 60 columns.

Graphics resolution
512 x 256 pixels (four colour), 256 x 256 pixels (eight colour).

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Having reached the ripe old age of seven — well nearly — we are due for a facelift . . . .
And the changes won't just be cosmetic. We are planning a new series of features for the next financial year which will make the magazine even more valuable to the serious user. Naturally there is a price to be paid for all this, but in your case it's just 10p a month more — a measly £1 will still get you an issue of *Practical Computing*.

>WORD PROCESSING

In the April issue special section *Practical Computing* takes its annual look at the field of word processing. We will be surveying the latest developments in the field, from the cheapest to the most sophisticated systems.

>REVIEWS

Two of the most important programs in all of microcomputing — WordStar and dBase II — have recently appeared in new guises. But it is by no means certain that the new ones are going to replace the old. We'll be taking a first look at the new WordStar 2000 and reconsidering dBase II to find out. Robert Piper will also be reviewing an important new IBMulator, the Wyse PC, from the famous terminal manufacturer.

>AND MUCH MORE..

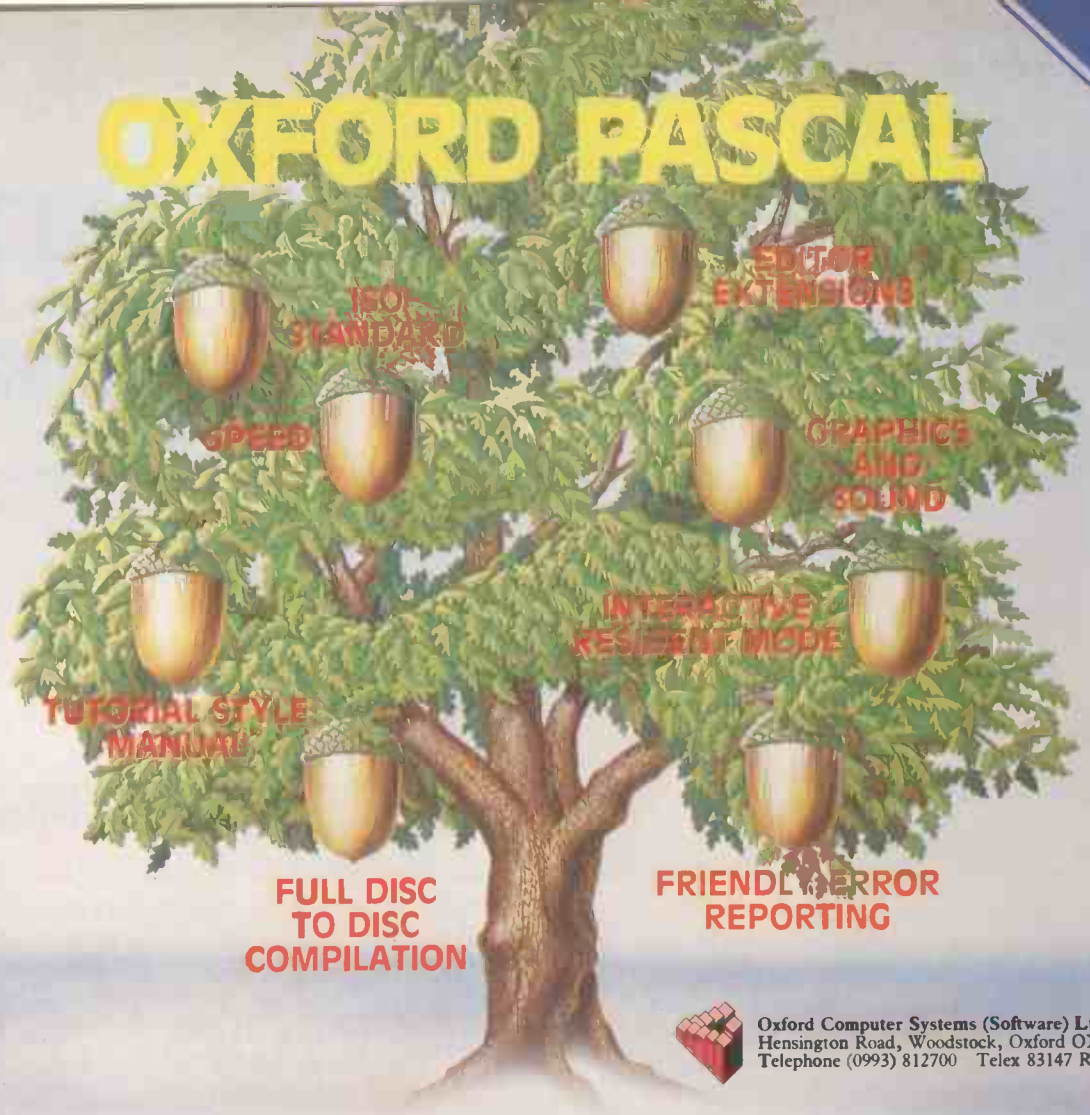
In next month's programming section we'll be looking at multi-tasking on the BBC Micro, while Roger Cullis continues his step-by-step analysis of the BBC's ROM. Our regular CP/M spot will provide an improved screen listing function.
Plus there will be all the latest news and regular columns to keep you in touch with what's really going on in the wide world of microcomputing.

Don't miss the April issue of

Practical Computing

On sale at WH Smith and all good newsagents after March 14.

Contents may vary due to circumstances beyond our control and are subject to change without notice.



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Telephone (0993) 812700 Telex 83147 Ref. OCSL

Compilers like these don't grow on trees

Oxford Pascal is Fast

Oxford Pascal compiles down to FAST COMPACT P-code, giving you the real speed and power of Pascal, together with the ability to compile very large programs.

Oxford Pascal is Standard

Oxford Pascal is a full extended implementation of Standard ISO Pascal. This means that you can compile any Pascal program (subject to size), written on any computer, anywhere.

Oxford Pascal is Compact

Because it compiles into P-code, Oxford Pascal reduces programs into the most compact form possible. In fact it allows you to pack more code into your BEEB than any other language, and should your programs become too large, you can still use the CHAIN command to overlay limitless additional programs without losing data.

Graphics & Sound Extensions

In addition to the entire Pascal language, Oxford Pascal features a whole range of Graphics (all modes) and sound extensions designed to make maximum use of the BBC Computer. Oxford Pascal also provides numerous extensions such as hexadecimal arithmetic and bit manipulation instructions.

Oxford Pascal in Education

In Education, Oxford Pascal is fast becoming a *de facto* standard. It is already the most popular Pascal on the Commodore 64, and will soon be released for the Spectrum and the Amstrad. In fact, Oxford Pascal will soon be available for 90% of the computers installed in the U.K., and is already available in German, French, Swedish, and American versions. Students and teachers alike find that it makes sense to use a standard implementation of Pascal across the whole range of educational micros. Call us for details of our generous educational discounts.

Manual

Both these compilers come with a manual which has been carefully designed, not only as a quick reference guide, but also as a full tutorial for those new to Pascal.

Resident and Disc Compiler

Oxford Pascal comes in two forms:

For Tape Users...Oxford Resident Pascal. A compiler located largely in ROM which is available at any time. Programs can be written and compiled on the spot without disc or tape access, and compilation is fast enough to make using the compiler much like using the BASIC interpreter. Thus, learning Pascal is a simple interactive process. Some 15K of memory is available for user programs, the remainder being reserved for compiled object code.

For Disc Users...Oxford Disc Pascal offers all the above PLUS...a full disc compiler which is capable of using the WHOLE memory for Pascal object code, it is supplied with a powerful LINKER, allowing you to break large programming tasks down into separately compilable, easily-manageable files.

Friendly Error Messages

Many compilers produce little more than an error and line number to help correct mistakes in Pascal programs. Oxford Pascal however, gives you one of 49 friendly and informative error messages. Messages which not only indicate the reason for an error, but also print out the line in question with a pointer to the exact position where the error was detected.
Run-time errors are reported using line-numbers from the original source-program, with a full explanation of how the error occurred.

Powerful Editor

With Oxford Pascal there is no need for you to learn how to use a new Editor. Pascal programs can be entered in exactly the same way as BASIC programs, without the need to learn any new commands. When you are used to using Pascal, you will find our extensions to the Standard Editor even more useful. What is more, Oxford Pascal allows you to mix BASIC and Pascal together, in much the same way that you can mix BASIC and assembler. In fact you can, if required, mix all three together...BASIC, Pascal and assembler...in one program.

Stand Alone Code

Unlike other compilers, Oxford Disc Pascal allows you to compile on the BBC and then relocate your program so that it will run on the BBC and on the Electron. The relocated program will run without a Pascal ROM and can be loaded and run from tape or disc just like any other program.

This means that you can distribute or sell your software freely and without the need for ROMs, to run either of the above machines.

Price/availability matrix

	BBC 'B'	ELECTRON	C64	SPECTRUM
DISC	£49.95	Not yet!	£49.95	Available April 1st 1985
CASSETTE	£39.95	£59.95 inc. Cartridge	£22.95	

All prices are inclusive of VAT
Please add £2.00 for postage and packing.

Oxford Compilers — The Future

During the next year, we at Oxford will be releasing a series of language implementations such as C, and Modular 2, for the BBC, and other popular micros.

These compilers are being built, using the most modern techniques in automated compiler construction, and will bring to the micro-user, a level of robustness and efficiency, only now becoming available to mini and mainframe users.

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the Compiler Compilers.

Oxford Pascal Order form. Please make cheques payable to OCSS Ltd.
Please rush me my copy of Oxford Pascal. I enclose £ ..... including £2 postage and packing
My computer is BBC 'B'☐ ELECTRON☐ C64☐ (Please tick as appropriate)
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Extra Speed Unlike many other PC's, the A-200 has the 8086 processor and uses a 16-bit data bus. So it's quicker thinking.

Extra Memory The A-200 has a basic memory of 256 K, expandable to 512 K, plus twin 360 K disk drives. So it's harder working.

Extra Expandability The A-200 has built-in Centronics and RS 232C interfaces, leaving 4 expansion slots for optional extras such as Winchester disks up to 140 MB and local area networking. So it grows with your business.

Extra Desk space The A-200 has a tilt and swivel, high resolution screen and an IBM compatible keyboard layout. It's not only quieter and better looking than most PC's, but smaller and lighter too. So it won't cramp your style.

Extra Quality Canon's unrivalled expertise in optics and micro-electronics, plus a world-wide reputation for excellence in business machines, is the ultimate guarantee of quality in the A-200. So you know it won't let you down.

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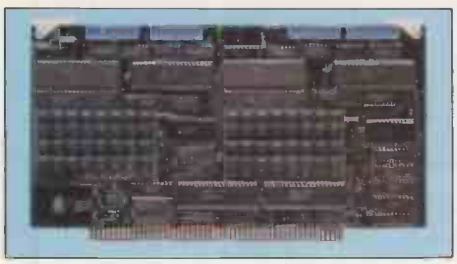
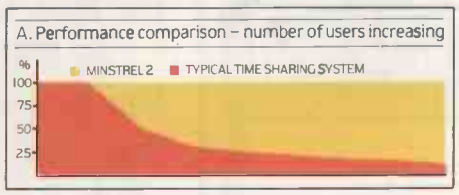
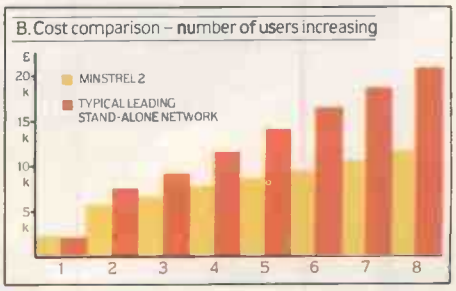


HM Systems HTS 86. 16 bit performance at 8 bit prices.



Costs rise and performance suffers when a number of terminals share a common processor. Graph B shows a network of leading stand-alone computers when compared with Minstrel 2. Graph A shows the effect on performance of timesharing compared with Minstrel 2.



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● Circle No. 155

by Ray Coles

Back to Basics

Intel's new CPU chip with built-in Basic joins the rest of the family.

I SPEND so much time writing about the technological jam promised for tomorrow, about 256K memory chips, 32-bit microprocessors and virtual memory, for example, that it is sometimes easy to forget that here and now for most people still comprises an eight-bit Z-80 based machine running CP/M and Microsoft Basic. Some readers may even feel that all this talk of Unix, 120Mbyte Winchesters and high-speed arithmetic co-processors is the technological equivalent of having sand kicked in your face.

So this month I take great pleasure in introducing an advanced new product which is so old-fashioned that even owners of ZX-80s will be able to relate to it without flinching. It is a chip which relies for its success on eight-bit technology and the Basic language, and to which 2K of RAM is usually more than enough: in short, an immediate tonic for all readers who are suffering from a bad dose of future shock.

Strange

One of the strangest features of this ancient new device, to the uninitiated at least, is the manufacturer. It is not made, as you might expect, by the Luton Semiconductor Co-operative, but by the mighty state-of-the-art Intel Corporation. No, Intel has not abandoned its 32-bit plans and switched to alternative technology like wood-burning fires, windmills and eight-bit microprocessors. Its new 8052AH-Basic microprocessor is very much part of tomorrow's world, it just looks old-fashioned.

The new device is actually a member of Intel's growing family of single-chip microprocessors, which all squeeze processor, RAM, ROM, and I/O into single packages for use in embedded controller-type applications. The main difference with the 8052AH-Basic chip is that it has a built-in 8K ROM-based Basic interpreter which allows control programs to be written directly in a high-level language instead of the assembly code used by all other members of the Intel family.

Intel is not the first to introduce single-chip microprocessors with an on-board Basic interpreter. Zilog was first with its Z-8671 — one of the Z-8 family — closely followed by National with its 8073. Unfortunately both of these earlier devices had only a limited on-chip ROM area available, and so only a Tiny Basic was possible in the 2K Z-8 and the 2.5K 8073. Tiny Basics can be useful for simple control tasks, but anyone used to the facilities of the 8K Basics to be found on even the simplest personal computers would soon be put off. This is because of their restriction to integer arithmetic in the range −32768 to +32767, and their lack of any mathematical functions or string handling.

The 8052AH-Basic is just a pre-programmed version of the 8052AH, which itself has one of the largest ROM arrays available, and so a full 8K Basic complete with floating-point arithmetic, string handling and transcendental functions was possible. However, despite the power of the Basic, the Intel chip is really intended for use in controller-type applications, not personal computers. As a result the Basic has many special control features not normally found on those machines.

To counter the usual criticisms that Basic is a messy, unstructured language, Intel has included the highly desirable Do-While and Do-Until statements in addition to the standard For-Next and If-Then-Else. Another major criticism of interpreted Basic in control applications is that it is very slow and cannot keep pace with many real-time control tasks. To overcome this limitation Intel has designed a fast, token-based interpreter and included a Call statement for fast access to assembly language subroutines. Combined with a 12MHz clock rate these features ensure that the 8052AH-Basic can keep up with most applications.

Clone

A complete system can be built by adding an eight-bit latch, a byte-wide static RAM chip, a crystal and a few discrete components to the 8052 itself. However, an RS-232 terminal of some kind is necessary to enter and debug programs. Using this basic three-chip computer for everyday tasks such as a heating controller or a burglar alarm is simply a matter of hooking up with appropriate I/O connections, plugging in a terminal — most home computers would serve adequately — and then entering and checking the required program. Once the system operates satisfactorily the terminal can be unplugged and, hey presto, you have cloned your home computer!

The standard 8052AH provides up to four eight-bit I/O ports. On the Basic version the two eight-bit ports, P0.0 to P0.7 and P2.0 to P2.7, are used together to form a multiplexed data/address bus capable of addressing up to 64K of external memory or other peripheral chips. Port 3 is dedicated to functions such as console serial I/O and interrupts, leaving only port 1 available for custom I/O functions. If lots of extra I/O lines are required then external parallel peripheral interfaces such as the Intel 8255 can be used. Also available on the 8052AH and on the Basic version are three 16-bit timer/counters, a serial Usart interface used for the console device on the Basic device, and 256 bytes of RAM.

Volatile RAM

The simple three-chip system had to rely on external and volatile RAM to hold programs, and this is obviously undesirable for the more permanent applications where programs held in ROM or some other form of non-volatile memory would be preferable. To cater for this, Intel has built in a software-controlled PROM programmer facility which is capable of programming most varieties of EPROM and EEPROM device.

To use the programmer, you plug an EPROM into a socket mapped on to location 8000H and enter a program into RAM beginning at location 0200H. You then type Prog or FProg to specify whether an older 50ms. device, such as the 2716 or 2732, or one of the newer 1ms. devices, such as the 27128, is installed. The rest of the process is automatic, the RAM program being copied into the EPROM at the appropriate location ready for execution.

Up to 255 different programs can be copied into a single EPROM provided there is enough room, and each time the Prog command is used the system returns a new file number. EPROM programs can be executed by typing

ROM <file number>

which locates the correct program, followed by the Run command. A transfer command XFer is also available to copy EPROM programs back into RAM for editing when required. A complete self-contained EPROM system of this type could be built on a small pcb and used for a wide variety of dedicated control applications.

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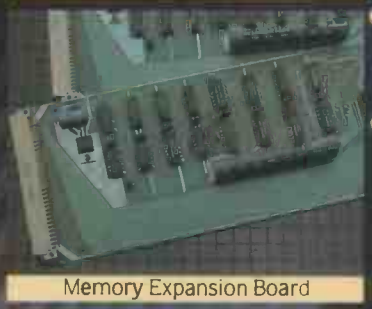
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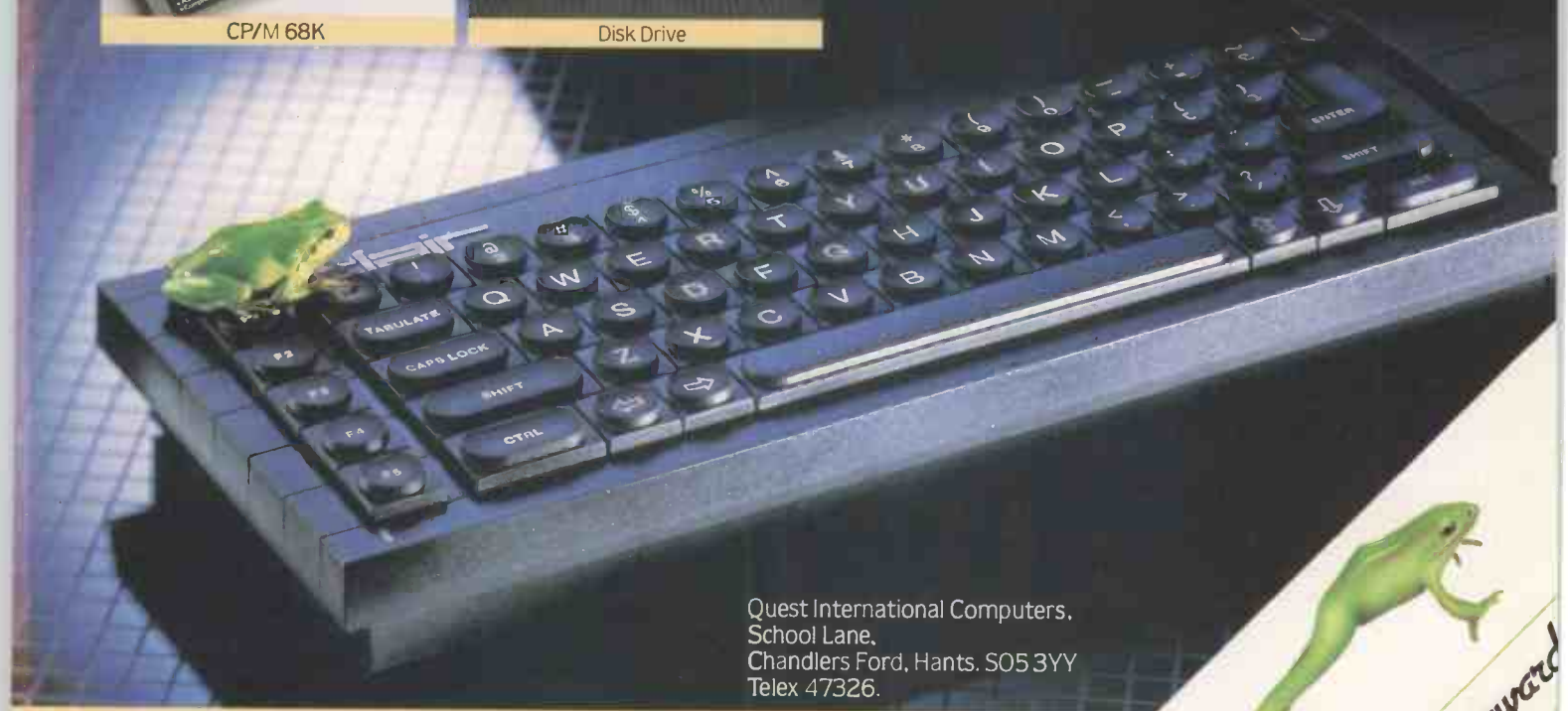

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by Ben Knox

International packet deal

BT's Packet Switch Stream can cut the cost of long-distance communication.

PERHAPS the most exciting aspect of computer communications is the possibility of linking up to systems in other countries. A modem meeting the correct standards is all that is needed, but this method is expensive and transmission quality is low.

Both these problems are overcome by the use of a digital network to relay transmissions. British Telecom provides a network known as Packet Switch Stream, PSS, and there are similar systems in many other countries. Each PSS user has a PSS number, and to link to users abroad you need only add a few numbers, the international code, to its number. The majority of computers linked to PSS are commercial, such as The Source, Compuserve, People Link, Dialog and so on.

A typical call to one of these systems, if dialled direct, would cost about £36 per hour, not including the connect time charges of the system being called. A call to the same system on PSS would cost only £6 per hour.

Cheaper

PSS is so much cheaper because it uses special techniques to send data. When you ring someone on your telephone, you use one whole line for the duration of the call. PSS splits up all data being transferred between two computers into blocks of 64 characters which have information about their source and destination added. The blocks are then sent one by one down the line, intermingled with blocks from other users. The block assembling, disassembling and intermingled transmission is all handled by the PSS exchange and is carried out so quickly that it is almost totally invisible to the user.

A typical session on PSS goes as follows:

- Dial the number of local PSS exchange and switch modem on-line.
- Wait five seconds to allow the carrier signals to stabilise.
- Press Return twice, followed by A2 and Return to initialise the PSS exchange. The PSS exchange then sends its identification code.
- Type in your 10-character PSS ID, called your Network User Identity or NUI, preceded by the letter N. PSS now replies

ADD?

- Type in the address of the computer system to which you want to connect: for example, Compuserve is on A93132 and People Link is on A9311031200070. The second character is always 9 for sytems outside Britain, and 2 for systems in Britain; the game Multi User Dungeon is on A2206411411.
- Now follow the log-on instruction for the system you have called.

It costs £25 to join PSS, and on-line charges are £6 per hour to the U.S. plus £3.50 for every 64K sent or received. Inland charges are £1 per hour and £0.25 per 64K.

Further details are available from PSS Customer Service Group, G07 Lutyens House, 1-6 Finsbury Circus, London EC2M 7LY. Telephone: 01-920 0661.

1,200/75 baud BBSs

Name	Number	Password	User ID
Aberdeen Itec Abertel	(0224) 641585		
Club 403 on Vital	(0203) 474645		403403403
C-View	(0702) 546373		
Estel	(0279) 441188		
Hackney Bulletin Board	01-985 3322	Public	
Northampton Bulletin Board Service	(0604) 20441		
Optel	01-794 0655		
System Aid	01-571 0026	Public	
Viewdata	(0752) 661866		

Bulletin board update

WHAT IS probably the first specialised bulletin board in Britain has recently opened. Clinical Notes On Line is dedicated to holding news and messages of interest to members of the medical profession. It is described by its Sysop Mike Buckingham as a trailer for a full commercial system. CNOL is available 24 hours a day at 300 baud on (0524) 60399.

The British Apple Systems User Group has opened two Bulletin Boards. BABBS1, British Apple Bulletin Board, is on (0394) 276306 and is run by Tony Game. BABBS2 is on (0268) 776956 and is run by Mike Jones. Both systems are on-line for 24 hours per day and work at 300 baud. They have a variety of special interest groups, some only of interest to Apple users. Among those of more general interest are groups covering Adventure, CP/M, Graffiti and Jokes.

The original Basug BBS has now become a commercial system. Pip BBS is run by Quentin Reidford and is on (0742) 667983. It runs for 24 hours per day at 300 baud and still has a number of files available which would be of interest to Apple users.

Metro BBS, run by Paul Beaumont, works 24 hours per day at 1,200/75 baud. It currently has some on-line adventure games, an art gallery and an adventure help section. Metro is on 01-341 7840. Another new BBS, OSI/Technical, is run by Frank Leonhardt 24 hours per day on ring-back at 300 baud. The system runs on a micro made by the now defunct Ohio Scientific and the homebrew software is constantly under development. If you have any problems while using the system please be patient, and leave a message to the Sysop. OSI BBS is on 01-429 3047.

If you have discovered a new bulletin board or information system which you think would interest other readers, write to me with the details either here at *Practical Computing*, or via Electronic Mail on TBBS London, Telecom Gold 84:TCC051, or Prestel Mailbox 919993567. *Practical Computing* is on Telecom Gold 81:JET727.

Things are looking up

Two more ways to speed up the process of searching a table.

IF YOU are a regular reader of this column, by now you should be an expert in the techniques of table searching. Over the months, we have perused all the popular algorithms for table look-up, ranging from the classic binary search to the use of tree structures. This month we are going to continue our Cook's tour by taking a look at two further methods.

The first allows you to search a table before the searched-for value is fully known. It is often used where an operator is entering a value from the keyboard. The program can do a lot of its work during the short delays that occur between keystrokes, so by the time the final character has been entered, the required item has nearly been found.

Suppose you are developing software for a travel information service and you have a database of train times and fares to every railway station in the U.K. You want the user to be able to type a place name, after which the program will respond with a screenful of helpful data.

Ideally, the searching should proceed as fast as the user can type. As an added bonus, you can arrange to stop the search the moment the user has entered as many characters as are needed to make the name unique. For example, Ipswich, Overton and Uttoxeter are among the dozen or so British railway stations that can be completely identified by their first two letters. By contrast, Chesterfield needs at least five letters to distinguish it from Chesham, Chessington etc., and a further three to avoid confusion with Chester.

The basic technique is fairly straightforward. You need a list in RAM of all the station names in alphabetical order. The timetable data will be held on disc. As each letter is typed, you move a pointer further up the table so that it always points to the first entry which matches the portion of the target value entered so far. You then look at the following entry. If this is equal to the target you wait for more characters. Otherwise you know that the value pointed at is the required one and you process it accordingly.

First pass

Unfortunately, it takes a disproportionate amount of time for the first pass of this loop compared with subsequent one. This is because there are some 2,600 stations in the U.K. so an average of about 1,300 comparisons would be needed to locate the first letter. Even on a fast micro like the Olivetti M-24, this takes about five seconds in interpreted Basic, and most people type a lot faster.

To get round this, you can set up a second RAM table holding just 26 entries

Listing 1.

```
1200 'Skeleton of a program to demonstrate a method of searching a table
     at the same time as the target key is being built.
1210 'BIGTABLE$() is the table to be searched. Each entry is a key, of
     variable length, ending with a terminator char. (such as CR). Keys
     are in alphabetical order. The final entry contains all Zs.
1220 'INDEXTABLE(26) contains pointers to entries in BIGTABLE$(). Each
     value points to the first BIGTABLE$() entry that starts with one
     of the letters, A-Z.
1230  DEF FNFIRSTPART$(P,T$)=LEFT$(BIGTABLE$(P),LEN(T$))
                           'This function returns a string consisting
                            of the first few chars. of the Pth entry in
                            BIGTABLE$(), of length equal to that of T$
1240 'Some other definitions:
1250      NO=0: YES=NOT NO     'Note all numeric variables are integers
1260 '
1300 'Now begin the processing
1310 WHILE YES                 'Loop indefinately
1320      OK=NO:
          WHILE NOT OK:
               ... get next char. in THISCHAR$ ...
               ... discard it if not A-Z       ...
1330           POINTER=INDEXTABLE(ASC(THISCHAR$)-64))
                           'Point to first entry in main table that
                            starts with this letter
1340           IF POINTER>0 THEN
                    PRINT THISCHAR$; : TARGET$=THISCHAR$: OK=YES
                           'Echo char; TARGET will contain the key
                            being built
1350      WEND             'If no entry starting with this letter,
                            start again
1360      WHILE OK
1370           WHILE TARGET$<FNFIRSTPART$(POINTER,TARGET$):
                    POINTER=POINTER+1:
               WEND          'Advance pointer past all entries that come
```

by Mike Lewis

corresponding to the letters of the alphabet. Each entry in the smaller array is a pointer to the first name in the main table that starts with the corresponding letter. It is like the thumb index that you sometimes see cut out of the edge of a large dictionary, and it enables you to go straight to the relevant section of the list. Although this arrangement will speed up the first iteration of the search, there is little point in extending it to subsequent characters since on average you only need 50 comparisons to locate the second letter, and just two for the third.

Another small problem is that the user must have some way of signalling when an entry has been completed. In most cases, this will not be needed because a unique match will be found before the name is completed. But you cannot always rely on this; if someone wants to go to Chester, how does the program know not to wait for the f in Chesterfield?

You need to define a terminating character — Carriage-Return is an obvious choice — and test for it each time a keystroke is processed. You can simplify this by storing the terminator at the end of each table entry, thus avoiding the need to test for it and to take special action when it is detected. By definition, a name plus the terminator will never be a sub-string of the following name, so the Chester/Chesterfield conflict will not arise.

By the same token, you can define a further character string to terminate the entire table. This will save you from having to test for table overflow each time you advance the pointer. A string of Zs will suffice.

To bring the whole thing together, listing 1 shows a skeleton program to illustrate these techniques. To keep it simple, details not strictly relevant to the table searching, such as accessing the database and displaying the results, are omitted. As far as trapping keystrokes is concerned, you can use a method that does not cause the program to suspend while it is waiting for the user. This can be achieved by Inkey$ or Constat% in some Basics. For more about this, see "Two at a time", *Practical Computing*, April 1984.

Refinement

Some further refinements to the skeleton program are necessary. If the program fails to find a match it ignores the whole of the user's entry. In a real system, something more elegant would be needed. You would also require some form of error correction to allow the operator to backspace over a typing mistake, with the program adjusting the pointer as necessary. Finally, there should be a mechanism for ending the entire process when it is time to go home, rather than looping indefinitely.

The second table look-up method is a variation of the binary search, known as interpolation searching. Many books on programming wrongly describe the binary search by analogy with a telephone directory. To look up a name in the phone book, they say, you open it in the middle, decide whether the name falls before or after the open page, then open that half of the book in the middle, and so on until the name is found.

This might be an accurate description of a binary search, but it bears no resemblance to the way you use a phone book. In real life, you start by making a rough estimate of where in the book the name is likely to appear. You would expect to find a name starting in D roughly one-sixth of the way into the book, while a name beginning with T would be about three-quarters of the way through. Having opened the book according to your initial guess, you might well repeat the process for a second try. If you were looking for D but found E, you would probably go back a distance of about one-fifth of the portion of the book before the open page, and so on.

Such is the principle of the interpolation search. With a conventional binary search, the program works by considering progressively smaller sub-lists, each sub-list being one-half of the previous one. With interpolation searching, the program estimates the size of each sub-list according to the actual value being sought. It assumes that the values are evenly distributed and estimates the likely position of the target value by reference to the two boundary elements. This is shown in listing 2. The routine is identical to a normal binary search except for the calculation of the variable Current in line 2020. With a binary search, this pointer would be half the sum of Low and High.

Given a reasonably even spread of values, using interpolation will nearly always reduce the number of iterations needed to conduct the search. Whether or not it is faster will depend on the relative speeds of calculation and comparison in your system.

```
                              before the target, as entered so far
1380      IF TARGET$=FNFIRSTPART$(POINTER,TARGET$) THEN
               IF TARGET$<>FNFIRSTPART$(POINTER+1,TARGET$) THEN
                    ... BIGTABLE$(POINTER) is ...
                    ... the required entry    ...
               ELSE
                    PRINT THISCHAR$; : TARGET$=TARGET$+THISCHAR$
                    ... then get next char; discard it if not ...
                    ... A-Z or terminating chararacter        ...
          ELSE
               OK=NO: ... execute procedure for rejecting the key ...
1390                          'If current entry is the last one that matches,
                               this is a hit; if no further matches exist,
                               echo char and get next; if no matching
                               entries, reject entire key
1400      WEND
1410 WEND
```

Listing 2.

```
2000 'To find ITEM in ARRAY() of SIZE elements, using binary search with
        interpolation. (All variables are defined as integers.)
2010 LOW=0: HIGH=SIZE
2020 WHILE LOW<HIGH:
       CURRENT=LOW+INT((ITEM-ARRAY(LOW))*(HIGH-LOW)/(ARRAY(HIGH)-ARRAY(LOW)))
2030 IF ITEM<ARRAY(CURRENT) THEN
       HIGH=CURRENT-1
     ELSE
       IF ITEM>ARRAY(CURRENT) THEN
            LOW=CURRENT+1
       ELSE
            .... item found ...
2040 WEND
2050 ... item not found ...
```

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ASK PC

Q Can the Advance 86A be connected either to the disc drives on an Apricot or to a 5.25in. drive?

P J Newcombe

A It is theoretically possible to hook up the discs from any computer on to any other, but this almost always requires special hardware to be built, making the project expensive. Alternatively you can often loosely couple two machine by wiring together the RS-232 ports on both machines. The Sirius has an RS-232 but the Advance 86A does not, so this technique cannot be used. Somewhat harder, but still feasible, you could connect the Advance 86A parallel port to the Sirius parallel port.

To connect your own 5.25in. drive to the 86 you need the following hardware: an extra power supply, a disc controller board, the drive itself and a cable to connect to the motherboard on the 86. In addition you need MS-DOS software to make it all work. Not a job I would start!

Q My problem is that I have recently bought the latest WordStar version 3.3. The installation program with this version is very much easier to use than earlier versions, but they have removed the patching facility which allowed you to alter specific bytes in the earlier versions. I would still like to be able to do this.

D C J B Bookless

A The Install program with versions of WordStar up to 3.0 offers the user in turn a choice of terminals, printers, communication protocols and drivers. Merely by saying that modifications are not complete you are then given easy access to a patcher routine which you may use to alter any other areas in the program. WordStar 3.3 has a much improved installation program called WInstall, which is easier to understand and more straightforward. It allows you to choose the terminal and the printer, and you may set a number of WordStar features, such as the default help level, page length or right margin. Finally it incorporates some features concerning the operating system. It does not allow direct access to the patcher subroutine, but it seemed improbable that Micropro would really throw away a useful feature like the patcher subroutine, so we explored further.

A special unpublished command will allow you to access the patching subroutine. Run the WInstall program as usual. When the menu appears type + to go to the patcher subroutine, and you can then modify bytes in the user area in much the same way as was possible with earlier versions of WordStar.

So far as we know the mnemonics of WordStar symbols used are the same as in earlier versions, and you may read and display the contents of any byte by typing a : followed by the name of the symbol. So :SCRLSZ, for example, will display the hex value corresponding to the number of columns that WordStar moves the screen during horizontal scrolling, when editing long lines. You could either leave this unchanged, by pressing Return, or change the value by typing the equivalent hex value.

Other bytes may be examined or changed in the same way. It is easier to use the WordStar menu than the patcher if the features you require are in the menu, but by using the patcher you can alter other features, including the proportional-spacing routines which are present in WordStar but not supported by Micropro.

WordStar on an Apple II

Q I have an Apple IIe with dual disc drives, an 80-column extension card, a Z-80 card and CP/M, and an Ensign 1650 printer. My copy of WordStar has been configured for a Diablo printer, and it seems to work. Unfortunately when I print a document, the second and fourth lines appear with the letters in the wrong order:

Twinkle, twinkle, little star,
;era uoy erehw rednow I woH
Up above the world so high,
.yks eht ni dnomaid a ekiL

Please can you explain what is wrong?

B Wilbraham

A The inverted order of the letters on the second and fourth rows is easy to understand. Your copy of WordStar was configured for a Diablo printer, and the installing procedure altered WordStar itself so that it sent the appropriate control code to the printer to make it do bi-directional printing. This avoids wasting time for the print head to fly back, but WordStar must transmit the characters for the second line in the reverse order.

I suggest that you try using a dot command at the beginning of your data file to switch bi-directional printing off: put .BP 0 starting with the dot in column 1 on the first line of your data file. I expect that this will cure your problem, but you may encounter other snags with WordStar configured for the wrong printer. Try it and see.

The best and permanent solution is to run the Install program to alter WordStar to drive a different printer. If your printer is not on the menu of printers you can install any printer to run as a Teletype, with no special features. After referring to the printer manual you may be able to install some of the special features as well.

Q Having recently retired it has occured to me that a home computer might be of value as an adjunct to other interests. I have looked at various machines and read reviews and buyers' guides, but none of them makes a reference to using the machine for actual computation. The problems I have in mind are calculation using complex numbers, matrix manipulation, linear regression, curve fitting, smoothing and interpolation, reduction of statistical data, and the calculation of statistics.

P G Redgment

A Most home computers come complete with some form of the Basic language though they vary significantly in both syntax and capabilities. We do not know of any version of Basic running on a micro that has adequate matrix manipulation statements built in. To implement matrix functions in Basic on a micro you have to write a set of subroutines for addition, subtraction, multiplication and inverse. Great care must be taken with the inverse subroutine to preserve numerical accuracy or the elements in the resultant matrix may be left with few, if any, significant figures. It would seem wise to use double precision: this means you need more than six-figure accuracy, and usually means 12 or more figures. The BBC carries nine figures, CBasic carries 12 and Microsoft Basic double precision carries 16 figures.

To use complex numbers you will have to use a pair of variables to represent the real and imaginary parts of a quantity. You will then need to write for yourself either subroutines or user-defined functions to perform complex addition, subraction, multiplication and inversion. If you need any other functions such as complex sine or complex cosine then you will also need to write subroutines for these too, based on the real Sin and real Cos functions provided.

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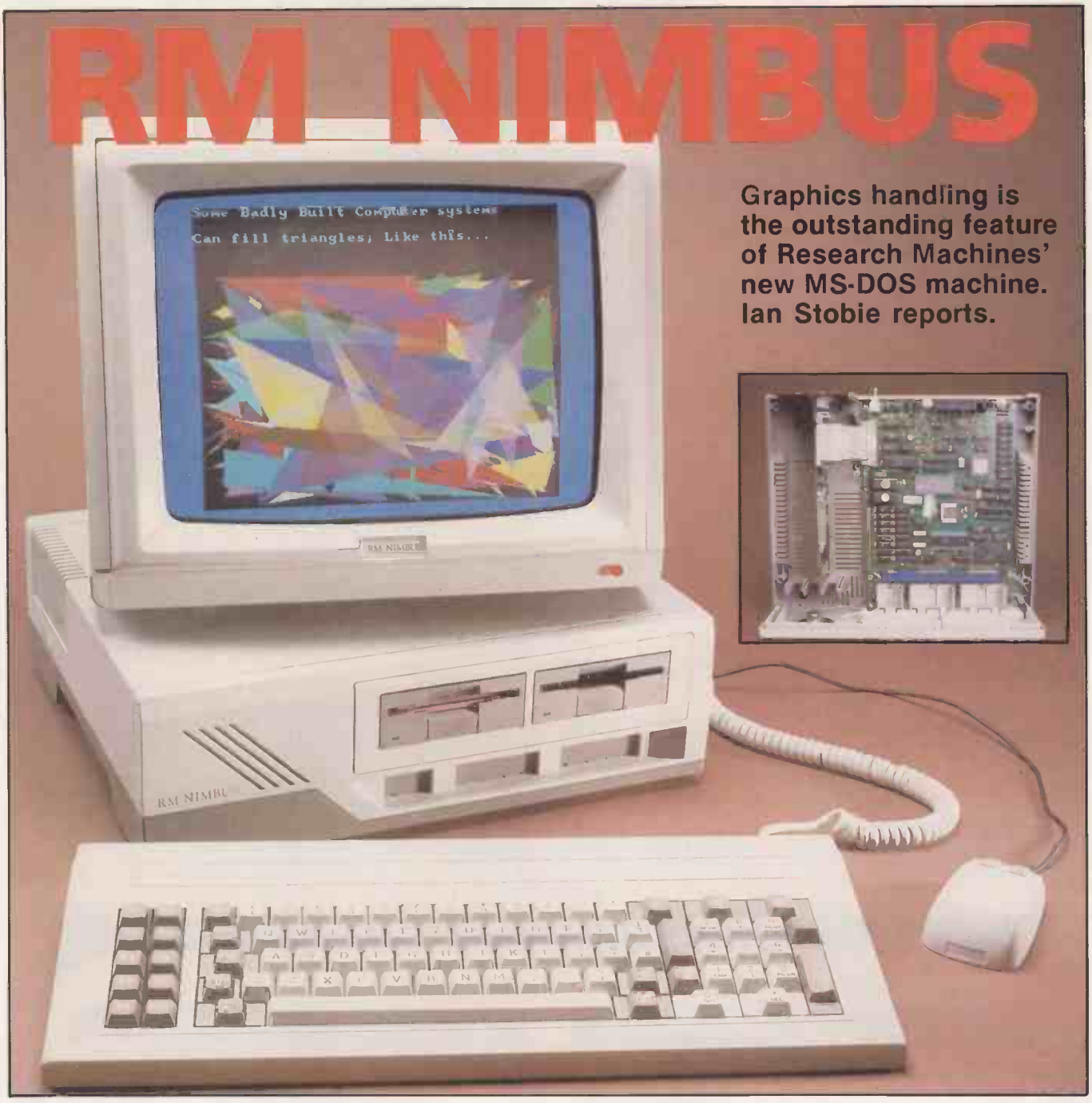
RM NIMBUS

Graphics handling is the outstanding feature of Research Machines' new MS-DOS machine. Ian Stobie reports.



AS A LATECOMER to the market Research Machines had to give its first 16-bit machine something to make it stand out from the crowd — and it certainly has. The machine is the Nimbus. It is an MS-DOS-running IBM near-compatible like all the rest, it is fast, it links easily into a local area network, and it has breath-taking graphics. The price is competitive too: around £1,220 not including the monitor to the typical user for the twin-drive version described here.

Like other RM computers, the Nimbus is aimed primarily at the educational sector, although with this system Research Machines also hopes to reach other local-authority departments and a broad range of technical and scientific users.

First deliveries of the Nimbus are scheduled for March. We have had a prototype of the system to look at in our office. Few hardware changes in the finished product are likely, but the system software and packages we had for review were not final versions. All the same, the machine made a strong and favourable impression on us.

Monitor separate

Physically, the Nimbus consists of a system box containing the cpu, memory and disc drives, a separate keyboard with optional mouse, and a monitor. The monitor is priced separately and any standard monochrome or RGB colour monitor will do. We were using a rather bulky 14in. Microvitec colour monitor which costs around £300.

The Nimbus system box itself is quite compact, with about the same footprint as the Apricot. Like the Apricot it too uses Sony-style 3.5in. microfloppy-disc drives. The Nimbus drives are actually manufactured by Y-Data, but we had no trouble using Sony discs in them. You get 360K of storage per side, giving each drive a capacity of 720K. The Nimbus comes in a variety of disc configurations, ranging from one microfloppy, to a microfloppy plus 40Mbyte hard disc. It is also available in a disc-less version for use as a network station.

Inside the box is an 80186 running at 8MHz and at least 192K of RAM, 64K of which is dedicated to graphics. This turns out to be a very fast combination. We did not have RM Basic with our test system, but we ran our standard set of Benchmark routines using Microsoft's Basic-86

Specification

CPU: Intel 80186 running at 8MHz; Research Machines custom graphics processor; optional 8087 maths co-processor

Memory: 192K, including 64K dedicated to graphics, expandable to 1Mbyte; 64K ROM containing low-level graphics primitives and other system routines

Display: connects to standard monochrome or RGB colour monitor; shows 25 lines of either 40- or 80-column text, and graphics in resolutions of 250 vertical dots by 320 or 640 horizontal dots; 16 colours in lower-resolution mode, or choice of any four in high resolution; text and graphics can be mixed on the same screen, and text displayed in different sizes, founts and orientations

Keyboard: detached QWERTY keyboard with same layout as IBM PC, including 10 function keys, a separate cursor/numeric pad and with 83 keys in all; generates either IBM character set or RM 480Z's; optional mouse

Sound: 8910 music chip providing three channels over seven octaves; Oki voice chip for digitised voice output

Discs: available in four different disc configurations and in a disc-less version for network use; the PC-2 has twin Sony-type 3.5in. microfloppy drives, 720K each drive; PC-1 has one microfloppy; XN-10 and XN-20 have a hard disc of 10Mbyte or 20Mbyte respectively and a single microfloppy; hard-disc models and the disc-less version come with an extra 128K of RAM

Interfaces: mouse/joystick port; RS-232 printer port; RS-422 serial port supporting Piconet, which lets you daisy-chain up to 30 external devices on to the port; two ROM cartridge sockets; 5V and 12V d.c. power-out lines; four slots are provided inside the Nimbus case for fitting expansion cards, one of which is usually occupied by the disc controller

Hardware options: mouse; 8087 maths co-processor; MS-Net network interface allowing up to 64 Nimbus or 480Z Chain stations to link

Software: PC-1 and 2 will come with MS-DOS, RM Logo and RM Basic included in the price; educational purchasers of network systems will get a discounted bundle of software including Microsoft Word, Multiplan, Superfile and Pascal

Size: main unit measures 405mm. (16in.) by 352mm. (14in.) by 122mm. (4.8in.); keyboard 467mm. (18.4in.) by 184mm. (7.2in.)

U.K. prices: Research Machines quotes its prices excluding VAT and with an educational discount, commercial users pay about 20 percent more; the educational prices are available to individual students and teachers on the PC-1 and PC-2; single-drive, 192K PC-1 £945; the twin-drive, 192K PC-2 £1,221; disc-less 320K TN £898; XN-20 20Mbyte hard disc, 320K £3,376; 14in. badge-engineered Microvitec colour monitor, around £300

Manufacturer: made in the U.K. by Research Machines

Distribution: available from March 1985; Research Machines Ltd, Mill Street, Botley Road, Oxford OX2 0BQ. Telephone: (0865) 249866

Dedicated hardware is responsible for the Nimbus's fast and flexible graphics.

interpreter, which is probably a fairer comparative test of the hardware anyway, as it is used on many other machines. The Nimbus was faster than any of the other machines we have tested apart from three 68000-based machines — the Sage, the TDI Pinnacle and the HP 200 — all of which cost much more.

Benchmarks do not test graphics, but RM has gone to great lengths to speed graphics up still further. The Nimbus has a custom-designed graphics co-processor working alongside the 80186. It carries out key sequences of instructions, such as address calculation followed by read-modify-write, at hardware speeds.

RM decided against using a standard display controller as, although it would speed up line drawing, it does not help much with common graphic tasks like area filling and block moving. Instead the company ran performance-monitoring routines with early versions of its own graphics software to find out where time was consumed, and then implemented the crucial loops as a custom gate array.

Memory

There is 64K of ROM on the Nimbus board, containing various system and I/O routines, with a very large chunk devoted to the graphics display. Four expansion slots are provided for adding cards inside the Nimbus system box; on our system one of them was occupied by the disc controller. RAM memory can be expanded inside the system box to 1Mbyte without using any of the expansion slots, as there is space provided for this purpose on the main board.

The floppy-based Nimbuses come with 192K of RAM, while the hard-disc and network models start at 320K — 256K plus 64K of graphics memory. Further memory expansion is possible, but MS-DOS is unable to access more than 640K directly; the same limitation applies to any machine using the operating system, including the PC-DOS variant. You can, however, configure spare memory as a silicon disc, and this is useful even on the smallest Nimbus if the program you are running leaves some spare RAM available.

The keyboard is as IBM-like as they come, with an identical layout to the PC and XT models. I personally prefer the IBM model's more positive feel, but the Nimbus keyboard is well built and far superior to that on the ACT F1E, a likely competitor. Software to support a mouse is contained in the 64K system ROM. The mouse itself will cost extra, probably around £90.

Once you have the Nimbus up and running the first thing you notice is the graphics. Maximum resolution is 640 dots horizontally by 250 dots vertically. This is about the same as on the BBC Micro and for the same reason: any higher resolution

(continued on page 65)

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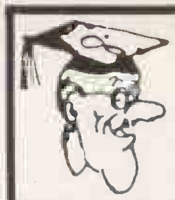

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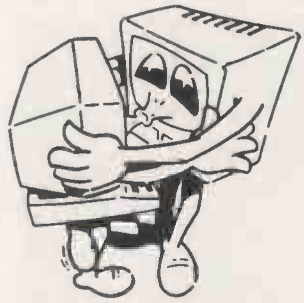

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Benchmarks

The Nimbus is undoubtedly a very fast machine. The table shows the time in seconds to run eight standard Basic routines. These routines test out various typical tasks, each repeating an appropriate set of Basic statements 1,000 times. We Benchmarked Microsoft Basic version 5.28 running under MS-DOS.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
RM Nimbus — 80186	0.5	1.8	3.9	4.0	4.6	8.5	13.2	13	6.2
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	14	6.8
Acorn BBC — 6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52	14.8
ACT Apricot — 8086	1.5	4.8	10.4	10.8	12.2	22.8	35.5	34	16.5
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30	16.8
RM 480Z — Z-80	1.1	6.9	13.5	13.0	15.0	23.2	33.1	51	19.6

The I/O ports are situated at the back of the system box. The Piconet interface, sixth from the left, allows you to daisy-chain up to 30 peripherals to the Nimbus.

(continued from page 63)
is getting beyond the capacities of a cheap monitor to display.

At this resolution, which corresponds to its 80-column text mode, the Nimbus lets you have any of four colours active at one time, as against two on the BBC. These four colours can be chosen from a palette of 16. Halving the horizontal resolution to 320 dots gains you use of the full 16 colours. Further shades are obtainable using software contained in the system ROM to set alternate dots in different colours — something Research Machines refers to as "dithering".

Mixed displays

The Nimbus displays text from the same memory areas as graphics, so there is no restriction on the way you can mix graphics and text. Indeed, text can be in colour, in several different sizes and plotted upside-down or at a 90-degree angle to the normal line.

RM Basic makes use of the graphics ROM routines and graphics co-processor, as probably any implementation of any future graphics-related product will, such as Microsoft Windows. We had several demo programs written in RM Basic but no interpreter. The demos were very impressive: speed and range of colour were beyond what you expect from a micro.

From the RM Basic spec all this power looks quite controllable. Although there are two different resolutions, the user can specify x and y values independently of mode. Most graphics commands will take either a single x,y co-ordinate, a list of x,y co-ordinates up to the maximum that will fit in a Basic line, or the name of an array which can contain up to 16,000 x,y co-ordinates. For instance.

```
LINE x,y . . . xn,yn
```

draws a multi-sided shape; Area followed by a similar list draws a colour-filled shape, while Points with the same set of x,y parameters draws a pattern of dots at the vertices of the shape.

All three commands can be modified by option-setting commands. For instance, Style used with Line redefines the type of line, as you can draw in six different sorts of solid and dotted line; used with Area it redefines the area-fill style — solid, hollow or hatched. With Points it sets the point style: you can have crosses or five other types of point. Other commands let you control colour dithering, select one of the six hatching patterns, and draw arcs, circles and pie-chart segments quickly.

Research Machines has decided to commit itself to MS-DOS as the Nimbus operating system, and at present has no plans to offer CP/M-86. The Nimbus is not fully IBM compatible and does not pretend to be — after all it has 3.5in. discs. The company believes its potential customers are more interested in performance than IBM compatibility, and also acknowledges that trying to achieve greater compatibility would have pushed up the price. The Nimbus has the same keyboard layout as the IBM PC, uses the same character set, and fully emulates the IBM monochrome screen. Porting well-behaved PC-DOS software across to the Nimbus should be no more difficult than to the ACT Apricot, for example.

We had early versions of Microsoft Word and Multiplan to look at, which illustrate this point. The exact composition of the software bundled in with the system has not been finalised. Stand-alone users will probably get Word, Multiplan, Superfile, Pascal and a version of PC Paintbrush at a reduced price. A school-administration bundle is also being assembled.

Research Machines says it has 1,000 Chain local area networks installed, with an average of 10 stations, usually RM 480Z, to each LAN. The Nimbus is Chain compatible. This means Chain will now allow up to 16 Nimbuses or 480Zs to be mixed on a network. It would cost around £160 to connect either floppy-based Nimbus model to the network; hard-disc models and the disc-less TN model are already appropriately equipped. By the early summer Research Machines hopes to have implemented MS-Net, Microsoft's network for 16-bit machines, which allows up to 64 stations on the LAN.

One other example of network thinking is applied at a lower level in the Nimbus design. Research Machines has devised Piconet, which allows you to connect up to 30 peripherals to one port on the back of the system box. This is a standard feature on all Nimbus models. It works in a similar way to the IEEE-488 and HP-IL interfaces, in that you daisy-chain devices together. Each peripheral is equipped with both a male and female RS-422 connector. The Nimbus is capable of providing power for the first three devices on the net.

Conclusions

- **The Nimbus is an impressive system. The graphics are superb, and the whole system well thought-out and appropriate to the educational, technical and scientific markets it is aimed at.**
- **Research Machines has decided that price and performance matter more than strict IBM compatibility for this type of user. At around £1,500 for a twin-drive MS-DOS system with colour monitor, falling to under £1,000 for the basic network model, pricing is competitive.**
- **The Nimbus uses the excellent 3.5in. microfloppy discs. Software houses should not have a great deal of difficulty porting MS-DOS and most IBM products across to it, but in the short term the range of software is liable to be restricted.**
- **Research Machines has a strong track record with local area networks. The option of linking Nimbuses into an MS-Net or Chain network will be attractive to a large number of users, enabling them to reduce unit costs and attempt more ambitious applications.**

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SANYO 775

Sanyo's new transportable looks set to challenge the Compaq for its degree of IBM compatibility. Robert Piper sees how it shapes up.

UP TO the launch of the controversial 555 series Sanyo had enjoyed a very unremarkable liaison with business micros, its earlier attempts having been both conventional and fairly expensive. The 555 was a very different story offering a 16-bit computer sold with an entire suite of Micropro software for an almost unbelievably low price.

The 555 range has now been enhanced but its major stumbling block, IBM compatibility, is little better on the new machine than it was on the old. However, Sanyo has a new machine up its sleeve which goes a long way to answering such criticisms: the Sanyo 775. It is a fully IBM-compatible transportable machine supplied as standard with a colour monitor and bundled with WordStar and Calcstar. The £2,150 price tag indicates that Sanyo is aiming at the market stronghold currently dominated by the much-revered Compaq portable, rather than the bargain basement sector epitomised by the 555 series.

In its portable condition the Sanyo 775 bears a remarkable resemblance to the Compaq, although it is larger and at 40lb. considerably heavier — probably due to the inclusion of a colour monitor. Carrying the machine around is possible but not a pleasant experience and should not be considered if the distances involved exceed more than 100 yards or so.

Setting up any transportable is simple and the 775 is no exception. The keyboard which forms the base of the suitcase during transportation is unclipped from the monitor and disc drives, then laid on the desk. Both the keyboard and the main processor can be angled towards the user by extending the flip-out legs on their respective bases. The keyboard plugs into a socket on the front of the machine adjacent to the disc drives.

The rear of the processor where the carrying handle resides has three incredibly vulnerable hinged panels, which open to provide access to the various interfaces. Generally, the standard of construction is far superior to that of the 555 series; but it may be marginally inferior to the Compaq, which gives the impression that it can stand up to rough use somewhat better.

The front of the unit has a panel on the far left which houses an on/off switch, mains pilot and a sliding brightness control. To the right of this is a 9in. colour monitor manufactured for Sanyo by NEC. Next along are two vertically orientated Chinon disc drives of 360K capacity each. The drives themselves are exceptionally quiet but are somewhat spoilt by the awkward pinch-style locking devices, which can prove fiddly in use. They are also reasonably fast drives, a definite point in their favour.

Colour monitor

The colour monitor produces a stable display with good colour balance. The coarse IBM-style character set composed in 320- by 200-pixel format, coupled to the small screen, does not lend itself to long periods of word processing, so it is advisable to connect a larger auxiliary monitor if this is required. Furthermore, it was not possible on the review machine to obtain enough brilliance from the display to suit bright working environments.

On the far right of the rear panel is a compartment which contains the mains socket and is large enough to stow the lead when not in use. The centre panel below the handle houses the auxiliary display connections for RGB and composite-video monitors.

The panel on the far left conceals the two IBM-compatible expansion slots and the parallel interface port. For some obscure reason Sanyo Japan has connected a socket like that on a serial interface to this port, making it extremely difficult to connect an Epson-style printer. Sanyo U.K. has indicated that this may be changed before the machines reach the dealers in quantity. The expansion slots can only be filled by lifting the top cover. This is surprisingly simple since it only requires the removal of two screws to reveal a well-screened chassis assembly.

It is necessary to remove the screens to gain access to the full-length expansion slots and main printed-circuit boards. The 775 uses an Intel 8088 cpu running at a very respectable 8MHz coupled to 256K of parity-checking RAM. The machine's Basic Benchmarks reveal quite a sprightly performance almost up with some of the true 16-bit 8086-based compatibles like the Compaq Deskpro and Olivetti M-24.

Unlike the 555, the 775 has an enhanced IBM-compatible keyboard. LED status indicators are fitted to the Num Lock and Caps Lock keys. The numeric pad is provided with its own Enter key. The main Return key is, sensibly, larger than that fitted to the IBM. Key action is superior to the Keytronics unit supplied with the Compaq and 70 percent of the other compatibles, but not up to the standard set by IBM.

The 775 is supplied with a standard implementation of MS-DOS version 2.11. There does not appear to be any form of mode command so it is hard to see how users will be able to customise the optional serial interface card which fits into one of the expansion slots. Microsoft's GWBasic interpreter is included with the 775, as opposed to Sanyo's own Basic supplied with the 555. Strangely, it is referred to on-screen as GWBasic but called up from disc by entering

```
Basica
```

presumably to ensure compatibility with IBM software that includes calls to Basica.

WordStar and Calcstar are bundled in with the 775 U.K. package. Unfortunately the review machine had only just arrived from Japan and no software was available for test. Sanyo says the packages are the same as supplied with the 550 machines.

One of the advantages of the specific 775 implementation is that both packages can now run in colour. Users can customise WordStar to produce a wide variety of combinations, some of them incredibly

Heavy to carry but simple to set up.

garish, but Calcstar has a pre-defined colour presentation which cannot be altered. However, the 555 series implementation of Calcstar did not support the use of the machine's cursor keys; the archaic practice of moving the cursor around the spreadsheet using Ctrl plus the ? key had to be adopted. Hopefully the necessary enhancements have been made to the 775 implementation.

A good job

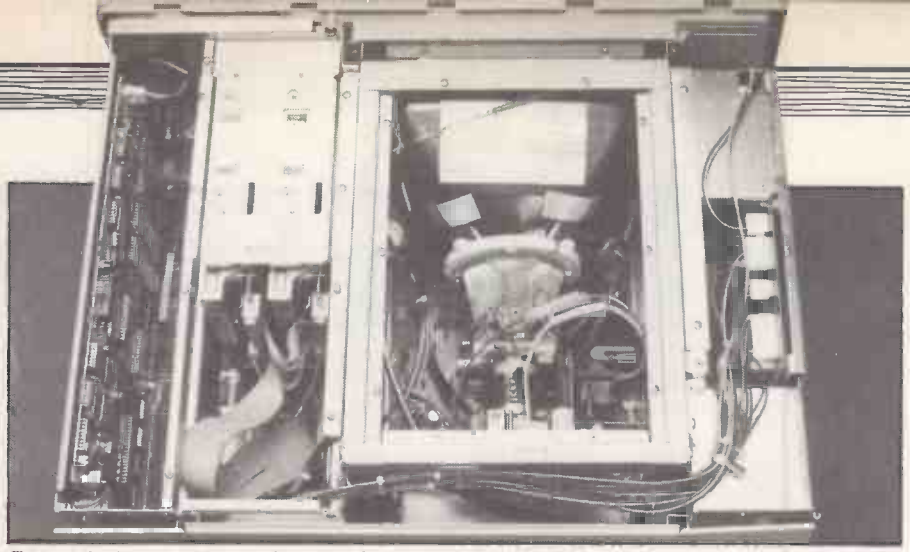
The 775 has been designed from the outset as an IBM PC compatible. In certain areas such as the colour display attributes, the 555 specification has actually had to be downgraded to achieve the required result. But Sanyo has done the job well and the new machine displays the highest orders of compatibility. Around 20 different IBM packages, including the new colour Flight Simulator, were tested and run successfully with no apparent problems.

The 775 appears to match the Compaq on compatibility except for one failing. When Microsoft Word was loaded the copyright notice appeared followed by the normal text-entry screen. However, it would not respond correctly to the keyboard: you only had to press any key and the program would exit back to the system. The only possible explanation of this may involve the type of copy protection used by Microsoft, which may be incompatible with the Chinon disc drives or controller.

As with many other portables, the 775's expansion possibilities are rather limited. The two expansion slots will quickly be eaten up by a serial interface card and extra memory. Compaq has recently announced an upgrade for its portable where chips on the motherboard can be exchanged to give 640K without filling any expansion slots. This is not possible on the Sanyo, but it may be feasible to use a third-party manufacturer's multi-function board to make the most of the available space. No guarantees can be given regarding their total compatibility so, as usual, the particular manufacturer should be consulted prior to purchase.In fact, when comparing the possibilities for expansion on the 775 to the opposition it does not fare quite so well. The Compaq and the Olivetti M-21 both have three expansion slots, and the Olivetti also has a serial port as standard.

The review machine was only supplied with one manual, which covered setting up, the operating system and GWBasic. Sanyo manuals have improved greatly since their early attempts, and are now well laid-out and comprehensive. However, they are rather brief and users will find the section on Basic handy as a reference guide, though not as a tutorial. If the 775 is anything to go by, WordStar and Calcstar will be supplied in one manual consisting of standard Micropro documentation plus a machine-specific implementation guide written by Sanyo.

As befits the 775's price, Sanyo intends to be selective in choosing the dealers that handle its machine to ensure customers get sufficient support. Maintenance will either be available direct from Sanyo through Systems Reliability Ltd or organised locally be dealers.



To reach the expansion slots you have to remove the machine's cover.

Benchmarks

The standard Basic benchmarks were run, to produce the following timings, in seconds:

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Sanyo 775 — 8088-2	0.9	3.0	6.4	6.7	7.2	12.8	20.0	20.7	9.7
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0	16.8
IBM PPC — 8088 **Compaq** — 8088	1.3	4.8	11.8	12.2	13.4	23.6	37.6	36.9	17.7
Olivetti M-21 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2

Specification

CPU: Intel 8088-2 running at 8MHz
Memory: 256K expandable to 640K
Dimensions: 280mm. (11in.) high by 510mm. (20in.) wide by 400mm. (17in.) deep
Weight: 18kg. (40lb.)
Display: colour 80 by 25 characters or 640 by 200 pixels mono; 320 by 200 pixels colour
Interfaces: RGB and composite video, parallel printer port
Discs: two Chinon 5.25in., 360K each
Operating system: MS-DOS version 2.11
Bundled software: GWBasic, WordStar and Calcstar
U.K. distributor: Sanyo Marubeni (U.K.) Ltd, 8 Greycaine Road, Watford, Hertfordshire. Telephone: (0923) 46363
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Conclusions

● Although the Sanyo 775 is one of the heaviest transportables around it is undoubtedly far more portable than the average desk-top machine. Weight aside, it still takes less than a minute to pack it or set it up for use and this is probably the most appealing feature of transportables.

● Compatibility with IBM software is excellent and definitely puts the machine among the best available.

● The integral colour monitor works well for graphics but is a little harsh when displaying text.

● At £2,150 including 256K RAM, WordStar and Calcstar, the price is only just competitive when compared to the likes of the Compaq and Olivetti M-21. In reality the bundled software and 256K RAM may well prove more appealing than the colour monitor.

● The 775 has a very creditable speed performance for an 8088-based machine.

The keyboard perpetuates most of IBM's vices and virtues.

ENTERPRISE

Bill Bennett concludes his review with an assessment of the machine's Basic and graphics capabilities.

IN THE HIERARCHY of eight-bit computers the Enterprise stands at the pinnacle. It is unlikely that there will ever be another eight-bit home micro which packs as a big a punch. Enterprise's home-grown IS-Basic represents a similar peak. It would be difficult for a programming language to be more capable or more structured and still be Basic.

The IS-Basic dialect is close to the new ANSI standard, with additional commands to make the most of the Enterprise's hardware features like stereo sound and very high-resolution graphics. There is also a liberal sprinkling of links to the micro's operating system.

IS-Basic is similar in many respects to BBC Basic. It is Pascal-like in its structures and Basic-like in its ease of use. It contains graphics and sound capabilities that Wirth would never have dreamed of when he specified Pascal, yet it retains the Goto statement. Educationalists will love it because of the structures; timid users will delight in the way it holds their hands, with meaningful error messages and clear layout. Programming heavyweights will warm to its ease of use and the comprehensive command set.

Sophisticated

The screen editor is very sophisticated, being based on the built-in word processor described last month. You can move the cursor around the screen to correct faulty lines of code, rather as you can with the Commodore screen editor. However, the Enterprise system is vastly superior, partly because the cursor is moved by the joystick which is built into the keyboard. It may sound peculiar, but with a little practice the joystick soon becomes as simple to use the as the Macintosh mouse. The screen scrolls up and down, allowing changes to be made to any of the program lines without the need to relist the relevant block of code.

There are two ways of removing unwanted text from a program line. The Erase key moves the cursor leftwards, devouring all in its wake. Delete leaves the cursor where it is but obliterates the characters immediately to the right. The Insert key adds spaces to the right of the current cursor position.

A very neat and somewhat surprising feature of the Enterprise's word-processor like editor is the way that keywords and variable names are wrapped around on the screen. Another useful feature is the indentation of sections of code to highlight the logical structure of the program. These two facilities make programs easy to read and even easier to debug. Variable names can be as long as you wish — though only the first 31 characters are significant — so there can be no excuse for not writing readable programs. It is possible to write programs in the 80-column mode, which also makes the code easier to read if your monitor's resolution is up to it.

The blue function keys come in useful during a programming session. Most of them are assigned to programming tool commands such as Auto, Renumber and List. Other such commands include Continue, LList to list to the printer, Type to switch to the word processor, Speaker to toggle the internal speaker on and off, and Text and Graphics to switch the display from one mode to another.

The Click command toggles the click which sounds when a key is hit. Display followed by Text or Graphics defines a window to display the relevant output. The interesting Info command prompts the interpreter to spew forth a number of statistics about the current program, including the amount of RAM it occupies. There is a full trace facility which also comes in useful for debugging recalcitrant software.

IS-Basic's Edit bears no relation to the similarly named command found in other Basics: here it is used to switch between the different programs stored in the computer's memory. Several programs can exist side by side in the memory, each having its own set of program lines and variables. Each program can be referred to by a name or a number, and can be called from another program by using the Chain command. Program 0 can use up to around 42K, other programs up to around 32K. Although the current crop of Enterprises only have 64K of RAM, the machine is capable of addressing a cool 4Mbyte.

The Delete command allows unwanted program lines to be purged efficiently, and it can be used in the form

DELETE <blockname>

to erase all the program lines in a program block. Merge works in the usual way as does New, but New All deletes all the programs currently in the memory.

"Structured programming" is a name to drop in trendy computing circles. All the best languages allow it. Pascal, Forth and Logo are all pretty strong on structure and so enjoy a good reputation with educationalists. However, Pascal can be painful to learn, and Forth is best described as a write-only language. On the other hand, the cognoscenti tend to sneer at Basic because it encourages poor programming habits.

In this respect IS-Basic is a compromise. It encompasses elements of Pascal and Logo, while retaining the fundamental simplicity of easy-to-grasp Basic. It is comprehensive in that it contains the more sophisticated structures alongside the much-maligned "spaghetti plate" Goto and Gosub control statements of minimal Basic. One might argue that by retaining these commands IS-Basic fails to grasp the nettle of truly structured programming. Yet without them the language would not really be Basic at all and it would be nigh-on impossible to convert programs which have been written for other machines to the IS-Basic format.

Differences

Of all program constructs, the most fundamental is the subroutine or procedure. In Basic they tend to be short diversions of code; in Pascal they take the form of mini-programs with their own sets of parameters. In IS-Basic ordinary Basic-style subroutines are allowed, but a higher form exists in the shape of the function block. It works in a similar manner to ordinary Basic functions, but with a number of important differences.

Like a Pascal procedure, a function block has parameters and is in effect a mini-program. It is given a name, which makes it easy to use and to identify within a program. Like its Pascal cousin, the function block uses local variables. Basic subroutines will tend to run if program control reaches them by accident, and give a Return without Gosub error. Function blocks only run when called using a statement of the form

CALL<function name>

It is defined using the Def statement like normal user-defined functions. The block definition can come before or after the Call. Local variables exist exclusively within the confines of their respective program block. Outside that block they have no valid existence.

IS-Basic also has global variables, which are defined in the main bulk of the program before control has reached a block. Any variable defined prior to the block can be used within it. Normal programming practice is to keep the variables within and outside a block entirely sep-

(continued on page 73)

Above: Compared to those on other low-cost micros the Enterprise keyboard is adequate. It is of membrane construction and offers colour coding: eight function keys in blue, the Stop key in red, special keys in green and the standard character keys in grey. Right: Like many other micros the Enterprise has a separate transformer.

(continued from page 70)
arate, only passing parameters between the two.

Looping can be performed by the For-Next construction, but IS-Basic also offers some more powerful options. Again these structures are Pascal-like and are based on the Do-Loop command pair. It is possible to have an infinite loop started with Do and finishing with Loop, all the code between the two commands being repeated *ad infinitum*. More usefully Do loops should include a get-out clause. The two possibilities are Do-While and Do-Until. The While or Until can be put at the front or rear of the loop, providing the option of a front or back door to the block of code.

Both Do-Loop and For-Next structures can be terminated by the Exit command, which allows the loop to terminate gracefully without executing the commands between the Exit and the end of the loop. It is vastly preferable to the more usual ways of leaving a For-Next loop, which always causes problems for conventional Basic programmers.

Elegant

Another Basic construction which makes programming aesthetes wince is the If-Then-Else structure. IS-Basic treats it in an elegant way by using program blocks. The structure will work in the conventional manner, but by introducing the Endif command a whole new way of working opens up. In IS-Basic it is possible to have a section of code which runs like

```
IF condition THEN
  block of code
ELSE
  another block of code
ENDIF
```

which is much neater than the mess that ordinary Basic can lead to with Goto statements all over the place.

The Select-Case structure is a little like a tidy, readable version of On-Gosub, though it can also be thought of as a way of tidying up a string of If-Then-Else-Endif commands. It enables the control to be sent to a program block chosen by the value of a variable. Should there not be any suitable case, it is possible to use Case Else, which takes care of all values not otherwise mentioned.

As cheap home computers go, the Enterprise is well endowed in its graphics facilities. The commands from Basic are extensive and they seem to be relatively quick, especially when compared to the Sinclair Spectrum or the Commodore 64. Though "high-resolution" is a much overused phrase in the language of home computers, the screen and colour resolution of the Enterprise are second to none, with a total of 256 possible colours and a screen capable of displaying 640 by 360 pixels. A program is also supplied that uses interlacing to provide a resolution of 640 by 720.

The Enterprise is very flat in shape.

So high is the possible resolution that a normal colour television set is not capable of displaying everything that could appear on-screen. The actual screen resolution is controlled by the Nick chip, and is highly flexible. Unfortunately the manual is vague about the graphics and we will have to wait until further documentation becomes available before the possibilities are fully explored.

No matter what graphics mode is in operation the co-ordinate system assumes a 1,280- by 720-pixel pattern, making it very easy to convert images from one graphics mode to another. There are 256 colours, though they are not all available in all graphics modes. To use all 256 at once the horizontal resolution is reduced to a chunky 80 pixels. It is possible to select a reduced palette of colours when working in a higher-resolution mode.

Colours may be selected by number, or can be mixed by combining the red, green and blue guns using the RGB command. Simple colours can also be selected merely by name. Ink and Paper commands will remind users of the Spectrum, and so will the attribute-style graphics which are also possible.

Maybe the neatest thing about the Enterprise's graphics commands is the way that turtle graphics can be combined with straight graphics when using the Plot command. There is even a choice of working in degrees or radians, and an Ellipse command which can also be used for drawing circles. Naturally there is an adequate Paint command and the ability to define characters.

Although the Enterprise does not have a built-in assembler, it does have some features which will appeal to machine-code programmers. The Allocate command sets aside an area of memory to store machine code. Code is used to store machine code and Hex$ converts codes to the correct format.

If there is one feature of the Enterprise which lets the whole show down it is the manual. It is simply not comprehensive enough in the way that the BBC Micro's manual is. Naturally there will be a whole crop of "Make the most of Your Enterprise" books around to help plug this gap, but it is a shame that such a worthy ship could be spoilt for a ha'p'orth of tar.

Clearly the main task of the manual is to provide a tutorial, but it reads very much like a case of the blind leading the blind. Beginners will be hopelessly lost. The key features that make the Enterprise unique are underplayed, as is the structured nature of the Basic. The example programs do not necessarily illustrate whatever point they are supposed to be making.

Worst of all, too many questions are left unanswered after you have completed the book. At no point does it explicitly state what the maximum values for the x and y co-ordinates of the screen are, nor does it mention which values in the sound command correspond to which notes in the musical scale. A few charts would not have gone amiss. A lot of time and care and thought have gone into making everything else about the Enterprise seem right. What a shame that the same cannot be said about the manual.

Conclusions

● The Enterprise is a state-of-the-art, cheap eight-bit home computer.

● At £250 it competes directly with the MSX micros, and beats them hands down on specification. It also provides the BBC Micro with some strong opposition at a much lower cost. Against the Amstrad, the Enterprise looks a touch expensive: even if it does enjoy a higher technical specification, it has no monitor or cassette unit.

● If the promises about expansion and software are kept then the Enterprise micro should have an interesting future.

● IS-Basic points forward to the future development of the Basic language. It is comprehensive, structured and very powerful. The addition of a Logo cartridge would make the Enterprise an incredible graphics tool.

Benchmarks

The timings below, in seconds, are for the set of standard Basic Benchmarks routines given in the January 1984 issue of *Practical Computing*. The Enterprise emerges as slow compared to other eight-bit home micros. There appeared to be a bug in IS-Basic's sine function, which was unable to return a value for sin (59) in BM8. The extra line Option Angle Degrees corrected this.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Enterprise — Z-80	24.0	19.0	21.0	32.0	33.0	49.0	94.0	308.0	68.5
BBC model B — 6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52.0	14.8
Commodore Plus-4 — 7501	1.4	9.4	17.9	18.5	20.9	34.2	54.6	100.6	32.2
Spectrum — Z-80	4.8	8.7	21.1	20.4	24.0	55.3	80.7	25.3	58.5

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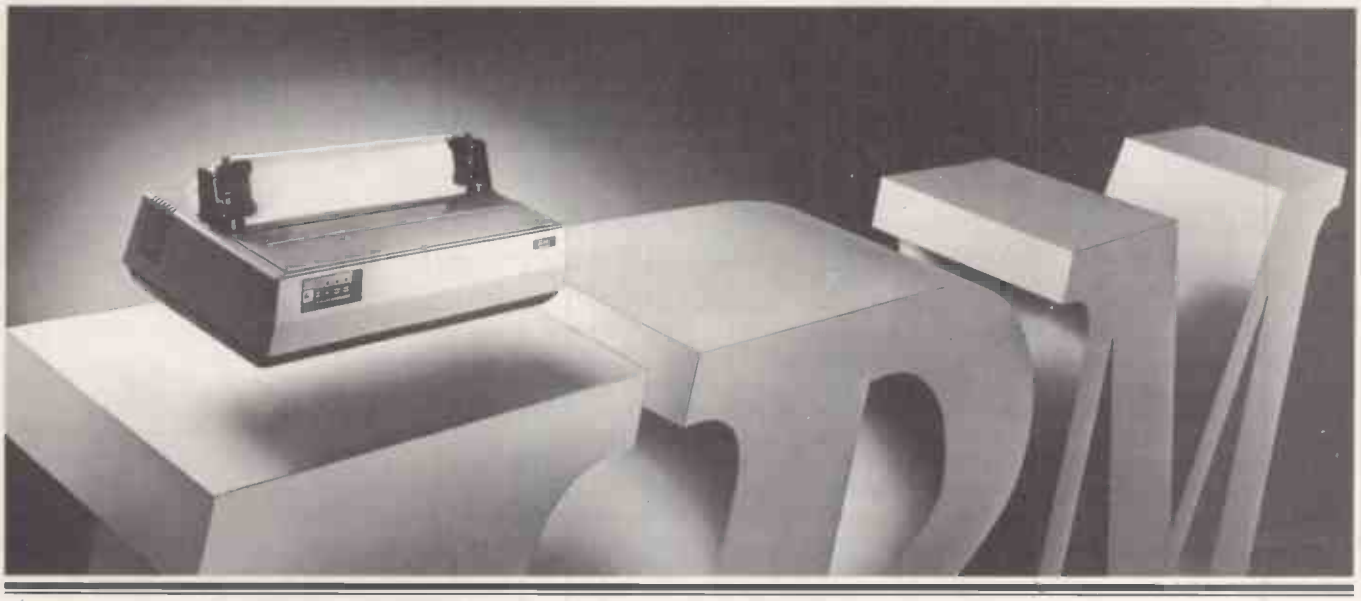

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BBC Logos

The wait is over, and now BBC Micro users have several Logo packages to choose from. Susan Curran appraises their strengths and weaknesses.

I AM NOT an entirely enthusiastic convert to Logo. Though the experimental work on Logo in education has been interesting and impressive, within limits, I sometimes feel the language is more publicised than used.

For the unfamiliar, Logo has two main elements: turtle graphics and list processing. The turtle graphics themselves are handled through list processing. The point is that in any version of the language worthy of the name there is graphic list processing and non-graphic list processing.

Logo is entirely procedural. User-defined procedures are added to the in-built primitive procedures to build up programming power. Procedures when run can call other procedures, or recursively call themselves; there are no separate elements called programs. It is not particulalry mathematics-orientated, and though all the versions stretch to non-integer arithmetic, only the perverse would select Logo for heavy number crunching.

One obvious problem with Logo is the gulf between simple turtle graphics and the complex demands of non-graphic list processing. Turtle graphics are easy to teach to even very young children and are also a useful tool for the more advanced. List processing is not easy, and attempts to introduce it to young children have not been an unqualified success. All too often, the programs simply build up very elementary databases that could better have been handled using a database application program.

Logo does, of course, face heavy competition from other list-processing languages such as Lisp and Prolog. Logo list processing is, in fact, normally more or less a subset of Lisp facilities. It is not a competition which Logo will always and inevitably lose, and this side of Logo is perhaps best seen as a serious tool for data structures, rather than as a educational language for young children.

Logo is remarkably unstandardised, though the versions covered in this review do show family resemblances to other micro-based versions of the language. Such semi-standardisation is obviously important to those who want to work with Logos on different machines, or to transport programs from one to the other. For the new user, clarity and ease of use may seem more important. All of the versions reviewed make proper use of BBC graphic modes and provide reasonably full access to operating-system commands, and to this extent they obviously differ from non-BBC Logos.

Curiously, the BBC Micro has only just acquired its first versions of Logo, long after other popular home computers. For a major educational computer this has been an extraordinary omission, but one now repaired with a vengeance. Four rival versions of the language have been launched.

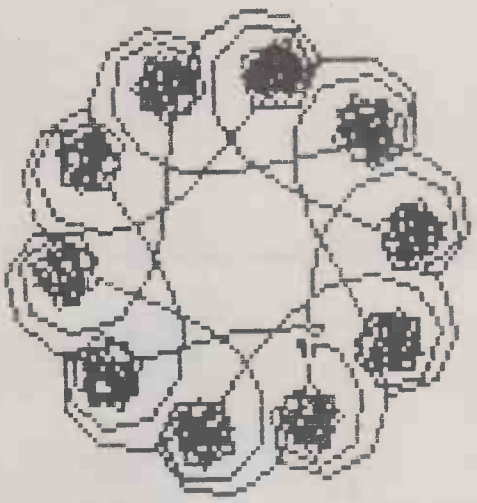
I tested three versions: Acornsoft Logo, LSL Lgo from Logo Software Limited, and LCSI Logo from Logotron Limited. The fourth version is from the Open University, and it is not covered in detail here. There appears to be remarkable unanimity about the cash value of a good Logo. All three packages reviewed cost just under £70, though schools and colleges may be offered special deals by some software suppliers.

All four versions are in ROM form, but while the LSL and LCSI versions are crammed on to a single 16K chip, the Acornsoft and Open University implementations take up two chips each. Though this results in more expansive instruction sets, it could pose problems for those who have only one spare ROM socket and are reluctant to invest in an expansion board.

LSL Logo

LSL Logo was once expected to become Acorn's official version. The fact that it didn't delayed its development, and clearly caused considerable ill feeling: there is a viciously negative acknowledgement to Acorn at the start of the LSL manual. It has gone through several versions, and there has been an unflattering review from the British Logo User Group of version 0.6. The final release version is 1.0, which is markedly improved in both speed and reliability.

This one-chip Logo is written in assembler. The manual is spiral-bound, has 234 pages and is nicely produced on thick paper with plenty of colour. It contains a beginners' guide aimed at children, some brief but competent teachers' notes, a full and clear technical specification, and some quick references including a very full bibliography. It lacks a single comprehensive index, but I found it adequate for general reference.



```
?PO "INSPIRAL
TO INSPIRAL :SIZE :ANGLE
FD :SIZE
RT :ANGLE
INSPIRAL :SIZE :ANGLE + 10
END
```

Figure 1. LCSI listing of Inspiral routine and screen dump.

The beginners' guide tries hard to be entertaining — too hard for some tastes. Its profusion of styles of illustration and type comes across as a bit of a mess. There are very full explanations of simple commands and of elementary matters like wiring up the system, but there are not many worthwhile programs. Very little space is given over to non-graphic applications.

A few more short sample procedures are incorporated into the technical section — again, nothing serious. It is a definite shortcoming of this package that it does not have in-depth program support. The technical section of the first edition of the manual was also riddled with printing errors but LSL has done a thorough job in identifying them and they should be corrected in the next edition.

In use LSL Logo defaults to a graphic screen with a square, white-bordered graphic window at the top and a text area at the bottom. Mode 4 is the default. The square window leaves a lot of screen space unused, but it is pleasant to work with, and easy to redefine. The bordered window works in fence style only accepting plots within it. Window plotting is available as an alternative, with off-screen points nominally plotted as usual in BBC graphics. One real drawback is the lack of a wrapping option, as on the other Logos.

LSL has altered the flexible but exasperating BBC co-ordinate system, and the graphics window has Cartesian scaling, with 220 plotting points on either axis and a centre origin. This made it rather difficult to benchmark graphics applications against the different scales used by the other programs. The scale can easily be altered. The SetX and SetY commands will not draw lines, making it impossible to simulate co-ordinate graphic commands. Otherwise, the graphic primitives are very good.

All editing is in mode 7. Though immediate commands can be given in other modes, procedures can only be defined in the editor. The package claims a full-screen editor, but what is provided is not what you, I or the writers of other Logos would recognise as one. The procedure is reproduced in a top window, and amendments are made by using the copy cursor and building up a new line in the bottom window.

The method is vaguely reminiscent of editing programs on the Spectrum. You have to use the function keys to open up a new line, delete a line or store the definition. Only one procedure can be edited at a time, and the length is limited to 90 screen lines or 50 Logo lines. The size of the lower window sets a practical limit of two lines to each Logo line, which is a considerable restriction in a list-processing language.

The obvious disadvantage of mode 7 is the different character set, in particular the absence of the square brackets that normally enclose Logo lists. LSL has worked around this problem by making square and round brackets functionally identical; the same is done with single and double quotes, too. This was possible only because of the restricted format of arithmetic functions, which means that they do not use round brackets. It is quite a neat arrangement.

LSL procedures can only be saved individually, under their procedure names. There is no option to produce a file consisting of several procedures with a name of its own, and this makes it unnecessarily awkward to load and run a program consisting — as any serious program will — of a set of procedures. It also means that it is unwise to give any procedure a name more than seven characters long.

There are a good selection of error messages and of debugging commands, including two Trace commands — one for variables, one for procedure names — and a Walk command to single-step through program execution.

Though LSL's primitives are reasonably comprehensive, one failing is in the arithmetic commands. There is no support for infix arithmetic of the usual 2+3 type. All arithmetic is handled in prefix form

ADD 2 3

which will be unfamiliar to small children.

(continued on next page)

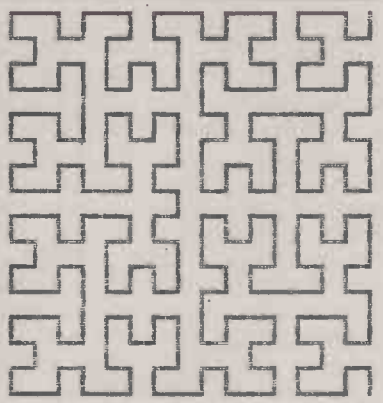


Figure 2. Listings of Hilbert routine and screen dump from LCSI.

```
TO HILBERT :SIZE :LEVEL :PARITY
IF :LEVEL = 0 [STOP]
LEFT :PARITY * 90
HILBERT :SIZE :LEVEL-1 -:PARITY
FORWARD :SIZE
RIGHT :PARITY * 90
HILBERT :SIZE :LEVEL-1 :PARITY
FORWARD :SIZE
HILBERT :SIZE :LEVEL-1 :PARITY
RIGHT :PARITY * 90
FORWARD :SIZE
HILBERT :SIZE :LEVEL-1 -:PARITY
LEFT :PARITY * 90
END
```

Acornsoft

```
?PO "HILBERT
TO HILBERT :SIZE :LEVEL :PARITY
IF :LEVEL = 0 [STOP]
LEFT :PARITY * 90
HILBERT :SIZE ( :LEVEL - 1 ) ( 0 - :PARITY )
FD :SIZE
RT :PARITY * 90
HILBERT :SIZE ( :LEVEL - 1 ) :PARITY
FD :SIZE
HILBERT :SIZE ( :LEVEL - 1 ) :PARITY
RT :PARITY * 90
FD :SIZE
HILBERT :SIZE ( :LEVEL - 1 ) ( 0 - :PARITY )
LEFT :PARITY * 90
END
```

LCSI

```
?INSPECT "HILBERT
TO HILBERT SIZE LEVEL PARITY
IF EQ :LEVEL 0 ( RETURN )
LEFT MLT :PARITY 90
HILBERT :SIZE SUB :LEVEL 1 SUB 0 :PARITY
FD :SIZE
RT MLT :PARITY 90
HILBERT :SIZE SUB :LEVEL 1 :PARITY
FD :SIZE
HILBERT :SIZE SUB :LEVEL 1 :PARITY
RT MLT :PARITY 90
FD :SIZE
HILBERT :SIZE SUB :LEVEL 1 SUB 0 :PARITY
LEFT MLT :PARITY 90
?EDIT "BM4
```

LSL

```
?PO "BM4
TO BM4
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1 MAKE "A :K / 2 * 3 + 4 - 5]
PRINT "E
END
```

LCSI

```
?INSPECT "BM4
TO BM4
PRINT "S
MAKE "K 0
REPEAT 1000 [ MAKE "K ADD 1 :K , MAKE "A DIV :K 2 ,
MAKE "A MLT :A 3 , MAKE "A ADD :A 4 , MAKE "A SUB :A 5 ]
PRINT "E
```

LSL

```
TO BM4
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1    MAKE "A :K / 2 * 3 + 4 - 5]
PRINT "E
END
```

Acornsoft

Arith benchmark listings in LCSI, LSL and Acornsoft Logos.

(continued from previous page)

Round brackets are not specific to arithmetic, and it takes some care to combine a number of prefix arithmetic operations correctly. Another serious omission is the list-processing Sentence primitive.

Some Logo purists have been upset by the need to separate commands on the same line by commas, no punctuation being the Logo norm. Personally, I found this feature quite helpful. The package works fast, particularly when the turtle is hidden.

LCSI Logo

The French Soli company developed this Logo along the lines of Apple, Atari, Spectrum and other popular versions. It too is written in machine code and it works fast.

The chip comes with a loose ring-bound manual in a fancy IBM-style library case. There are 183 pages, including the index, neatly and plainly written with no pictures. I found the manual style a little patronising, but the contents are solid enough. There is little difference between the sections aimed at pupils and teacher, and young children would find it heavy going. There are several programs in the manual, and two useful sets of utilities for list processing: Mike Sharples' Phrasebook and Boxes.

LCSI starts up in mode 4. As soon as a graphics-orientated command is given the initial text screen switches to a graphics screen with a text window at the bottom. The manual provides full information on memory management. The editor too will work in any mode, if sufficient memory is available. There is no visible fence as on other packages, but the screen arrangement is neat and versatile.

There is a good full-screen editor, with a buffer that holds 1,500 characters. Editing commands include screen scrolls and page switches, Find and Replace. Sets of procedures can be switched in and out of the buffer as required and as space permits. Procedures can be saved individually or collectively.

The set of primitives is sensible, though short forms only are given of some standard primitives, like SE for Sentence and BF for ButFirst. A good feature of the syntax is the ability to include BBC * commands anywhere within a program line: the rest of the line is not automatically passed to the operating system as in BBC Basic. A less good one is the lack of specific local variables, except for those passed direct to procedures.

The set of graphics primitives is not extensive. For instance, you have to use operating-system commands to change default colours, alter the default windows, write text in the graphics window or fill shapes. The graphics window cannot be redefined in Wrap or Fence mode, when it always takes up most of the screen, leaving only the text window at the bottom. It can be redefined in Window mode, but you have to correct the origin by hand using VDU 29.

Benchmarks

Logo benchmarks are not fully standardised. We ran five reasonably common ones: Hilbert (see figure 2), Inspiral (see figure 1), and Circle to cover the graphics, a list-reverse procedure for non-graphic list processing, and a simple arithmetic benchmark. Timings are in seconds. Graphics timings are given with turtle displayed and (in brackets) with it hidden, which make quite a difference on some packages.

	Hilbert	Inspiral	Circle	Arith	RevList
Acornsoft	77 (58)	63 (54)	40 (20)	115	110
LCSI	49 (29)	50 (26)	44 (25)	88	28
LSL	55 (13)	88 (36)	90 (37)	38	26

Suppliers and prices

Acornsoft Logo, £69 including VAT from Acornsoft. Telephone: (0223) 316039
LCSI Logo, £69.95 including VAT from Tecmedia. Telephone: (0509) 230248
LSL Logo, £67.85 including VAT from Logo Software Ltd. Telephone: 01-891 0989. Schools should place orders via E J Arnold.

Acornsoft Logo

Acornsoft's Logo package is comprehensive to the point of going over the top: two chips, a disc, a cassette, three manuals, a reference card and sundry extra bits of paper, posters and so on. I almost expected badges and balloons to emerge from the bottom of the box. It is all elegantly put together, and though the manuals are not as inherently strong as the loose-bound volumes of the other packages they appeared reasonably robust.

Of the manuals, *Introduction to Logo* is an 89-page beginners' book, beautifully written and simply illustrated. *Logo* stretches to 163 pages, and is intended for those familiar with the computer and with Basic programming; it too is well done and well indexed. Neither contains much in the way of usable programs, but the package provides the luxury of 16 example programs and 11 extensions on both 40/80-track disc and cassette. Though the programs are not all major works, they do add up to an excellent illustration of the package's potential.

Among the extensions are screen dumps to Epson and Olivetti-type printers, as well as driver software for the BBC Buggy, Valiant and Jessop floor turtles only available as an optional extra for LSL and LCSI Logos. Also on disc/cassette are some mathematical functions not in-built, some property list functions, and machine-code interface primitives like Call. The example programs include a simple natural-language system, a mini-Prolog interpreter, a character definer, and various educational game outlines.

The list of primitives in the manual has over 200 entries, enough to tax the memory of anyone and more than twice as many as in LSL Logo. However, this difference is not a very accurate way of measuring the power of the two packages. Acornsoft Logo was written in BCPL and is not especially fast, particularly in list processing. In the graphics routines, too, it seemed frequently to stop in its tracks, presumably for garbage processing.

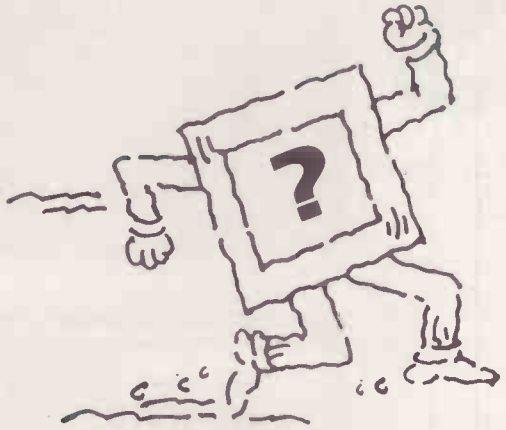
Acornsoft Logo is the only version to provide multiple turtles and redefinable turtles as standard. They are a real plus, making it possible to develop graphics microworlds quickly and simply. However, they do slow down the action markedly, and I found it quite difficult to program co-ordinated multi-turtle sequences using Logo's limited control primitives.

Similar facilities will be provided in LSL and LCSI Logo only through hardware sprite boards. Sprite boards should be faster and more powerful than software-generated sprites can be, but they are likely to cost around £100 to £150, putting them out of the reach of many users.

The Acornsoft Logo's text/graphics window arrangement is not easily adapted. There is a text window at the bottom, and a rectangular fenced graphics area above. The graphics window stays the same size, and does not default to whole-screen, in the Wrap and Window modes.

Conclusions

- **All three packages are above average in presentation and content, and all seemed reliable in use.**
- **LSL offers less than the other packages, with its poor editor, shorter list of primitives and lack of program support. It has several non-standard features, but it is speedy and easy to use.**
- **LCSI Logo is a well-rounded package which has fast and full list-processing capabilities.**
- **Acornsoft Logo is generally competent, though slower than LCSI. Its multiple redefinable turtles and good program support make it the winner in my opinion, as long as you have two ROM slots to spare.**



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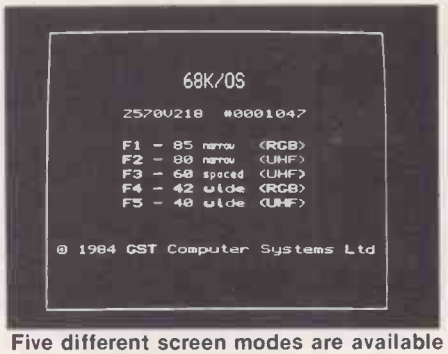
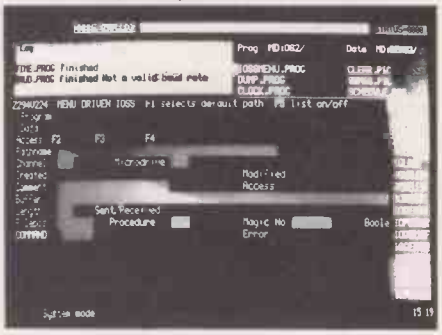
68K/OS

Chris Bidmead examines a multi-tasking OS for the 68000 cpu, now available on the Sinclair QL.



Five different screen modes are available from the opening menu.



The IOSS interface menu.

68K/OS was originally commissioned by Sinclair as the production operating system for the QL, and when the Sinclair machine was launched in January last year it was 68K/OS that was shown to the press. At that stage QDOS, which was supplied with the machine to paying customers, was something Sinclair began getting together in-house when it became clear that 68K/OS was not going to leave room for SuperBasic. Ironically, QDOS also got too big, and the first production machines were sent out with the notorius extra protruding ROM pack.

GST's product is now marketed as the alternative operating system for the QL. It is aimed at the advanced home user who wants to do a lot of machine-code hacking and write personalised utilities in high-level languages when they come on stream later. For the student of computer science, too, GST's 68K/OS will provide a low-cost experimentation system to support course work. It is also designed for the small independent software supplier who needs a cheap software development system.

Bare boards

GST has an agreement with Sinclair to sell the QL processor board — without case or keyboard — in conjunction with its operating system for OEMs who want to bring low-cost 68000 machines to the market. The operating system is also being evaluated by manufacturers of other 68000-based systems.

Transfer outside the realm of the QL is implicit in the design of the product. Like CP/M, it gathers all its machine-dependent aspects into a single module, leaving the bulk of the OS machine-independent and portable. GST claims to be able to port the system across to any other 68000 device within two to three months.

68K/OS is a single-user multi-tasking OS inspired by the Unix kernel. The main advantage over QDOS, apart from its device independence, is the ease with which windowing software can be written, as the operating system comes complete with an outer wrapping along the lines of Microsoft Windows.

The early evaluation kit came on a pair of 16K ROMs and required some fairly in-depth interior reconstruction to install on the standard QL. Purchasers of the production version of 68K/OS do not have to go through these traumas: conversion is simply a matter of slipping a small pcb into the expansion slot on the left-hand side of the machine. A set of utility programs on Microdrive is also supplied — see box.

The best news is that you do not lose QDOS. A switch on the board protrudes discreetly from beneath the QL's left edge, and allows you to revert to the Sinclair operating system at a touch.

On power-up 68K/OS signs on and displays options for five different screen modes, depending on whether you have a TV or dedicated monitor, and offers a 40- 42- 60- 80- or 85-character wide screen. The choice at this point affects more than the size of the characters, because the screen layout is adjusted accordingly.

On the Hitachi television we used initially we found the 60-column display the easiest to read. The "Getting Started" part of the GST manual was biased towards the 80-column display, so the layouts were slightly different, but it was not difficult to see what was going on.

After your selection of the screen mode the system loads Adam from the ROM. Adam is the user interface to the operating system, the equivalent of CP/M's CCP or MS-DOS's Command.Com. Using the operating system's Menu Manager it divides the screen into a number of different display and data areas, the precise layout depending on the capabilties of your monitor or TV. Adam makes use of the five QL function keys to select the basic functions — see box on page 82.

All code that runs under 68K/OS is re-entrant and position independent. As its name implies, position-independent code contains no absolute addresses, and can therefore be executed at any point in memory, which is essential when you are trying to run several independent processes simultaneously. Re-entrant code is code that does not alter itself as it runs, so that the identical routine can simultaneously form part of several processes.

Adam can run itself just like any other program; an illustrative exercise, even before mounting any Microdrives, is to do just that. A second copy of the Adam layout appears on the screen, overlaying the first but leaving the top line of the original Adam screen visible, like a pair of stacked card-index cards. You can repeat the process several times, building up a pile of Adam images.

Like Unix, 68K/OS sets independent default data directories and program directories, and the Adam screen provides a separate window for each. If you have chosen the TV type of display the two directory screens replace each other as you toggle with the F3 button. With 80 or more characters to the screen line there is room for the two screens to appear simultaneously side by side. In this mode the same F3 key swaps the cursor between the two areas.

Mounting

Also Unix-like is the idea of mounting devices. Maths purists will be delighted that under 68K/OS the drives are known as 0 and 1, but this will be yet another source of confusion to QL users who have come to know their drives as 1 and 2. The only time you really need the unit numbers is during the act of mounting. The full physical device names are MD0: and MD1:, to allow for a variety of non-Microdrive devices, but individual cartridges also have logical names.

Mount a cartridge called Mydata on MD1: and the directory will henceforth be known as MD:Mydata. When you have finished with Mydata you dismount it to tell the system it is no longer available. Adam provides options to perform this mounting and dismounting explicitly, but normally they are never used. The operations take place automatically as a by-product of setting the program or data default.

The mounting concept makes it easy to extend the operating system to include new devices — such as floppies, hard discs, etc. — as they come along, but is rather cumbersome when all you are dealing with is a pair of Microdrives. Once program and data cartridge have been mounted, Adam

is no longer available by default. You can still get to it by giving its full path name of

<logical device>:<filename>

in this case

ROM: ADAM

Alternatively you can change the default program directory to ROM:, access Adam, then reset the default directory to what it was before, giving its logical name. This happens quickly because Adam keeps the full directory of each mounted logical device. You can, of course, reset the directory by giving the physical name, but this will evoke an implied mount, re-reading the directory from the tape.

Adam has a third screen area, which is used to log session activity. Here the names of the various programs used during the session are allowed to accumulate, together with a note of what became of them.

At this stage we noticed that the TV set was incapable of displaying the row of tiny dots in the left-hand corner that are supposed to give an indication of processor activity. We didn't miss that very much until we came to run the time and data utility, which replaces these dots with a rather more useful digital clock.

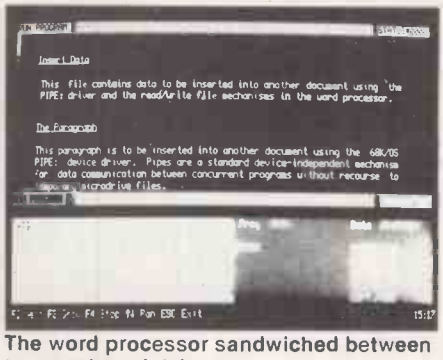
No doubt the television could have been adjusted to bring this into view, but on the Hitachi the internal control was hard to get at, and we were in no mood to fool with high voltages. As luck would have it, at this point a very handsome black monitor specially designed for the QL arrived from Microvitec. Now we were able to switch to 85 characters per line, and see a full screen of crisp, easily readable characters.

There is one crucial difference between 68K/OS and a single-tasking system like CP/M. All the components of CP/M are synchronous. 68K/OS, on the other hand, also supports asynchronous processes that take place in their own time, almost as if they were running on separate processors. One practical implication of this to the user is the way 68K/OS appears to be able to read and write to the Microdrives without pausing in its service of an application program.

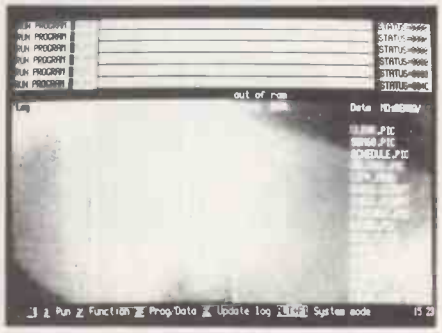
Aside from these asynchronous processes, the interface between the operating system and applications running under it divides into four categories of functions, each category having its own entry point. Specific functions within the categories are differentiated in the conventional way by loading a different function number into the D0 register.

One entry point, called the SP vector, is reserved for direct assaults on the hardware-dependent system primitives, notably the graphics routines. Software is provided to draw points, lines, blocks and conic sections, but these functions are strictly specific to the QL and so should be avoided by applications that aspire to be portable.

Another entry point, the input/output subsystem or IOSS, creates a connection



The word processor sandwiched between two copies of Adam.



Running multiple copies of Adam.

to device drivers, which are either standard to the operating system or supplied by the user. Device drivers can be interrupt driven, polled or run as asynchronous programs, but the interface with the IOSS ensures that whatever the level of complexity of the device driver, it simply appears as a subroutine to the rest of the operating system.

Limitations

Unfortunately hardware limitations mean that it still has not been possible to make the resident driver for the two RS-232 devices work entirely sensibly. You still have to put up with not being able to set separate baud rates for send and receive, so Prestel-type comms requires expensive additional hardware. If you want different baud rates on each line you have to confine communication to transmitting, and give up any idea of receiving; there can be no soft handshaking, for example. These hardware shortcomings are, frankly, tatty but QL users should console themselves with the thought that they could spend over twice as much on a Tandy 1000 and get no RS-232 at all.

A third entry point, the DFM vector, takes care of all the display-file manager calls. Display files are sets of linked lists retained in RAM that maintain the contents of windows, allowing them to scroll or be overlaid without loss of data.

The snag with windowing under SuperBasic is that if one window overlaps another the contents of the earlier window are destroyed. This can only be avoided by writing additional code that takes responsibility for checking for any damage done by overlapping windows and repairing it as necessary. Separate tasks therefore have to know what the others are up to. Display files, on the other hand, result in windows that can coexist, and even occupy the same physical location, without being mutually destructive. And you can actually scroll text through the windows without losing any of it.

The final entry point, the OS vector, is used to access the remainder of the hardware-independent functions like memory management, heap allocation and multiprocess handling. Of these the most novel is the menu manager, a collection of functions designed to make it easy for applications programs to provide a consistent user interface. It draws heavily on the window functions to create two kinds of special window: the menu window and the list-selection window.

The menu window writes a set of indestructible prompts and reads data keyed into input fields, which it also provides. Variable messages can be displayed, to provide context-sensitive help, for instance. The second kind of window displays a scrollable list of items, from

(continued on next page)

Utilities on Microdrive

Format.PRG — A program to format a new Microdrive cartridge or wipe an existing cartridge.

Copy.Prog — Copies program and data files one by one between cartridges.

Time.Prog — Sets system date and time.

Dump.Prog — Dumps a screen image to an Epson FX-80.

Edit.Prog — An easy-to-use screen editor with a help screen; a real joy compared with Quill, and a lot faster.

Draw.Prog — Lets you create drawings on the screen using a menu and two sets of hair-line cursors used for positioning rectangles, circles, ellipses, squares, lines, pixels. Text can be added and areas can be filled with various colours. Your keystrokes can be saved to a file which can be called up later. Not a serious utility — it is intended as a demonstration of how application programs can tap into the OS facilities.

Slides.Prog — Allows you to display serially a set of pictures created by Draw.Prog. Fun for demos.

Print.Prog — A program to print out a file. This is where you begin to miss the simplicity of CP/M, with its built-in Type command.

Rename.Prog — Renames files. Here again, you need a separate program to do what other operating systems take charge of themselves.

IOSSMenu.Prog — Lets you experiment with the input/output sub-system and also serves as a demonstration of the menu-handling abilities of the system.

Fount.Prog — An under-documented teaser for use with Edit and some predefined founts. There are no details about to how to create your own founts.

(continued from previous page)

which the user can make selections for transfer to the menu window.

Functions like memory management are, of course, crucial to an operating system. But you might be forgiven for asking whether the more exotic functions of windowing and menu management. should not rather be supplied as library routines, to be appended to application programs as needed. Why have them permanently taking up precious operating-system space? The ability to delete and rename files is conventionally a resident part of the operating system, yet CP/M and MS-DOS users coming to 68K/OS will be surprised to find they have to be loaded from the Microdrives as transient programs.

On the QL there may be some argument for this inversion. Because scrollable text-window routines are already part of the operating system and reside in ROM, an application package like a word processor does not have to pull all that code into RAM every time you load it.

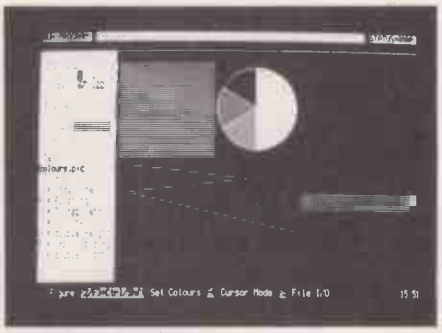
The advantage of an operating system that takes care of things like windowing becomes clear when you power up WP.Prog, the pre-release copy of the word processor GST plans to release to run under 68K/OS. It loads far faster than the Psion equivalent, as it only contains about 16K of code — though it is only fair to point out that the GST offering has fewer functions than Psion's Quill. This is partly because the tricky business of displaying and scrolling text through a window, which forms a large part of any word processor, is taken care of by the operating system. When it comes, the full word processor is destined to occupy a 16K EPROM for mounting on one of the spare slots on the 68K/OS plug-in board.

Out of hand

The windowing can get out of hand, as we discovered when trying to save text to a full microcassette from inside the GST word processor. An error window opens towards the top of the screen, inviting you to make more disc space. Thanks to multi-tasking you can do this by returning to Adam, expanding the Adam screen until you can see all the data directory, and then evoking Delete.Prog.

This utility also opens a window of its own to ask you to confirm the delete, and rather unnecessarily takes half the screen to do it. When this window closes again you expect to see the lower half of the screen restored. But in fact half the word processor screen popped up here. More curiously still, if you try to repeat the save and have not deleted enough files, the Disk Full warning pops up underneath the top half of the Adam screen, so you do not see it until you hop across to shrink the remains of the Adam screen.

The word processor is still in its pre-release stage, so it is not fair to judge



Graphics drawing.

The GST hardware.

it. But it does seem to indicate that the operating-system window manager — presumably now a mature part of the product — rather curiously allows an application package to think it is showing you a window, while another process of a lower priority is blocking the view.

This serves as a reminder that, as it stands, the operating system is not designed for fools and is not foolproof. I found, for example, that it is possible to corrupt the directory relatively easily. Log a cartridge called, say, Progsa on to mdl: and load a program from it into memory. Swap the cartridge in mdl: for a second cartridge — let's call it Progsb — and try setting it as the default program device.

The operating system will tell you that you cannot do this, as the directory — of Progsa — is already in use, signposting the activity of the process we have loaded. You might be inclined, by using Alt-F1, to kill the process that is causing the trouble. Don't! If you do, the system will write the directory back to drive mdl:, assuming that Progsa is still there. As it isn't Progsb will receive the Progsa directory, lose its own directory and consequently all hope of finding its own files again.

Attention to the details of true multi-tasking makes the addition of 68K/OS a great improvement on the standard QL. But it leaves you without any applications software, or even high-level languages to develop your own. An assembler is supplied as an extra, but one of the attractions of the 68000 generation of chips is supposed to be that we can say goodbye to assembler writing forever.

Even regarded as an assembler system, there is one very important utility missing — a debugger. Like the high-level languages, this is promised for the future. But until it arrives the system will require a lot of patience from its users. Significantly, GST has been developing what utilities there are under the Motorola Exormacs system and not under 68K/OS.

What we missed most in the new environment was SuperBasic, one of the best things about the QL as bought in the shops. GST hopes to offer a Basic of its own soon, and Fortran and Pascal are rumoured to be on the way.

Swapping programs and data with QDOS is also not a solution. The two operating systems use quite different formatting, and cannot read each other's cartridges.

Function-key assignments

F1 — Selects the Run mode. The program directory can be scanned using the cursor keys, and a program selected by pressing the Escape key when the cursor is against the correct directory entry. This copies the name into the command-line window. Alternatively the name of the program to run can be typed in the normal way.

F2 — Selects the function mode. This is used for setting up the default program and data drives or devices, or explicitly mounting or dismounting them.

F3 — Swaps the directory selection between program and data.

F4 — Updates the log and directory screens, something which is not done automatically at the termination of each program.

Alt-F1 — Takes you straight out of whatever you are doing and into the System mode. From here you can skip about between the various jobs currently running, expand or contract the window area on a particular display, suspend that job, restart it, kill it, or bring a completely new task to life. You can also perform a warm boot into Adam.

Conclusions

● 68K/OS is an ambitious, fully fledged multi-tasking operating system for the QL and other 68000-based machines. It comes with excellent documentation on an easy-to-fit expansion board that allows you to revert to QDOS at the touch of a switch.

● The dearth of languages makes 68K/OS something of an anomaly — a development system for what is supposed to be a high-level language chip, with the only language being ASM.

● 68K/OS costs £99.95, which includes a brief Users' Manual. Purchasers of the system are going to want to go into it all a lot more deeply, and won't mind forking out £4.95 for the highly detailed and well-written System Programmers' Manual.

● Unlike CP/M, 68K/OS does not include the assembler as a standard operating-system utility, and it will cost you another £39.95.

A SELECTION FROM OUR PRODUCT RANGE

High Level Languages

		CP/M	CP/M-86	MS-DOS	PCDOS
BASIC INTERPRETER	Microsoft	●		●	●
BASIC COMPILER V5.3	Microsoft	●		●	●
BUSINESS BASIC COMPILER	Microsoft			●	●
C COMPILER	Microsoft			●	●
CBASIC	Digital Research	●	●		
CBASIC COMPILER	Digital Research	●	●	●	
CIS COBOL	Micro Focus	●	●		
COBOL COMPILER	Microsoft	●		●	●
FORTRAN COMPILER	Microsoft	●		●	●
LEVEL-2 COBOL	Micro Focus	●	●	●	●
muLISP	Microsoft	●		●	
muMATH/muSIMP	Microsoft	●			
PASCAL COMPILER	Microsoft			●	●
PASCAL MT+	Digital Research	●	●		
PL/I	Digital Research	●	●		
PROFORTRAN	Prospero	●	●	●	●
PROPASCAL	Prospero	●	●	●	●

Low Level Languages

		CP/M	CP/M-86	MS-DOS	PCDOS
MACRO-80	Microsoft	●			
PROGRAMMERS UTILS (RASM)	Digital Research	●	●		

Program Development Tools

		CP/M	CP/M-86	MS-DOS	PCDOS
ANIMATOR	Micro Focus	●	●		
BUG	Phoenix Software	●			
DISPLAY MANAGER	Digital Research	●	●	●	
FTNUMB	Micrology	●			
LEVEL II ANIMATOR	Micro Focus	●	●	●	●
PASM	Phoenix	●			
PDEVELOP	Phoenix	●			
PLINK	Phoenix	●			
PLINK II	Phoenix	●			
PLINK-86	Phoenix		●	●	●
SID	Digital Research	●	●		
SPEED PROGRAMMING PACKAGE	Digital Research	●	●		
XLT-86	Digital Research	●			
ZSID	Digital Research	●			

Utilities/System Tools

		CP/M	CP/M-86	MS-DOS	PCDOS
CLIP	Keele Codes	●	●	●	●
DESPOOL	Digital Research	●			
DISKED-2	Slogger Software	●			
DISKMAN	Slogger Software	●			
DISKORG	Slogger Software	●			
DISKTOOLS-1 (DISKMAN & DISKORG)	Slogger Software	●			
DISKTOOLS 2 (DISKTOOLS-1 & DISKED-2)	Slogger Software	●			
dUTIL (FOR DBASE-II)	Fox & Geller	●		●	●
FILESHARE	Micro Focus	●	●		
DEC RAINBOW SERVICE S/W:	Silicon Valley Corp.				
(1) Formal/Verify Service			●		
(2) Autorun Service			●		
(3) Function Key Service			●		
SERVICE S/W VOL. I (1, 2 & 3)			●		
THE OPERATING GUIDE	Decision Systems	●			

Sorting

		CP/M	CP/M-86	MS-DOS	PCDOS
MSORT	Microsoft	●		●	●
SUPERSORT	Micropro	●	●	●	●

Code Generators

		CP/M	CP/M-86	MS-DOS	PCDOS
AUTOCODE	Stemmos	●		●	●
FORMS-2	Micro Focus	●	●	●	●
QUICKCODE	Fox & Geller	●		●	●
SOURCEWRITER	Softwright	●	●	●	●
THE LAST ONE	D.J. 'Al' Systems	●	●	●	●
THE LAST ONE—COMPACT	D.J. 'Al' Systems	●	●	●	●

Telecommunications/Conversions

		CP/M	CP/M-86	MS-DOS	PCDOS
BACOEBIT	Comley	●			
BACSCOPY	Comley	●			
BSTAM	Byrom Software	●	●	●	●
BSTMS	Byrom Software	●			
ICL CO3 EMULATION (Bulk)	Synchro Systems	●			
ICL CO3 EMULATION (Interactive)	Synchro Systems	●			
ICL CO3 EMULATION (Interactive & Bulk)	Synchro Systems	●			
REFORMATTER CP/M ↔ DEC	Microtech Exports	●			
REFORMATTER CP/M ↔ IBM	Microtech Exports	●	●		

Word Processing/ Text Editing/Editors

		CP/M	CP/M-86	MS-DOS	PCDOS
EDIT-80 V2.02	Microsoft	●			
MAILMERGE	Micropro	●	●	●	●
MEMOPLAN	Chang Labs	●	●		●
WORD	Microsoft				●
WORD WITH MOUSE	Microsoft				●
PARAGRAB	Focus	●			
PEDIT	Phoenix	●			
PLANSTAR	Micropro				●
PMATE	Phoenix	●		●	●
SPELLSTAR	Micropro	●	●	●	●
STARBURST	Micropro				●
STARINDEX	Micropro	●	●	●	●
WORDMASTER	Micropro	●	●		
WORDSTAR	Micropro	●	●	●	●
WORDSTAR PROFESSIONAL (WS+MM+SS+STAR INDEX)	Micropro	●	●	●	●

Databases/Data Management Systems

		CP/M	CP/M-86	MS-DOS	PCDOS
DATASTAR	Micropro	●	●	●	●
dBASE-II	Ashton Tate	●	●	●	●
dBASE III	Ashton Tate				●
FRIDAY	Ashton Tate	●	●	●	●
FRAMEWORK	Ashton Tate				●
INFOSTAR	Micropro	●	●	●	●
REPORTSTAR	Micropro	●	●	●	●

Financial Accounting

		CP/M	CP/M-86	MS-DOS	PCDOS
INCOMPLETE RECORDS SYSTEM	MPI	●	●	●	●
NOMINAL LEDGER	Padmede	●		●	●
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BBC utility ROMs

David Oborne looks at what you can do with Toolkit and Caretaker plugged into your BBC Micro.

ALL SORTS of programs and functions can now be purchased that sit in the ROM sockets of the BBC Micro. Their great value is that there is no need to load the programs from tape and disc, and normally they do not take any appreciable computer memory from the user. As well as application programs such as word processing, databases and spreadsheets, ROMs can contain any utility software to help programmers in their task. Graphics ROMs, alternative programming languages and Basic and machine-code utilities can now all be bought for a few pounds.

In my machine I have two Basic utility ROMs which have increased my Basic programming productivity. The Toolkit ROM comes from Beebug Software, and Caretaker is supplied by Computer Concepts. Some facilities are common to both packages, but when they are used together they offer a full range of helpful utilities. Both packages arrive with supporting documentation, which is easy to read and understand, and with full instructions on how to insert the ROM into the micro.

No problems

I found no problems with either ROM. As with most ROM-based software, all of the functions from the two ROMs are accessed using * commands.

As soon as you insert Caretaker, you are provided with two useful facilities. Whenever you make a mistake in the syntax of any Caretaker command, the correct syntax is automatically given. Caretaker gives single-key entry for most Basic keywords: holding down Tab and another key will enter the Basic command word for you. For example, pressing Tab and M writes the command Mode to the screen. Pressing Tab and A produces Auto, and so on.

The single-key entry system can be turned off with a *Normalkey command so that you can use the *Tabstops command, which makes the BBC Micro's Tab key work like a typewriter-style Tab key with tab positions that can be defined by the user.

Both ROMs offer a couple of facilities which really have only limited usefulness. From Toolkit, *Old and *New do what the Basic versions of these commands do, with the difference that you can use them from within a program. Similarly, *Report gives a report of the last error message plus the line number. This saves you having to type Report and Erl. The *Clear command clears all variables, including the integer variables A% to Z%. Caretaker's *Cursor toggles to turn the cursor off or on, though the appropriate VDU commands work just as well and have the advantage that you can play around with the cursor in programs for other machine that don't have Caretaker installed.

More accurate

The main value of the two ROMs lies in helping Basic programmers to enter and check programs faster and more accurately. For example, both offer the facility to search for and replace a string. On the whole I prefer the way in which Toolkit does this, which is menu driven from the *Util command. Option 1 allows you to search for any string, including Basic keywords. Option 2 does the same but replaces the string with another. Another major plus for Toolkit is that the *Util command lets you restrict operations to any range of program lines that you want.

The only problem with the *Util options is that the strings which are searched for or replaced are highlighted in colour, as are the instructions, so they may be difficult to read on monochrome monitors. You can turn off the colour facility with a *Off command, but it is one more thing you have to remember to do. Both Toolkit and Caretaker commands can also be preceded by a unique letter in case the command conflicts with another ROM. So Toolkit's letter is B giving, for example, *BUtil, *BOn, *BOff, and Caretaker's is C.

Caretaker's way of doing all this is through one command, *Exchange,which has a lot of possible parameters. However, you cannot simply search, you can only search and replace. So to find all occurrences of the string "Caretaker", for example, you need to *Exchange "Caretaker" with "Caretaker", which is rather laborious. Also, Caretaker only reports the line numbers at which a replacement has been made and you cannot see the actual line as you are able to with Toolkit.

A further annoying feature of Caretaker is that you have to tell it to search for Basic keywords. It is easy with Toolkit: all you have to do is to put a £ sign in front of the appropriate word. However, with Caretaker you have to tell it to search for the keyword token number which is put between two vertical brackets. So instead of looking for £Input, for example, you have to search for |232|. Although Computer Concepts provides a Basic token table in its manual, it is not as easy as just having to type in the word with £ in front.

However, Caretaker does allow the facility to replace strings only on command. You may not want to replace all occurrences of variable A with B, so you can arrange for Caretaker to ask each time, in which case it does give you the full line. Also, whereas both Toolkit and Caretaker have wild card facilities, Toolkit only searches for single wild card characters. Caretaker has the additional facility of searching for and replacing groups of characters. For example, searching for Jenk* would find Jenkins, Jenkinson, Jenkinsop, etc.

Menu operation

In Caretaker list procedures, functions, variables, arrays and the like are done using the *LVar command with a series of optional parameters. Toolkit does it from the more user-friendly menu within *Util.

The Basic programmer often has to strike a balance between two conflicting needs of clarity and memory. The program has to be easy to read so that debugging can be done with the minimum of searching. This means leaving spaces, including Rem statements, and not having too many statements on one line. However, this wastes memory, and a

Summary of commands

	Toolkit	Caretaker
Supplementary commands		
NEW	NEW	—
OLD	OLD	—
CLEAR	CLEAR	—
CURSOR ON/OFF	—	CURSOR
Commands common to both ROMs		
String search	UTIL1	EXCHANGE
String replace	UTIL2	EXCHANGE
Basic word search/ replace	£	Token number
List procedures, functions	UTIL1	LVAR
List Variables, Arrays	UTIL4-8	LVAR
Remove spaces, etc.	PACK [S,R]	SQUASH [S,R,M]
Renumber whole or parts of prog	RENUMBER	RENUMBER
Recover bad program	RECOVER	RETRIEVE
Move program in memory	MOVE	MOVE
Merge two programs together	MERGE	MERGE
Memory Information	FREE	STATUS
Machine-specific commands		
Screen edit Basic lines	EDIT	—
Error trap and Edit	ON	—
Hex and ASCII dump of memory	MEMORY	—
Screen dump to file	SCREEN	—
Verify memory with file	CHECK	—
Produce a program listing	—	EXPAND
Save part of program	—	PARTSAVE
Insert program into one in memory	—	INSERT
Save/Load function keys	—	KEYSAVE/ KEYLOAD
Set Tab function	—	TABSTOPS

useful feature of any Basic utility ROM allows you to avoid such waste.

Both ROMs have facilities for stripping out spaces and Rem lines, and will strip out spaces where you would not otherwise be able to do so. For example, if you had the statement

IF A = B THEN C

there must be a space between B and Then. Otherwise, the Basic interpreter, which works in a left-to-right direction, would read the statement as if it were looking for a variable BThen. Because the packing utilities are able to know that B, Then and C are separate entities, they can tokenise Then first to produce a meaningful

IFA = BTHENC

to make a saving of five bytes. Toolkit tells you how many bytes it has saved.

Caretaker scores

Caretaker scores over Toolkit in so far as it has the facility for combining statements to make large, multiple statements separated by colons. Because each time you enter a new line number you use four bytes, this can be quite a significant saving of three bytes per line. Because it can tokenise the keywords first, the statement lines that you end up with are often longer than you could put in yourself. Having such large statements makes it very difficult to read a listing of the program, so Caretaker includes a function, *Expand, that lists the program with one statement per line. It separates lines at a colon and makes it easier to read a program.

Both ROMs allows you to moves lines around in the program. So you could take a section of the program — say some procedures — from the end and put them in the middle of the program. This is very useful for untidy programmers who like to end up with a neat program in which common procedures and functions are grouped together.

Toolkit easy

Toolkit does this through its list of *Util options. You type in the first and last line number of the segment to be moved, and the line number after which the segment is to be moved to. If the line numbers are all out, Caretaker's solves the problem by doing it all in one go using the *Renumber command. For example, *Renumber 42,2,168,180 will renumber and reposition lines 160 to 180, in steps of two starting at line 42. The only problem occurs if there are more lines to be inserted than there are available line numbers: then *Renumber does not work, returning an error message. First you have to create the right amount of space using *Renumber with a large enough gap size between lines, and then renumber the appropriate section. But all in all, Toolkit is easier for moving program lines around.

The other common facilities work in the same way in each ROM and often they have the same name. To recover a bad program with Toolkit you use *Recover; with Caretaker you use *Retrieve. To merge a program from disc/tape to the current program, overlaying common lines, you use *Merge. To renumber the program or part of the program you use *Renumber. Caretaker's does not use any extra memory. To move the program up or down in memory you use *Move. Finally, to report on the memory status with Toolkit you use *Free, while with Caretaker you use *Status.

In the areas where the two ROMs differ, Toolkit's strength is in editing Basic programs while Caretaker is best at playing around with program segments and using disc or tape to store them.

The main facility of Toolkit is the *Edit command, which allows quite sophisticated screen editing of Basic programs. With the Up and Down cursor-control keys, it enables the user to move forwards or backwards through the program. Unfortunately, it only prints lines down the screen; consequently when moving backwards through a program it is only the line numbers that tell you where you are.

Irritations

In Edit mode you can use the left and right cursor keys to move along the line to the point that needs changing, and make the alteration without having to use the Copy key. Any changes made to the program line will be stored when you pass to the next line. With very long, multi-statement lines this can be a great time saver. If you suddenly find you need another statement in the program, pressing Ctrl and Tab together will cause an additional line to be added to the program, providing there is room to insert the line without overwriting an existing line.

There are two minor irritations associated with *Edit. First, mode 7 is automatically selected, which is annoying if you program in mode 3 to be able to see whole lines on a screen. Secondly, as soon as *Edit is entered, all variables except the integers A% to Z% are cleared. This can

(continued on next page)

Suppliers and prices

Caretaker costs £33.35 including VAT from Computer Concepts, Gaddesden Place, Hemel Hempstead, Hertfordshire HP2 6EX. Telephone: (0442) 63933.

Toolkit costs £27 including VAT plus 50p post and packing from Beebugsoft, PO Box 109, High Wycombe, Buckinghamshire HP10 8HQ. Telephone mail-order service: St. Albans (0727) 60263.

Utility ROMs

(continued from previous page)

be annoying if you want to check the value of a variable before making a change to a program.

Another command associated with *Edit is *On, which is convenient for debugging. If a program encounters an error when running, the *Edit facility is automatically entered at the line which was in error, and the cursor is moved either to or near the point in the line which was in error. The only problem with this facility is that all values are cleared, which is annoying for all users, and all error reporting is done in colour, which is annoying for those with monochrome monitors.

The final three facilities in Toolkit deal with the computer memory itself, rather than the program. The *Memory command provides hexadecimal and ASCII dump of the memory between two addresses, and is useful for seeing where information is stored in the computer. The *Screen command saves a screenful of information to a file, which is very useful for instant screen displays. Finally, *Check checks that the contents of the computer's memory between two addresses is the same as that in a disc or cassette file. Essentially it is a Verify feature that saves you from losing information through it not having been stored correctly. Since discs are usually reliable, its main value is for tape users.

Play around

The main individual features of Caretaker allow you to play around with parts of programs. For example, you can save parts of programs on to disc or cassette using the *Partsave feature. So if you have developed a properly structured program which is composed of a number of procedures and functions you can use * Partsave to create a new disc or cassette of the program parts, which can be used later. When you start a new program you can *Merge the small program segments that are stored as separate programs into your new program using either Toolkit or Caretaker, or with Caretaker you can *Insert them.

The *Insert command enables you to insert the program segments that are stored on disc or cassette into the program in memory without overlaying existing program lines. It does not matter if the line numbers are all out, as *Renumber will see to that. Along with *Partsave, this is an invaluable facility since you can develop new programs from old ones without having to type in the program segments again.

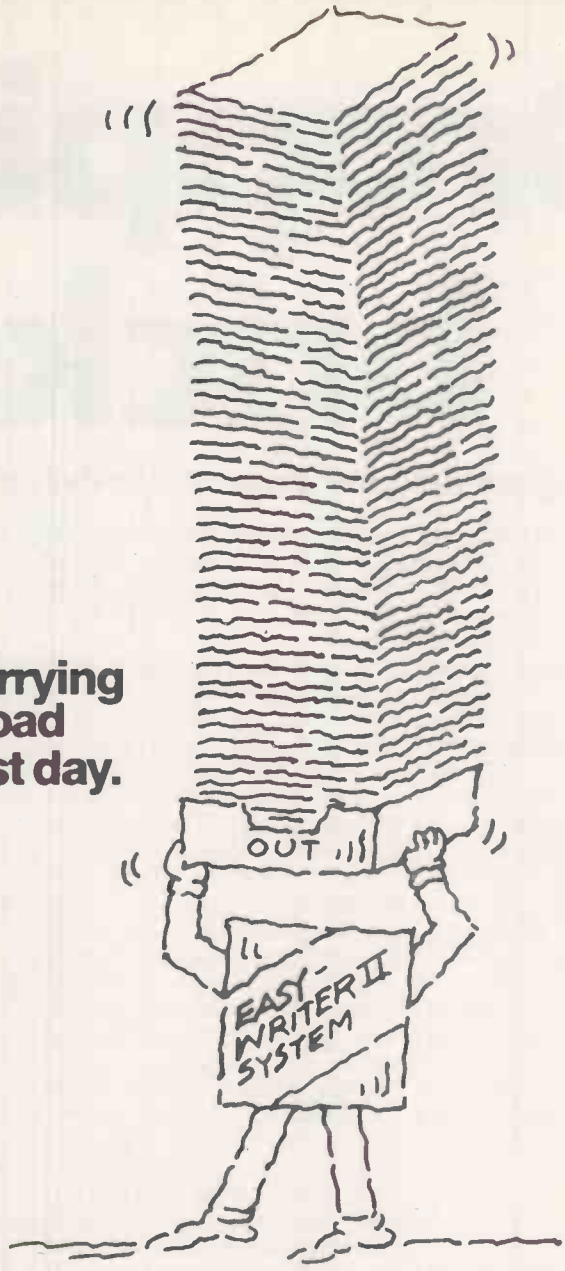
While Toolkit allows you to save the screen to a file, Caretaker saves another important memory area, the function keys. Using *Keysave or *Keyload you can tailor the BBC Micro keyboard to the task in hand. For example, you may want to set up the function keys differently when producing an assembly-language program than when writing one in Basic. Caretaker allows you to do this without having to go to the bother of typing in the key definitions each time.

Conclusions

● Both Toolkit and Caretaker provide an invaluable aid to the programmer in use each one complements the other.

● Priority in the ROM sockets is immaterial since both use difference command words for the main features. When the command words are the same, such as *Merge or *Move, they do the same thing anyway.

● The BBC Micro, is an extremely powerful machine. With Toolkit and Caretaker inside it, the ability of the programmer to make it work efficiently is given a substantial leap forward.



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Dropping bricks

Some tips for programming the game of Pferdeäppel, suggested by David Levy.

THE SCATOLOGICALLY NAMED Pferdeäppel is marketed in Germany with the subtitle "The Funny Jumping Knights Game". It is the brainchild of the brilliant games designer Alex Randolph, an American who for some years now has lived in Venice. Pferdeäppel is simple to learn and great fun to play, but for some inexplicable reason it appears not to be on sale in the U.K.

Pferdeäppel is played on an eight-by-eight board by two players, each of whom has one horse. White, who moves first, has a white horse and is the defender. The other player has a brown horse and is the attacker. The players move alternately, and the horses move in exactly the same way that a knight moves in chess: two squares in horizontal or vertical direction and then one square at right angles to the first part of the move. From the initial position White may therefore move from h1 to either g3 or f2, while Brown may respond by moving from a8 to either c7 or b6.

40 bricks

At the start of the game there are 40 bricks, 28 of them brown and the other 12 golden. When making a move with his horse, a player must put one brown brick on the square from which his horse moves. When a horse has been moved a player may, as part of the same move, put another brown brick on any vacant square, although neither player is permitted to put a brick on the last remaining flight square of his opponent's horse. If and when all the brown bricks have been dropped the golden ones are used, and an extra golden brick may be added after moving his horse if a player so wishes.

A player's horse may move to almost any square which is not already covered by either a brown or a golden brick. The only restriction is that a player may not move to a square one move away from the square currently occupied by the opponent's horse.

The object of the game is slightly different for each of the players, although there is the common aim of running the opponent out of legal moves. White tries to stave off being trapped for as long as possible, and if White is trapped while there is still at least one brown brick unused he loses the game. Brown then scores one point for each brown brick unused.

White wins if he is trapped when there is at least one golden brick on the board, and then scores one point for each golden brick on the board. If he survives until all the golden bricks have been used White scores 24 points rather than 12. If White is trapped at exactly the moment when the last brown brick has been put on the board, the game is a draw and neither player scores any points. If Brown runs out of legal moves at any stage, White wins the game and scores 24 points.

The differing aims of the two sides mean that the strategy for each of them is also different. One preliminary observation, which is rather obvious, is that Brown should not place any bricks on the board unless in doing so he can force a win. In other words, if the tree search spots a forced win for Brown, it is perfectly acceptable for Brown to put one or more bricks on the board voluntarily, provided that they form an essential part of the winning variation. Otherwise Brown should never add a brick of his own volition.

It is not difficult to appreciate that mobility — usually defined as the number of legal moves a player can make — is the key to success. White should always try to maximise his own mobility, since with a wider choice of moves White is more likely to be able to stave off being trapped.

It is well known from chess that those pieces with maximum mobility are usually those situated near the centre of the board, while those near edges and corner squares are normally far more restricted. But in Pferdeäppel it is quite possible for most of the central squares to be covered in bricks, in which case it is less obvious which squares offer the greatest mobility.

There is another factor affecting mobility which makes matters even more complicated. A horse which can legally move to any one of, say, four different squares will normally be considered to be more mobile than a horse which has only two legal moves. But if each of those four squares was, in itself, only good for one legal move, while each of the two squares would allow the horse to move to three further squares, a move to the 2 square might well be better than a move to the 4 square. In other words, you must not only take into account the immediate mobility from a square, you must also consider the potential mobility from that square. With this in mind, the program's evaluation function can be of the form:

```
If position is a win Then score (1,000 x
  winning score) Else
If position is a loss Then score (– 1,000
  x losing score) Else score (White's
  mobility – Brown's mobility)
```

The tree search can perform a full-width analysis of the game tree to a fixed depth. If it encounters any drawn positions at the terminal depth the program should, if it is playing White, score a draw as −500, while if it is playing Brown it should score the draw as +500. This will encourage it to take a draw as Brown if it cannot see a forced win by the time that the brown bricks have been used up, and to avoid a draw as White if it cannot see a forced loss before the golden bricks begin to drop.

Proximity

How should the mobility measures be quantified? The fact that you need to consider potential mobility as well as immediate mobility has already been established, but there is one further factor worthy of inclusion: the proximity between the two horses. If the horses are near to each other, moves by the brown horse will of themselves create problems for the defender, since the brown horse will drop a brick in the vicinity of the defender. If the two horses are far away from each other, Brown may, if he wishes, drop his extra brown brick near the white horse, but he does not have the luxury of putting two bricks near to White.

The measure of White's mobility may therefore be

```
White's immediate mobility + White's
  potential mobility + D
```

where D is a multiple of the number of legal moves required for Brown's horse to reach the square currently occupied by White's horse. White's immediate

mobility is simply the number of legal moves that White's horse can make from its current square.

So White's potential mobility may be expressed as a multiple of

(1/2 × number of squares White's horse can reach in two moves)
+ (1/4 × number of squares White's horse can reach in three moves)
+ (1/8 × number of squares White's horse can reach in four moves) + ...

although your program may take rather a long time to compute these numbers. The two multipliers that I have indicated — one for the distance D and the other for potential mobility — should both be determined by one of the learning methods described in my earlier articles. From my limited experience with the game I suspect that D will turn out to be more important than potential mobility, so try starting with a relatively high value for the D multiplier.

Brown's mobility is less important, but not insignificant. First, Brown may not run out of moves without suffering the indignity of a 24-point loss, so the question of potential mobility is significant there. Also, if Brown's mobility is severely limited he will find it more difficult to move near to White's horse, and White will find it easier to increase the value of D. For Brown's mobility I would suggest employing the similar measure

Brown's immediate mobility + Brown's potential mobility

and that this value be subjected to another multiplier, also determined by an iterative learning process.

End of game

I have already mentioned that the search should be full width to some fixed depth, but there is also one exceptional case to consider. This is a test for an end-of-game condition in the terminal position. If during the course of calculating the terminal score for a position the program finds that one side has zero immediate mobility, but the other side has at least one legal move, the program knows that the side with zero mobility must lose the game on its next move — apart from the drawn situation. This might be the side to move next in the terminal position, or its opponent. The program should therefore score such terminal positions as wins, with the number of bricks multiplied by 1,000 or −1,000 as appropriate.

Sorting the moves in order to speed up the alpha-beta search is not difficult. When generating a group of moves the program should first examine those which offer the player concerned the greatest immediate mobility. The search should proceed iteratively: it should first perform a one-ply search and sort the moves; it then does a two-ply search, reordering root moves when necessary, and so on.

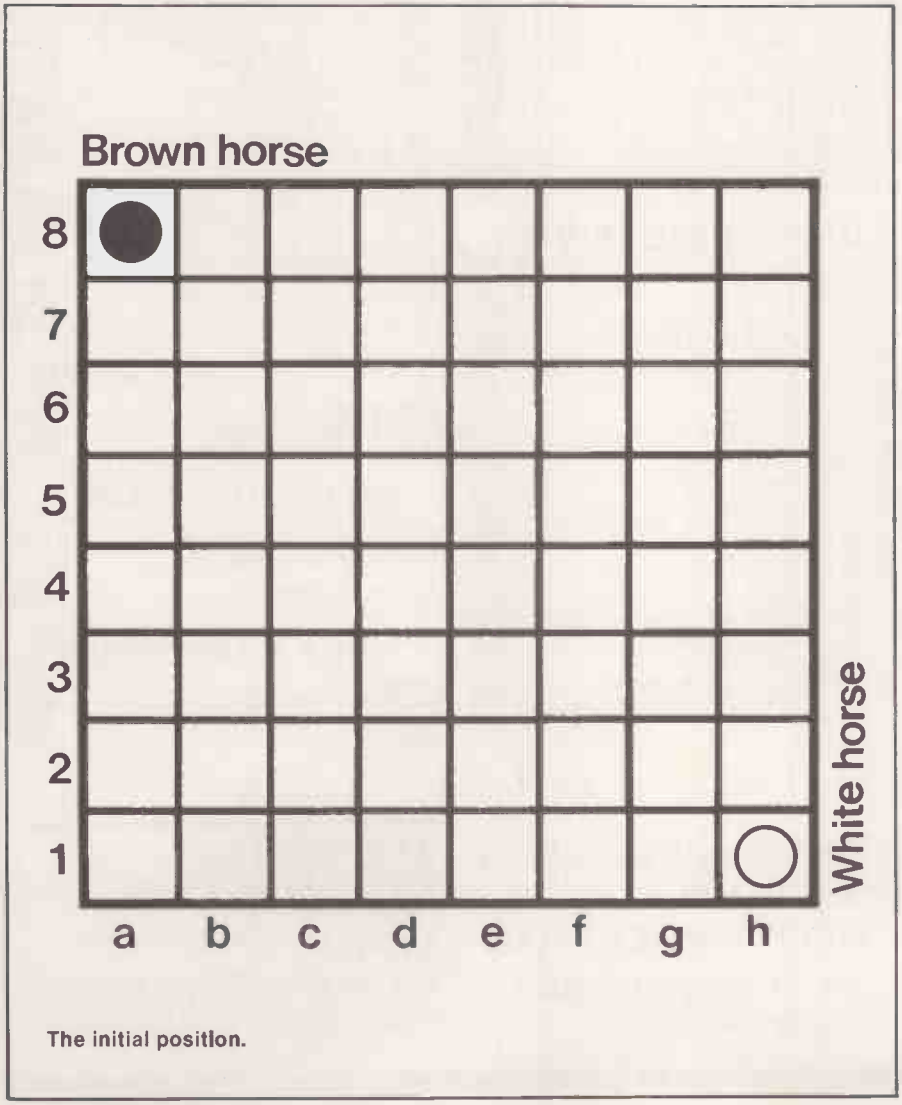
Since mobility is often very low, particularly late in the game, your program might well be able to perform searches of up to 20 ply if you write in assembler, but this will depend on whether you are able to restrict the branching factor of the tree by omitting many of the inferior drops that can be made. Even programs written in Basic could, with the right multipliers in the evaluation function, play quite a good game with only a six- or eight-ply search.

Branching factor

I have already explained that Brown should only put extra bricks on the board if a forced win can be detected in the tree search. Obviously it is to White's advantage to drop extra bricks at every possible moment, but if your program were to examine every possible drop in combination with each legal White move the branching factor would become very high. I would suggest that the program consider White putting an extra brick on the board only on the square furthest away from the White horse, and on those squares to which Brown may move on his next turn.

Pferdeäppel is one of those games where it may, from some point, be possible for your program to analyse exhaustively up to the end of the game, as there are a finite number of bricks to be dropped before the game ends. How far from the end of the game such an analysis is possible will depend largely on how efficiently your program is written, and which programming language you use. I would suggest that you carry out a number of experiments on positions where only eight, 10, 12, 14 ply or more remain to the end of the game, in order to determine roughly how long it will take your own program to play perfectly from such positions. You can then decide, for each playing level, at what stage the program should switch to the end-of-game search.

If you have a program level which normally responds in an average of, say, 10 seconds, you might consider it worthwhile allowing 20 or 30 seconds for an end-of-game search, or even longer. You then have the option of making the program think in its opponent's time, so that if the user makes a predicted move the program can reply more quickly. Then, any time saved earlier in the game can be used for a deep endgame search, while still keeping to the target average time per move.



The initial position.

Public knowledge

Glyn Moody introduces this month's special section detailing the possibilities that public networks and databases hold in store for micros users.

THE MICRO REVOLUTION represented a triumph of the individual over the institution. Gone were the days when computing meant DP departments graciously allowing the uninitiated to use the jealously-guarded mainframes. Micros meant real, personalised processing power that not only sat on your desk, but was completely at your disposal.

However, this tended to encourage isolation. Replacing the hollow-eyed, polo-neck sweater wearing computer junky that used to wander about computer installations late at night, came the personal-computer addict. Sufferers from this vice would retreat to their rooms with a micro and never be seen again.

Turning tide

But the tide is turning. Gradually it is being realised that perhaps more important than the narrow personalised power which micros offer is the possibility of using them as windows on an almost limitless world of information. In fact, micros have turned out to be just the thing to tap all the promised power of the information revolution.

The first and simplest example of a public network that allows you to access large databases of information was Prestel. Initially telephone lines and modified TVs with special keyboards were used to call up some of the thousands of pages stored on the central Prestel computers. But like many other brilliant British ideas, Prestel was badly marketed for many years and until recently has been a failure in terms of the size of its user base.

If the situation is now changing it is largely because micros can be easily adapted to function as Prestel terminals. In this way, for very little extra cost, you can now access some 350,000 pages currently on offer. They range from financial information and updates on the weather, sport and consumer prices, to more specialised sections. One of these is specifically aimed at micros, Micronet 800. It requires an extra subscription and currently boasts about 30,000 subscribers. It also accounts for more accesses to Prestel than any other single section.

Although Prestel possesses a wide range of information, it is hampered by the fact that its technology is old. Information transmission is slow, and there are no advanced search techniques. If you want to find out about, say, IBM you just have to look everywhere that is likely to have information on it.

But the large, specialised databases that are appearing in increasing numbers present you with a simple range of commands that can be used to search out particular spheres of knowledge. For example, you could specify IBM as a search topic and the host machine would scan through all its data. The result would most likely be useless, because the search topic specified was too broad. Instead, you could narrow your research by including limiting contexts, such as IBM and micros and the U.K. and 1984. The combination of all these factors would then produce a usable, though not necessarily useful list of information.

Developments in the public database world are proceeding in two main directions. First, there is a mad rush to acquire on-line rights to just about everything printed. The general philosophy is that knowledge is power, and that even if they are not viable now, the information sources could one day prove profitable. To give an idea of the scale of things, the American service Dialog has about 75 million items currently and is still growing.

Improvement

Secondly, as databases grow the search techniques used to access them are improving. This is partly a question of computing power — how quickly the host mainframes can sort through the information they hold. The way in which the information is stored is also crucial. From using limited searches on keywords only, which act as limited indexes, databases have progressed to full-text siftings.

Also releated is the way in which the search is carried out. The commands available are gradually being refined and made more powerful, and you can expect to see forms of artificial intelligence beginning to play a role in the years to come. In other words, the database will try and understand what we are looking for and help us, rather than blindly stumbling through its huge information banks.

Many databases are now starting to add electronic-mail facilities to their services, so allowing users of a particular system to exchange information and requests. Otherwise there are the dedicated electronic-mail systems, of which the best known in the U.K. is Telecom Gold. In a sense, an electronic-mail system is like a very specialised database. Mail sent is stored in the host machine and then accessed or searched for by the recipient. In both cases the idea of a central mainframe or mini acting as a mediator of subsidiary micro communications is present.

Integrity

The whole development of electronic mail and databases raises questions regarding data privacy and integrity. Last year's Data Protection Act was at least nominally designed to prevent abuses of database information held on individuals. In particular, it aims to regulate the transfer of information, which in turn impedes cross-referencing. But as databases and search techniques become more extensive and sophisticated, so it will become easy for anyone — including governments — to build up detailed composite files on individuals, companies and so on.

Correspondingly, electronic mail presents the perfect surveillance medium, where data is presented in a convenient computer-readable form. Searching for keywords and phrases would merely require computers with the necessary raw processing power. The recent flurries of excitement over the possible breaches of Prestel's security emphasise the importance attached to data integrity.

Public networks, both as sources and as channels of information, represent one of the most significant steps beyond the circumscribed world of the stand-alone computer. They enlarge the private domain of the micro to include the outside world.

Keep in touch

Electronic mail is not just for commercial users but for the individual with a single micro too. Chris Bidmead explains the various systems available.

SURVEYS confirm what we all suspect: the postal service is in decline. Luckily, information technology is providing a new approach to correpsondence, and one that is often faster and cheaper than the postman's sack.

The answer lies in the telephone. In the U.K. the telephone network operates well below capacity for most of the time. Apart from the peak between 11a.m. and 11.30a.m. during workday mornings, its daytime use has been estimated at around 60 percent of capacity. In the small hours between midnight and 6a.m. the system is hardly used at all.

Hence the recent promotion of electronic mail. You may be thinking that the new heavyweight technology that suits big company budgets is not for you. For them it is a natural development of existing commercial services like telex and fax, and like these two conventional communications systems, electronic mail is out of reach to the individual user.

However, the micro has brought word processing down to earth, and is about to do the same for electronic mail. The chances are that if you are reading this you already have access to the capital equipment that represents most of the expense: the computer. A modem need set you back no more than an additional £50 to £60 unless you want to be fancy. The subscription to the electronic mail service comes cheaply at, say, £12 per month, or even free if you confine yourself to correspondence via one of the many public bulletin boards — see *Practical Computing* December 1984. The only other expense is the cost of telephone calls, but if your early enthusiasm carries you away the phone bill can come as a terrible shock.

Although it is quite possible to set up a simple two-way electronic-messaging system by connecting a pair of micros together via modems and the public telephone line, true electronic mailing comprises a network of addresses. Like the conventional telephone system, it allows you to contact anyone on the network provided you know their identity code. It is a sophisticated system that requires at least one intermediate computer, usually a mainframe, which provides software to take care of housekeeping such as password protection, temporary storage space and message routing.

Normally the mainframe remains in the background and the user is given the illusion of a straightforward two-way connection that presents the recipient's mailbox as a pigeonhole where messages can be safely left for minutes, hours or days to await collection, technically known as store-and-forward. This way electronic mail avoids the "he's in a meeting . . ." syndrome; you can get ungarbled messages to people even if they are not available at the same time as you are. Correspondence is almost as quick and casual as the telephone, but can also be informally documented if you save your messages and replies on disc.

Some systems also allow the users direct access to the power of the mainframe. You can run remote maths programs, play games or even cross-compile down the telephone line. Few such activities come under the heading of electronic mail, but there is a cluster of programs, roughly classified as electronic office software, that behaves like an extension of the communications facilities.

There are a surprising number of companies that handle very large volumes of private electronic mail on worldwide mainframe links, chief among these being ADP and Geisco. But their clients tend to be exclusively large companies with annual bills running into four or five figures. The three chief rivals for your custom as an individual electronic communicator are Prestel, Telecom Gold and Easylink. Gold was hived off from British Telecom before it went public; Prestel remains in the fold as part of British Telecom's Value Added System Services department, VASS, and Easylink is the outside contender, being an arm of the U.S. Cable and Wireless company.

PSS

All the services at some time or another prevail upon another important subdepartment of BT VASS, an outfit called PSS — another club the individual electronic mailer can join. PSS stands for packet switch stream and is a simple and cheap way of maintaining a real-time data connection between computers over long distances. If one of the computers is, say, a lap portable and the other a mainframe carrying the electronic mail service, the subscriber can tap into PSS or one of its local variants from any part of the world. The call charge will be at the local rate, and even with the additional PSS charge the total cost could compare very favourably with standard long-distance charges.

PSS is cheaper because it does not monopolise the line for the whole duration of the call. Unlike an ordinary modem connection, where the data is carried on an analogue signal that mimics the normal voice use of the telephone line, PSS data is carried as a series of digital pulses. But before being transmitted over the PSS circuit the data is first electronically

PSS charges

Fixing yourself up with an NUI requires a down payment of £25, with an additional quarterly rent of £6.25. Three other costs are simultaneously chargeable. First there is the regular local charge call to the computer, which will appear on the phone bill in the usual way. The two other charges are for volume and duration, in much the same way as a taxi charges for time and distance.

For example, on a call to the Source in the United States you would pay a volume charge of £3.50 for each kilosegment — 64K to you — of data that is transferred in either direction, and a duration charge of £6 for each hour of connection. The charges in Europe are considerably less: £1.20 for each kilosegment transferred, and £1.32 per hour. In the U.K. the costs are £0.90 to £1 per hour duration charge and £0.15 to £0.20 per kilosegment.

Like Prestel, PSS is part of British Telecom's VASS department. To find out more ask the operator for a Freefone connection to the PSS Customer Service Department, or dial 01-920 0661 and talk to David Harper direct.

```
Telecom Gold Network: For assistance type 'HELP LOGIN' at the prompt 'PAD>'
This is Dial-up Pad 0 line 1 speed 300

PAD>call 83
*** Call connected
Welcome to Telecom Gold's System 83
 Please Sign On
>ID JNL020
Password:
TELECOM GOLD Automated Office Services 18.4K(83)
On At 0:49 17/01/85 GMT
Last On At 0:42 17/01/85 GMT

Those wishing to access Telecom Gold on Sat. 19th January, please type AOSNEWS

Mail call (1 Read, 1 Unread, 2 Read express, Total 4)

>mail

Send, Read or Scan:  re unread

     To:  JNL020 (83:JNL020)
   From:  MKD429            Posted:  Thu  17-Jan-85  0:39 GMT UK GMT  Sys 81  (13)
Subject:  Using Telecom Gold

--More--

Dear Reader,
This printout shows the sequence of logging on and reading a
letter using the Telecom Gold electronic mail system.
     83:JNL020 is the mailbox used by the editor. Practical
Computing uses a separate box, 81:JET727, accessed mainly with
the office Apricot. Chris Bidmead and Ben Knox are among the
other writers with their own boxes.
     We are always pleased to receive comments and queries via
Telecom Gold.
     Yours faithfully,
     Jack Schofield


Action Required:  del

End of Mail.

Send, Read or Scan:  .q

>off
Off At 0:50 17/01/85 GMT
Connect Mins = 2
Compute Secs = 1/1

Mail call (1 Read, 2 Read express, Total 3)
*** Cleared

=0]V0=v_0
```

A session reading the messages in a Telecom Gold mailbox. A welter of information is provided automatically, such as the time you last used the system and how many messages are being held in your mailbox. The user only has to respond to the > prompts, and to answer the queries "Action required" and "Send, read or scan".

divided up into packets of a few kilobytes. Each packet is wrapped in additional digital data, including a packet number, a value used for error checking and a destination identity.

The point at which this takes place is called a PAD, or packet assembler disassembler. Once the wrapping has been done, each individual packet makes its own way to the destination, signposted on the way by a series of PADs which read the address and direct the packet accordingly, storing it if necessarily until the required line becomes free. At the final destination another PAD disassembles the packets in sequential order, restoring the data stream.

Each PSS user has a network user identity, or NUI. Renting your own NUI allows you to make direct connection at baud rates up to 1,200 in both directions simultaneously with other computers on the network, provided you know their NUA, or network user address.

Prestel

Boxes on Prestel are provided by some micro manufacturers and it may therefore be the first system that springs to mind as a carrier for electronic mail. Although it is being used for that purpose there are factors that make it less than ideal. Prestel

(continued on next page)

Prestel charges

There is no initial charge to join Prestel, and the quarterly Mailbox rental is a very modest £5. The various closed user groups will add their subscription fees to this.

Contacting the system during peak time — that is 8a.m. to 6p.m. weekdays, 8a.m. to 1p.m. Saturdays — costs five pence per minute in addition to the normal phone-call charge. Out of peak hours there is no extra charge. Most of the pages you are likely to need for the purposes of electronic mail are free, but many Prestel pages are priced and you will be billed accordingly.

Contact Stephen Rogers, Prestel's Mailbox Manager, on 01-583 7130.

(continued from previous page)

is a graphics and text system based around the technology of the television screen. Most electronic mail does not require graphics, but does need to convey the maximum sense in the fewest bytes.

Also Prestel is conceived primarily as a one-way communication system, with a few information providers creating pages of information to be read by the masses. The communication protocol reflects this: data comes in to the user at a healthy 1,200 baud, but anything the user wants to transmit is slugged to 75 baud.

Further, because it does not use ASCII coding, text received over Prestel cannot easily be gathered into or transmitted from a conventional micro word-processing system. Most Prestel communication software running on micros allows you to store downloaded pages, but if you are tempted to pull those pages into your word processor for reformatting or to search through them for occurrences of a phrase you are in for a disappointment. Instead of a text file, all the word processor will find is a collection of escape codes.

Such problems are not insuperable. Prestel is probably the cheapest of the commercial systems for the small user, and if you are tapped into it already to make use of its other facilities, you will find it perfectly usable for sending electronic mail. You have a choice of the main Prestel mailbox or the equivalent on one of the closed user groups within Prestel.

A simple way to get an ASCII text file from Prestel is to access it over its dedicated 300-baud line, which provides an automatic translation for Teletype terminals. This mode also gives you faster transmission, but reception is slower than usual on 300 baud, because as well as the asterisks that replace all the fancy graphics and colour, a great many spaces are also transmitted.

Easylink

Easylink has been recruiting customers by way of the micro dealers, as it sees its service as being particularly geared to the single-micro user and small business. The main selling point is the modest initial cost, lower access charge and the two-way telex facility, which until recently was a feature notably missing from its biggest rival, Telecom Gold.

During a short trial I found the system to be swift and efficient, with plenty of courteous help waiting at the end of a voice line. However, if you are looking for action and excitement you will not find it. Unlike Telecom Gold it has no games to play or baroque software byways to explore. What I missed most was a directory to tell me who is on the system and where. Prestel and Telecom Gold have on-line directories you can scan through to see if there is anyone you want to talk to, but if you do not know any numbers on Easylink you will probably find yourself alone.

Telecom Gold

The infrastructure of Telecom Gold grew up around British Telecom's need to keep its staff in touch with one another. But even before the recent privatisation of the main company, Telecom Gold had already set up a separate existence. BT is still one of its main customers, but the system has now been thrown open to other users from large institutions to private individuals.

In contrast to the simple, clean lines of Easylink, Telecom Gold computers present a rich stew of software to the subscriber who is prepared to spend a little money to delve beneath the surface. Like Easylink, during normal messaging the central computer is more or less invisible to the user, but it is capable of a lot more. Database software called Infox allows you to build a personalised information storage and retrieval system, a forms package formalises the business of entering data, and WPMail lets you prepare your messages on a word processor and send them all out in a batch. If you are working with a dumb terminal rather than a micro you might be tempted to use Telecom Gold's own built-in word processor, though it is inevitably somewhat slow and cumbersome in comparison with software running on a micro.

One area where the electronic office comes into its own is the shared diary. The one on Telecom Gold is called Tickler, and as well as reminding you about appointments it can also be used by selected colleagues to find out when you will be available. To ensure your schedule is not open for everybody to inspect, Tickler allows a hierarchy of password protection to allocate the privilege of reading and writing entries. Also, like Easylink, Telecom Gold now has full telex facilities. So that lap portable in your briefcase is not just a letterbox, it's a complete office.

For the individual who does not need the elaborate extras, Easylink's low initial charge probably makes it a more economic way into electronic mail. Unfortunately there is no direct link between these two main rivals or Prestel. The gateway is bound to come but as yet there is a battle of wills between the two companies so the choice is more likely to depend on which system the people you want to communicate with are using. The fact that neither publishes a full directory of users does not make the choice any easier.

Telecom Gold charges

Telecom Gold officially charges an initial £100 plus VAT to join the system, but a number of existing users have spare boxes available for a lot less, or in some cases for no charge at all. Once you are on the system the two main charges, in addition to the standard charge for the line that will appear on your normal telephone bill, are

Connect time

Standard rate: 08.00-19.00 Monday to Friday excluding public holidays

First 250 hours charged on any bill	10.5p per minute
Next 250 hours charged on same bill	8.5p per minute
Thereafter	7.5p per minute
Cheap rate all other times	3.5p per minute

Filing

First 2,500 units	20p per 2,048 characters per month
Next 2,500 units	15p per 2,048 characters per month
Any further units	10p per 2,048 characters per month

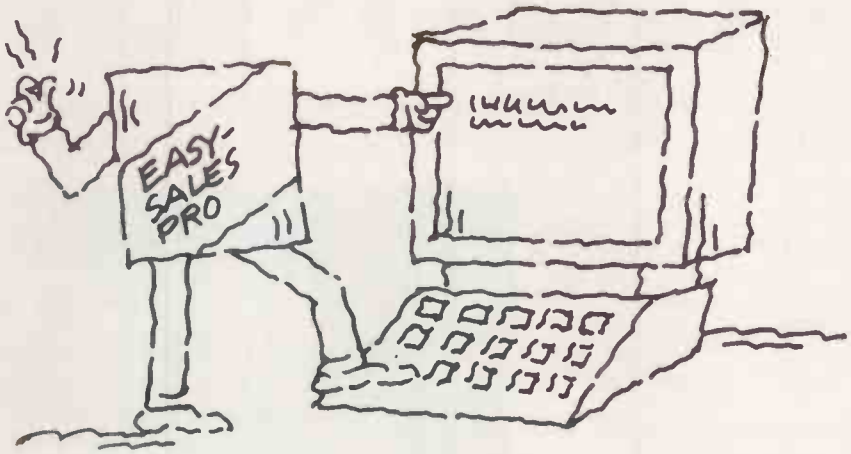
International mail to the United States, Canada, Australia and Hong Kong costs 15 pence per 1K of data, with a minimum charge of 30 pence. The difference between the cheap rate and the standard rate is very striking, and means that provided you tread carefully it should be possible to get away with quite small bills.

Easylink charges

The initial charge is £25 for any one subscriber, with an additional £5 for each mailbox being rented. The monthly subscription also depends on the number of mailboxes rented. For one to three mailboxes the charge is £12 per mailbox per month, dropping to £9 for four to eight mailboxes, and £8 thereafter. Easylink puts a ceiling on the charge of £98 per month.

On top of this there is a connect time fee of five pence per minute, as well as a traffic rate which varies with destination. Within the U.K. the charge is 12.5 pence per 200 characters; for Europe it is 22.5 pence per 200 characters; and for the U.S. and Canada, 65 pence per 400 characters. Charges for the rest of the world are considerably higher, at £1.10 for 400 characters. There is no charge for receiving mail.

EasySales Pro™ picks your best prospects instantly.



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Sorcim/IUS Products: EasyWriter 1 System, EasyWriter II System, SuperWriter, SuperCalc 3 Rel.2, and other SuperCalc Software, EasyFiler, and EasySales Pro.

● Circle No. 151

A view to information

Despite their potential, phone-based viewdata systems have proved to be a worldwide flop. Jack Schofield examines why and speculates on their future.

THE POST OFFICE launched Prestel in September 1979, predicting 100,000 users by the end of 1980, and exponential growth after that. One of the earliest users, and keenest supporters, was *Practical Computing*, and in fact this magazine put the first computer programs on Prestel in 1980 before eventually pulling out.

Prestel was a dismal and expensive flop. By June 1982 there were just 16,350 terminals. Even by the end of 1984 there were only about 45,000. However, the system is worth looking at because it provides a great deal of information and has a special section devoted to microcomputing — which includes Micronet 800.

Electronic mag

Micronet is a sort of electronic computer magazine, complete with news pages, readers' letters, advertisements, games and chat. There are programs that can be downloaded for a few selected micros, too. The most interesting section of Micronet is the news, which is updated daily. Coverage is mainly of the Sinclair and Acorn micros, but sometimes contains some interesting industry gossip. Micronet's main problems are, however, created by the limitations of Prestel itself.

Prestel is a videotex service like the text transmission you often see on television sets: Ceefax, Oracle and 4-Tel. These broadcast videotex services are called teletext. Prestel comes down the telephone line, in which form videotex is known as viewdata.

Because the frames are stored on a computer, there can be millions of them. The frames are arranged in a tree structure. At the top, Prestel has pages 1 to 9 and each of these can have another 10 pages attached to it. Page 1, for example, "owns" pages 10 to 19. Therefore the second level has 90 pages, from 10 to 99. Each of these can, in turn, have its own sub-pages, and so on until the end of the line is reached with nine-digit numbers. Pages can be extended by the use of frames. A frame is a screenful of information, and it has a page number followed by a letter from a to z.

The Welcome frame for Micronet 800, Prestel's most popular information provider.

Apple dealers receive information and place orders via a Prestel closed user group.

Suppliers of viewdata services

Air Call Videotex. Turnkey systems, training, bureau services. Telephone: (0582) 603123

Aregon International. Turnkey systems and consultancy. Telephone: 01-831 7536

AVS Intext. Electronic publishing and consultancy. Telephone: 01-434 2034

Baric Computing Services. Consultancy and systems. A Prestel IP with a gateway and national network, which runs Holidaymaster. Telephone: (04862) 27241

CAP (Reading). Turnkey systems and consultancy. A Prestel IP offering umbrella facilities. Telephone: (0734) 55900

Datasolve. Umbrella IP services, gateway systems for book and travel trades, etc. Turnkey systems and consultancy. Telephone: (09327) 81266

Disc International. Viewbase interactive viewdata and Envoy electronic mail via gateways for a wide range of industries; also consultancy. Telephone: (0823) 85292

D M England. Turnkey packages and training. Telephone: (0734) 342666

Eosys. Consultancy and project management. Telephone: Farnham Common 5123

FB Computer Services. FB Dataview package, plus bureau facilities. Telephone: (0372) 66891

GEC Computers. Supplies computer equipment for Prestel, and software and computers for many other public and private systems. Telephone: 01-953 2030

GEC Viewdata. Software for GEC computers, plus bureau services. Telephone: 01-836 8000

Herts 288. Consortium of local authorities in Hertfordshire providing local service via Prestel. Telephone: (0707) 268100 x 321

Honeywell. Themis private viewdata system, plus training and consultancy. Telephone: 01-568 9191

IBM U.K. Turnkey systems and IBM gateway facilities. Telephone: 01-995 1441

ITM. Rotovision and low-cost private viewdata systems using the BBC Micro. Telephone: 01-708 9066

ICL. Bulletin private viewdata system. Also works with its Baric subsidiary company. Telephone: Freefone ICL

Istel. Bureau services, training and consultancy, own packet-switch network. Telephone: (0527) 64274

Jasmin Electronics. Turnkey systems. Telephone: (0533) 58128

Mars Group Services. PVS-990 viewdata system and complete turnkey systems. Telephone: (0753) 30721

Prestel. World's largest viewdata system. Telephone: 01-583 9811

Systems Designers. Turnkey systems and consultancy. Telephone: (02514) 22171

Systime. Computext software and turnkey systems. Telephone: (05327) 702277

Tandata Marketing. Viewdata terminals and peripherals. Telephone: (06845) 68421

Torch Computers. Communicating micros with Metrotel software suitable for Prestel IP editing. Telephone: (0223) 841000

Viewtel Services. Claims to be leading IP on Prestel. Telephone: 021-236 3366

Viewtext Ltd. Turnkey systems and consultancy. Telephone: (0892) 45178

Prestel's service for GPs transmits information provided by the DHSS, among others.

Thus Prestel can handle a vast amount of information. It is in presenting and accessing it that problems arise, as follows.

- The tree structure means a large proportion of the frames contain no useful information, but just direct you on the long route to where that information is held. It is possible to go straight to a particular frame, but that only helps if you know the number of the frame you want.
- Frames contain only pre-packaged information. Prestel is not a true database, it is a form of publishing. It offers little or no true computing power. As yet you cannot search on keywords or make your own selection of data.
- The frame was designed for domestic television sets, and holds very little text. The limit is 24 rows of 40 characters, that is 960 characters or about 150 words. With their fancy borders, most Prestel frames carry less than half that.
- Prestel is not a live service. Once a frame has been downloaded it cannot be updated without downloading it again — and, if it is a charged frame, paying the fee again. With fast-moving information like stock-market prices this is a drawback.
- The graphics are crude. Prestel uses an alphamosaic pattern of three- by two-square characters to draw pictures. This is economical as a page can be stored in about 1K of memory. However, the limitation is less relevant today than it was in the early 70s, when the system was specified.
- Prestel is slow. At its 1,200/75 baud rate it takes about six seconds to receive a frame. The system cannot cope with smaller units than one frame, even where a one-word answer would do.
- Prestel is relatively expensive for the home user, though the cost is far less than serious databases like World Reporter, etc. But even if it were cheap, the way you pay for it still makes it confusing. You pay for the equipment, you pay to join and there is a continuous charge for Prestel computer time during business hours. The time you spend on the system adds to your phone bill. Also there are sometimes charges for reading individual frames. So it is hard to keep track of what the real costs are, especially as you get billed much later.
- Prestel lacks excitement. It has no sound, no pictures, almost no movement, no emotion and no drama. Prestel is actually a file-card system. Even pretty coloured graphics do not disguise that.

Many of these problems were pointed out in *Prestel in Use — A consumer view* by E Scott Maynes, published by the National Consumer Council in April 1982. This booklet records the appalling difficulties faced by people trying to get real information out of the system. It con-

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cludes that all the indexes are unsatisfactory, but "the tree index is highly unsatisfactory and should be discarded or drastically revised". Multiple keyword search should be used instead, as with most on-line databases. Unfortunately this sensible advice has has never been taken up, and Prestel remains a fundamentally crippled system as a result.

However, there are some areas where the benefits outweigh the disadvantages. Examples include stock-market prices, airline and hotel bookings, and details of cars and houses for dealers and estate agents. In these cases up-to-date information can be worth tens or even thousands of pounds.

Prestel can also handle simple transactions. Home banking is already available through the Bank of Scotland's service and Nottingham Building Society's Homelink. Teleshopping is another possibility, especially useful for the disabled. Club 403 in the Midlands is an example, albeit not a very successful one.

Prestel can provide information to selected groups of users, instead of to every subscriber. A closed user group, CUG, enables large companies to make stockholdings and prices available to their dealers, for example. Micronet 800 is a CUG. Many other CUGs have been a great success.

A limited electronic mail system is available, and through Telex Link users can also send telexes. Both facilities are very useful, though the system cannot be compared to, say, Telecom Gold in power and flexibility.

Finally, Prestel can provide a gateway into the information providers' computer systems. Examples includes Skytrack for airline reservations, Homelink for home banking, Homeview for estate agents and Viewtrade for used cars. The possibilities are exciting.

Disparate aims

However, such developments mean Prestel is no longer simply an information service. Instead there are many different companies pursuing different aims under its umbrella. Most have nothing in common except the limitations of the Prestel tree structure, frame size, limited processing power and slow delivery speed.

Internationally Prestel has two major rivals: Teletel in France and Telidon in Canada. Teletel is like Prestel. It has enjoyed extravagant government support. In two current experiments terminals are being given to households to replace telephone directories, and used by government to communicate with businesses, replacing form filling for example. Free terminals are being installed at the rate of about 10,000 per week. People can also buy them cheaply or rent them for 70 francs per month.

The French government's aim is to install viewdata to streamline government and reduce the flow of paper. It also helps the French information industry, which now has a bigger share of the world market than the British one. Electronic mail and other uses will grow as the system becomes widely installed.

Canada's Telidon has two advantages: better graphics and hardware independence. Telidon's superb display comes from drawing pictures geometrically, instead of building up mosaics. This requires terminals with more memory — 32K instead of the 3K for Prestel and Teletel terminals. Also it needs accurate transmission, since if data is lost the entire frame may be scrambled. However, Telidon is clearly more suited to current and future computer and telephone technology than Prestel is.

The Burgess view

Frank Burgess was Head of Services and Head of Marketing, before becoming General Manager of Prestel in December 1981 — a post he relinquishes on March 1 this year. In November he presented a paper at The International Forum for the Videotex and Teletext Industry in Amsterdam, making the following major points.

Videotex will not sell itself. Newcomers falsely assume that because Prestel is so easy to use, it must be easy to sell. This has not proved to be the case.

Common carrier does not work. "Common carrier" meant Prestel would not own information but that anyone could publish information on a first-come, first-served basis. This led to disparate services, poor databases, unco-ordinated marketing and pricing policy confusion. It also meant IPs could take their data off Prestel and set up competing services.

"All things to all men" does not work. The famous 1980 slogan "A world of information at your fingertips" has to be discarded because profitability could not be foreseen, it was almost impossible to index, and there was no USP (unique selling proposition).

The technology is not the product. The Prestel industry fell into the trap of concentrating on the technology and not on the applications.

There is little market for basic information retrieval. Prestel was invented and launched on the assumption that there was.

The dedicated dumb terminal has a limited life. Prestel assumed the mass market would use TV sets with modems and Prestel decoders, whereas most now use personal computers.

Price is important but not the biggest problem. Media analysts originally thought that customers were not buying because of price. Research within Prestel demonstrated that customers did not want the service at the time *at any price* because it did not make enough useful contributions to customers' needs.

Instead, Prestel marketing now concentrates on what it calls trigger services. The aim is to provide a specific service to a clearly identified group of people. Examples include Micronet 800 for computer users, and Homelink, the building society. If the trigger service is good enough to justify the cost of subscribing to Prestel, the rest of the database is essentially free and therefore does not attract as much hostility for any failings.

Linked to the Brailink terminal, Prestel can display information in Braille.

The Prestel computers

There are six Prestel computers for subscribers. They are all powerful GEC 4080 minis with software written in Babbage and Coral. They work in pairs: Dickens and Keats in Birmingham, plus Dryden and Kipling, and Derwent and Enterprise in London. The network is star-shaped with each computer holding the same data. A seventh central computer, Duke, is used by IPs to enter and update material. Gateways to 18 other computers are provided by two GEC 4082s.

GEC/Prestel systems are operating in Australia, Austria, Hong Kong, Italy, the Netherlands, Malaysia and West Germany, as well as the U.K.

Prestel can be accessed via a special terminal, TV set or business micro or by using a popular home micro such as the Sinclair Spectrum, Acorn BBC, Apple II or Commodore Pet, etc. Unfortunately it uses the 1,200/75 baud system, where most microcomputer users have 300/300 baud modems.

The French scene

In the 70s France planned a national electronic telephone directory service using its Transpac packet-switch network to replace printed telephone directories. Unfortunately when the Socialist government came to por in 1981 it made acceptance of a Minitel home terminal voluntary. With only half of those offered accepting a terminal, directories still have to be printed, which destroys the cost savings offered by the electronic system.

Nevertheless, around 500,000 terminals were installed by the end of 1984. The targets are 1.3 to 1.7 million terminals by the end of 1985, 2.4 to 3 million by the end of 1986, and 8 million by 1992. So far most terminals have been installed in Brittany, Paris, Picardy, Provence and the Côte d'Azur. Minitel sets can also be purchased separately or rented. A model similar to ICL's One Per Desk costs about £14 per month.

As well as telephone numbers, the service provides information — like Prestel — and games. In some areas, businesses are using sets to fill in and submit government forms, while government departments are also using the system for internal communications. Electronic mail is available to business users. In the future, mail, banking and shopping services will be offered to everyone.

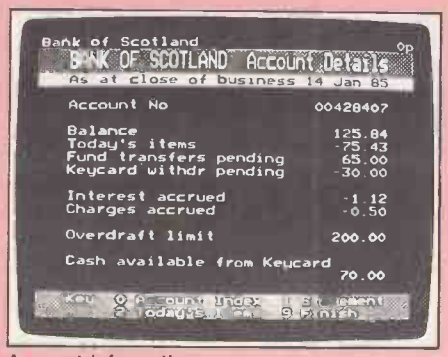
The million-plus Minitel terminals ordered has provided a massive boost to the French information technology industry, which now has a larger share of the world market than the British one.

D.I.Y videotex

A Liverpool company, ITM, has launched a videotex system called Rotoview, which allows anyone with a BBC Micro, disc drive and modem to set up a videotex service.

The system is intended for public display, much like a slide carousel. Companies could use it as a 24-hour sales and service system. Enthusiasts could open their own Prestel-type bulletin boards with message areas and telesoftware that can be downloaded. Educational establishments and libraries could find many uses for the system, which was used to provide information for visitors to the International Garden Festival in Liverpool last year. Other possible users include conference centres, hotels, airports, shopping precincts and railway or bus stations.

The Rotoview software costs £75, and Host software for the BBC Micro costs £20, both plus postage and VAT. Contact Information Technology and Marketing Ltd, E3, New Enterprises, S.W. Brunswick Dock, Liverpool L3 4AR. Telephone: 051-708 9066.



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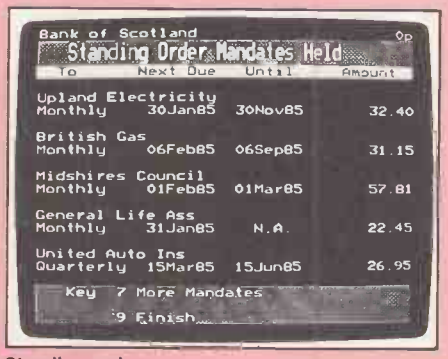

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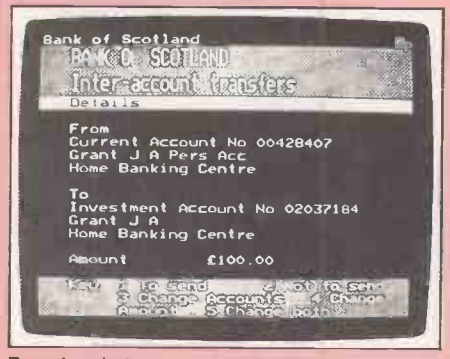
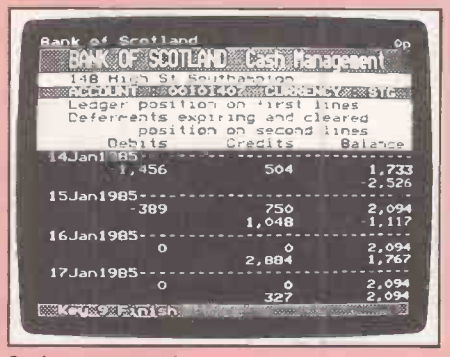


Transfers between accounts



Cash management

Home banking is one of Prestel's newest features.

More important is hardware independence. Telidon keeps the information storage separate from the communications and display terminals used. The aim is to avoid rapid technical developments making data unusable. At the moment North America is a hotchpotch of systems. but a new Telidon-based standard looks likely to prevail. This standard is NAPLPS — pronounced "naplips" — the North American Presentation Level Protocol Syntax. Micros are already being built to comply, just as the Acorn BBC model B and Rediffusion Teleputer have Prestel graphics built in.

However, it must be admitted that so far viewdata has been a failure everywhere in the world. Prestel is not unique, just the most spectacular example. If viewdata is to succeed it will do so by abandoning futile attempts to imitate magazines and newspapers. Instead it must concentrate on simplifying and speeding up the really boring transactions like looking up phone numbers, sending electronic mail, paying bills and looking up facts.

These are things that, in the last five years, Prestel has learned the hard way, at enormous cost. With its recent change of emphasis on to marketing "trigger" services like the successful Micronet 800 — see "The Burgess view" box — there are now signs that Prestel could, in the future, be a success. At the moment, however, it remains what it was: a wonderful idea with enormous, but unrealised, potential.

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Data up-to-date

Public databases are becoming increasingly popular as they provide a wealth of current information on a diverse range of subjects. Glyn Moody summarises what can be found on some of those currently on-line.

ONE OF the oldest on-line databases, and still the largest, began as yet another spin-off from the Nasa space programme. Originally called Recon, for Remote Console Information Retrieval Service, it was set up by Lockheed Corporation as a tool for Nasa researchers and initially drew on government and research publications. In 1972, when the service was made available to the public, the name of the database service was changed to Dialog, which was the name of the command language used to search through the files. Today there are over 60,000 users.

Limited field

Dialog is big: it currently holds over 75 million records, and the number is growing steadily. Alongside such mammoth enterprises, smaller databases have sprung up that limit their field of activity to a very narrow sphere. Examples include databases covering areas such as Finnish business periodicals, hydrogen in metals and packaging legislation.

But whether large or small, on-line databases share a number of common features. They are nearly all accessed through the public telephone network. Some private networks still exist for certain very specialised services where the cost includes provision of a separate network. But by and large, on-line systems use the Packet Switched Stream network, which is described in more detail in the article on electronic mail on page 92 of this issue. Essentially it allows you to access distant telephone numbers for the cost of a local telephone call plus annual membership of the PSS scheme.

As a result of the greatly reduced costs, it is quite viable to access databases all around the world. So databases are increasingly international in their appeal and use. Major databases are to be found in the U.K., U.S., France, Germany, Italy and Holland, all of which contain international information likely to be of interest to U.K. users.

The first databases evolved as electronic indexing systems and bibliographic services. Blaise, run by a department of the British Library, is still used predominantly for this purpose. The older systems were used, especially in scientific disciplines, to search through abstracts of papers and conference proceedings. Such databases were easy to set up and had a clearly defined market. Today there are hundreds of such databases, covering most areas of science and technology.

Apart from their usefulness in academic institutions, scientific databases also play an important role in industry. In particular, chemical information is widely accessed using on-line techniques. Patents form another sphere where on-line searches have become quickly accepted.

The biggest growth area today is probably business. As more and more businesses equip themselves with micros, so the possibilities of on-line searching increase. Many of the statistics and forecasts widely used in the business and financial community are now available on-line. These include such services as information from the *Financial Times*, the Bank of England, the IMF and the U.K. Treasury.

Share services

Two areas which obviously lend themselves to interactive searching are shares and company information. There are a number of share services that provide constant updates on various sectors of the world's stock markets. Some even allow you to set up your own portfolio and monitor its progress. Eventually this kind of system will tie in directly with stockbrokers to enable you to place orders from your micro.

Company information is required for a variety of purposes, and often entails costly and time-consuming visits to Companies House. Once again, on-line searching is well suited to provide up-to-date information very quickly and easily. A number of database hosts offer information of varying detail on British and foreign companies.

An extension of business applications is the full-text service. Instead of providing abstracts or streams of statistics, the full-text service offers complete documents. For example, Datasolve's World Reporter provides the full text of *The Guardian, Washington Post* and *The Economist*, along with the BBC's Summary of World Broadcasts and External Services News.

Specialised

Another specialist full-text service is provided by Lexis for lawyers. Some 200,000,000,000 characters of text make up a file of legal cases from the U.K., U.S. and France, which can be searched in a variety of ways to obtain information on precedents and relevant background.

This kind of service moves beyond providing standard sources in a more convenient form. Instead, you can start looking for facts or connections that may or may not be there, and which certainly could not have been found by any other means. In this way it possible to start extracting useful information from the deluge of raw data that assaults us daily. In the future this kind of database use will become increasingly important.

Another development likely to gain ground already exists in the U.S. The databases available through Compuserve have 800 subject areas and over 168,000 users. They offer something for nearly everyone, and provide a kind of total environment which places greater emphasis on two-way interaction. Compuserve offers a special interest group which caters for people with a very specific interest. Subjects covered at present include those of interest to users of IBM PCs, Commodore and Apple computers, golfers, doctors, veterinarians and cooks. It also possesses a highly popular CB simulator, which permits users to chat over some 40 channels, using only

(continued on next page)

Using an on-line database

Most major international databases can be accessed via the PSS network. Assuming you are a member of the service, you can dial up an on-line system simply by getting on to the service, and then typing in the database's network user address. You may need to supply passwords to gain entry to the database, which will be provided when you sign up with the host. Normally, signing up with an information host gives you access to several databases. The host may have provided the database itself, or it may buy them in from an outside firm. Some of the databases may be exclusive to one host or common to many.

Once you are in your chosen database or the main command mode, you normally use a small group of simple commands to begin search procedures. For example, Knowledge Index, which is a cheaper subset of Dialog, uses the command Find followed by a word to initiate a search; World Reporter uses Get. In both systems it is possible to narrow the field of enquiry by adding more words in various ways.

For example, searching for micros And mainframes will only find items that have both in their files of identifying words or concepts.There are also Or and Not operators, just as in Basic. Some databases allow you to use wild cards in searches. As in CP/M, they enable you to sepecify only partially your search topic, leaving an intentional ambiguity. So MOT* would search for any word beginning with mot, such as moth, mother, motor, motion and so on.

Normally, search procedures produce a statement of the number of files found meeting the criteria. Using additional Ands and Ors, they can be whittled down until a manageable number is obtained. To display the items, you normally select various formats, ranging from complete printouts to short forms.

Most systems have their own specific commands, which may include provision for electronic mail, for example. But the overall structure is usually the same — there is even a Common Command Language that can be found in use across a wide range of European databases. CCL came about largely through the efforts of an agency of the European Commission.

One service available from its Luxembourg offices is a free Help Desk which deals with all queries concerning European databases. Its telephone number is (010-352) 488041. Upon receiving your call, they will phone you back. The same office has information about a free trial use of its own database service. As well as a number of scientific databases, there is a translation database and a training system that helps you learn how to use the CCL.

In the U.K., there is help from the On-line Information Centre, soon to be an independent consultancy firm run under the auspices of Aslib, the Association for Information Management. The address is 26-27 Boswell Street, London WDC1N 3JZ. Telephone: 01-430 2502.

(continued from previous page)

handles, as in CB, instead of names.

Compuserve also has a very wide range of business services, news information and databases which can also be found elsewhere. There are various bulletin board facilities too, as well as electronic shopping services. All in all, Compuserve represents one step beyond the conventional database service, and moves towards an environment in which users can find information, send messages, and order goods and services.

MUD accessible

In the U.K. things have not moved so quickly. But Commodore's Compunet system is the first to offer a wide range of interactive services. As well as a CB simulator, there is a link to Compucard and an on-line shopping service. There is even access to Mud, the multi-user interactive adventure game running at the University of Essex — see page 92 of January's *Practical Computing*. A section called the Jungle allows software to be uploaded and downloaded, and sends electronic messages. At present the scheme is restricted to Commodore 64 owners but there are plans to extend it.

The growth of on-line database provision seems to be accelerating. In the U.S. and Canada, the number of on-line searches went up sixfold from 1975 to 1981. From 1972 to 1982, the number of purely bibliographic references went up from about 3 million to 77 million. The growth in the newer areas of full-text services has been even more dramatic.

Many large companies in the field of in-

```
?find micro or personal or home
          1381 MICRO
          4394 PERSONAL
          1842 HOME
    S1     6519 MICRO OR PERSONAL OR HOME

?find computers or computer
          7983 COMPUTERS
         14067 COMPUTER
    S2 16790 COMPUTERS OR COMPUTER

?find doctor or doctors or physician or physicians or medical
          34 DOCTOR
          21 DOCTORS
          39 PHYSICIAN
          52 PHYSICIANS
         706 MEDICAL
    S3      747 DOCTOR OR DOCTORS OR PHYSICIAN OR PHYSICIANS
            OR MEDICAL

?display s1
              Display 1/L/1
    1191020       D84000287
    HOW DOCTORS CAN BEAT THE INFORMATION OVERLOAD CRISIS
    CLARKSON, D.
    COMPUT. WKLY. (GB) NO.892 24 5 JAN. 1984 Coden: COMWAA
     ISSN: 0010-4787
    Treatment: GENERAL,REVIEW; PRACTICAL
    Document Type: JOURNAL PAPER
    Languages: ENGLISH
    INFORMATION TECHNOLOGY IS ABLE TO ENSURE THAT THE VAST
    AMOUNT OF DATA AVAILABLE TO DOCTORS IS USED PROPERLY. ANY
    SUCH PROCESS OF DECISION AIDS MUST SEEK TO EXPRESS, IN
    TANGIBLE FORM, THE DIAGNOSTIC SKILL OF THE CLINICIAN. IT
    MAKES SENSE TO EXAMINE A SPECIFIC MEDICAL PROBLEM IN A
    HOSPITAL ENVIRONMENT. FOR EXAMPLE, WORK HAS BEEN UNDER-
    TAKEN AT ST. JAMES UNIVERSITY HOSPITAL, LEEDS, ON ACUTE
    ABDOMINAL PAIN AND AT THE SOUTHERN GENERAL
```

Searches can be widened or narrowed by using combinations of search topics. Individual items can then be called up with a command such as Display.

On-line databases

ABI/Inform (ESA-IRS, Datastar). Business management and administration.
Acompline (ESA-IRS, Scicon). Urban management aspects.
Alis (Datacentralen). Automated Library information system.
Bank (ADP.) Bank of England financial statistics.
BCD (ADP). U.S. business conditions digest.
Business (Datastar, Inka). Worldwide trade opportunities and business contacts, company data.
Cisdoc (EAS-IRS). Occupational health and safety.
Citibase (SIA). U.S. principal economic indicators.
CNRS Lab (Questel). CNRS current research activities.
Comext (CISI). External trade statistics.
Compendex (ESA-IRS, Inka, Pergamon Infoline, Datastar). All branches of engineering.
Compustat (ADP). Balance-sheet statistics of 6,000 U.S. companies.
Computerpat (Pergamon Infoline). U.S. patents on the subject of digital data processing.
Conference Board (ADP). 750 business-related economic time series.
Conference Papers Index (ESA-IRS). Scientific and technical papers presented at conferences.
Conference Proceedings Index (Blaise). Index of conference proceedings.
Cronos (CISI, Datacentralen). Range of E.E.C. economic indicators and statistics.
Defotel (Questel). Financial information on about 1,500 French and foreign companies.
EDE (Datacentralen). Environmental database and ecological parameters.
EDF-DOC (ESA-IRS, Questel). Scientific and technical database.
EI Engineering Meetings (Datastar). Information on the proceedings of some 2,000 technical conferences.
Electronic Publishing Abstracts (Pergamon Infoline). Literature on electronic publishing and related areas.
Essor (Questel). Management, personnel and field of activity of 65,000 French companies.
Exstat (ADP). Balance-sheet statistics of 2,500 companies.
Fintel/FT (Datastar, SIA). Company and business information abstracts from the *Financial Times*.
FUTU (Datacentralen). Journal articles in all subject areas of forecasts, trends and ideas of the future.
Future (ADP). Commodities database, daily prices on world market.
FX (ADP). Daily exchange and interest rates at New York.
HSEline (EAS-IRS). U.K. health and safety executive aspects.
IRS/FMI (ADP, CISI). Financial data for member countries for the IMF.
International Economic Abstracts (Datastar). Economic information on markets, trends and investments worldwide.
Key British Enterprises (Pergamon Infoline). Profiles of the top 20,000 companies in Britain by turnover.
LCMarc (Blaise). Books and serials catalogued by the U.S. Library of Congress.
Math (Inka). Mathematics and related subjects.
Meeting Agenda (Questel). Advance notices about congresses, conferences and exhibitions throughout the world.
MEI (ADP). OECD main economic indicators.
MMA (Pergamon Infoline). Worldwide management and marketing practices.
Newsline (EAS-IRS, Finsbury). News from British, French and German daily papers.
New York Times (Datastar). *New York Times*, bibliographic file.
Pascal (EAS-IRS, Questel). General coverage of science, technology and medicine.
Phys (Inka). Physics and related areas.
PINCCA (SIA). Price index numbers for current-cost accounting.
Predicasts (Datastar). Business and technology.
Robomatix (ESA-IRS). The applications and impact of robots on society.
Routes (SIA). Data on the U.K. road network.
SB-I (Questel). Computer science abstracts.
Scicopath (Scicon). Information on motorways and roads in U.K.
Share Price Data (Scicon). Daily prices for the U.K. market on equities, commodities and overseas stocks.
Standards and Specs (ESA-IRS). U.S. standards and specifications.
Statis-Bund (CISI). German economic data.
STP (ADP). Short-term forecasts of main U.S. indicators.
Teledoc (Questel). Information on telecommunications and electronics.
UKCSO (SIA, Scicon). Macroeconomic indicators for U.K.
UK Treasury (SIA). Major economic time series.
USflow (ADP). Financial statistics on about 1,000 U.S. companies.

formation provision probably entered the field with an eye to long-term profits and a need to stake out a claim in the world of information, rather than any strong belief that easy money was there to be made now. Correspondingly, there has been a pell-mell rush to buy up on-line rights to suitable material, particularly in the business field.

The table at the top of this page gives a flavour of some of the main databases currently operating, with the name of the host and a brief description of their contents. Obviously it is impossible to do anything like justice in this space to a database containing a million records. Again, you should contact the relevant host for details.

A useful guide in this context is the directory of databases and databanks published by the European Commission in Luxembourg. The address is 177 Route d'Esch, Luxembourg; telephone (010 352) 488041. It is also available on-line as one of the free databases provided by this organisation.

Future prospects

In the immediate future, we can probably expect to see further dramatic growth and a consolidation of public databases. The on-line database represents the coming together of both sides of the computer coin: the mainframe with its raw processing capability, and the desk micro which provides power that is distributed but limited. Together they could provide not just a new way of looking at and using the world of information, but also a way of interacting electronically with the outside world.

Database hosts

The table on the following page gives some information on the leading database hosts, with a bias towards those that are based in Europe. The telephone number is that for dialling from Britain, as is the NUA number. The cost per connect hour should only be taken as a very rough guide to the range of prices involved; check with hosts for details. The same goes for the costs of the hard-copy service, if any. Some services allow you to take screen dumps directly, others send you copies for a fee. The number of users and type of users gives some indication of the size and scope of each host's end market.

Database hosts

	Address	Telephone	NUA	Comms (baud rate)	Cost per connect hour	Email provision	Hard copy provision
ADP	Poortweg 4, 2612 Delft, The Netherlands	(010 31 15) 569382	—	—	200-400 guilders plus subscription up to 30,000 guilders	—	—
Blaise	Blaise Marketing and Support Group, British Library, Bibliographic Services, 2 Sheraton Street, London W1V 4BH	01-636 1544 ex 242/284	A227900102	300 and 1,200	£27	N	Y
Butterworth Telepublishing	4-5 Bell Yard, Temple Bar, London WC2A 2JR	01-404 4097	—	1,200	£70	N	Y
CISI-Wharton	Ebury Gate, 23 Lower Belgrave Street, London SW1W 0NW	01-730 8171	219200394	300 and 1,200	£50-£100 for European databases; £35-£40 for U.K. databases	Y	Only CSO: £10 per enquiry, £1.60 per series
Compuserve	500 Arlington Center Boulevard, Columbus, Ohio 43220, U.S.A.	(010 1 614) 457-8600	—	300 and 1,200	$6-$12.50	N	Y
Datacentralen	Retortvej 6-8, 2500 Valby, Denmark	(010 45 1) 468122	2382415 92400	300 and 1,200	$36-$60	Y	—
Datasolve Ltd	Datasolve House, 99 Staines Road West, Sunbury-on-Thames, Middlesex TW16 7AH	(09327) 85566	A275312212	300 and 1,200	£60	N	£0.30 per page
Datastar	Plaza Suite, 114 Jermyn Street, London SW1Y 6HJ	01-930 5503	A9228464 110115	300 and 1,200	£60	Y	N
Dialog Information Services	PO Box 8, Abingdon, Oxfordshire OX13 6EG	(0865) 730969	A212300120	300 and 1,200	£75	soon	$0.25
Echo Customer Service	177 Route d'Esch, L-1471, Luxembourg	(010 352) 488041	A927 0448112	300 and 1,200	free	Y	N
Finsbury Data Services	68-74 Carter Lane, London EC4V 5EA	01-248 9828	A219200101	300 and 1,200	£70	N	N
Inka	7514 Eggenstein-Leopoldshafen 2, Germany	(010 49 7247) 824566	2624572474 0001	300 and 1,200	DM120-DM300	N	DM0.40
IRS-Dialtech	Room 232, Ashdown House, 123 Victoria Street, London SW1E 6RB	01-212 5638	A92222 620021	300	£27-£67	Y	£4
Pergamon Infoline	12 Vandy Street, London EC2A 2DE	01-377 4650	A219200190	300 and 1,200	£40-£75	N	£0.15
Questel	83-85 Boulevard Vincent Auriol, 75013 Paris, France	(010 33 1) 582 6464	20800604 0010	300 and 1,200	FF500	N	FF2
Scicon	Brick Close, Kiln Farm, Milton Keynes MK11 3EJ	(0908) 565656 ex343	A290840111	300 and 1,200	£55	N	—
SDC Information Services	Bakers Court, Bakers Road, Uxbridge, Middlesex	(0895) 37137 ex235	A931060051	300 and 1,200	$80	Y	$0.20
The Source	1616 Anderson Road, McLean, Virginia 22102, U.S.A.	(010 1 703) 734 7500	—	300 and 1,200	$7.75-$20.75	N	Y

Main databases and subject areas	Type of User	Number of users	Date established	Location
business, financial: Disclosure, Compustat, Cronos, OECD	mainly business, some academic	500	early 1970s	London and U.S.
bibliographic: UKMARK, LCMARK, DPB	libraries, academic	800-1,000	1977	London
Nexis for business, finance, energy and high-tech; Lexis for legal cases from U.K., U.S. and France	Nexis: media, stockbrokers, banks Lexis: lawyers only	Nexis 2,000 Lexis 7,200	Nexis 1979 Lexis 1968	Ohio
numeric, economic and financial statistics: CSO, FT currency and share database	large and small companies	80-100	mid-1984	Paris and London
general-interest, communication channels, special interest groups, CB simulator	professionals	168,000	1979	Ohio
chemical and environmental: EEC, Ectin Cronos	industry, research	1,300	1978	Denmark
World Reporter for news and current affairs; World Exporter plans and projects; Eurolex; Wildscape	media, government, industry	400-500	January 1983	Sunbury-on-Thames, Middlesex
business and biomedicine: Predicast, FT Abstracts, Medline	industry, academics	—	November 1981	Switzerland
chemistry, medicine and business: CASearch, Medline, Disclosure	industry, business	60,000	1964	California
database use training, translation database, European tenders	business	1,500	late 1970	Luxembourg
Textline business abstracts; Newsline headlines	banks, insurance, libraries	—	January 1980	London
science, technology and engineering	academic, business	1,500	1979	West Germany
science and technology: Inspec, NTIS	business, government	1,000	1976	Italy
science and technology: Jordans, Impadoc	industry, business, libraries	—	1981	London
scientific and technical: Pascal, CNRS, Index	academics, industry	5,000	1979	France
Polis parliamentary data, Acompline, Urbaline	government, libraries, industry	160	1981	Milton Keynes
chemistry, energy, engineering and patents: Compendex, Tulsa	pharmaceuticals, oil, industry	1,800 in Europe	1972	California
business, electronic mail and newswire information	mostly business, some home	62,000	June 1979	Virginia

SOFTWARE CENTRE

CP/M CP/M-86 MSDOS

MICROPRO SOFTWARE SYSTEM

PLANSTAR: Advanced financial planning £295
WORDSTAR: Best selling professional Word Processing software; On screen formatting, Block manipulation, File read/write, Simultaneous Editing and Printing £295
MAILMERGE: Enhancement for document personalisation and mailing applications £145
SPELLSTAR: Enhancement for checking spelling and maintaining spelling dictionaries £145
STARINDEX: Useful package for creation of Table of Contents, Index, List of Figures. Interfaces to Wordstar to improve document presentation quickly and easily £116
INFOSTAR: Impressive Data Base system combining the power of Datastar with the flexibility of Reportstar £295
DATASTAR: Screen based Data Entry, vetting and retrieval system. Screen formats under user control £175
REPORTSTAR: Powerful report generator, provides much needed enhancement to Datastar for report production and transaction processing £210
CALCSTAR: Electronic spreadsheet with interfaces to all MicroPro

NB: Combination prices — WS/MM £390; WS/MM/SP/SI £399

DATABASE MANAGEMENT

FORMULA II: Unique information management system with exceptional capabilities for Application Generation. Multiple files and indexes, transaction processing, interactive, no programming language required £450
dBASE II: The most popular of data management systems, very powerful application generator £37
QUICKCODE: Add-on facility for dBASE programmers to speed development process by generating dBASE command files £200
dGRAPH: Extremely useful program for graphical representation of dBASE and user created data files £200
dUTIL: Utility to speed up dBASE execution £69
CARDBOX: Highly popular electronic card index system. Easy to use, with powerful retrieval facilities £195
FRIDAY: End user file management system from the authors of dBASE II. File definition, input and reporting under user control £195
OPEN ACCESS: Multi-function Executives Information System £450
RETRIEVE II: Information Management with unique features £495
EVERYMAN: Database Systems for the IBM-PC £475

Telesystems Ltd

The Geans, 3 Wycombe Road, Prestwood. Bucks., HP16 ON2 Tel: 02406 6365

LANGUAGES

Microsoft	CP/M	MSDOS	Digital Research	CP/M	CP/M-86	PCDOS
BASIC Interpreter	£325	£325	CBASIC Interpreter	£130	£275	
BASIC Compiler	£365	£365	CBASIC Compiler	£425		
FORTRAN Compiler	£465	£325	PASCAL MT+	£300	£325	£325
COBOL Compiler	£645	£645	C Compiler		£295	£295
C Compiler		£465	PERSONAL BASIC Int		£125	
PASCAL		£285	CIS COBOL	£425	£425	
BUSINESS BASIC Comp		£550	FORMS-2	£110	£110	
MACRO ASSEMBLER	£185	£99	FILESHARE	£250	£425	
			FORTRAN 77		£295	£295
SUPERSOFT C Comp	£185	£185	SUPERSOFT BASIC Compiler		£200	£200
PROFORTRAN	£220	£320	PRO PASCAL	£220	£320	£320

UTILITIES

ASCOM: The most flexible asynchronous communications package available to the micro world. Interactive, batch, menu-driven. Available for CP/M, CP/M-86, MS/PCDOS £170
BSTAM: Simple communications program for exchanging files between CP/M systems £140
TRANSFER: System for exchanging files between CP/M systems. Provided with full 8080 source code £130
CONVMS: Operating system converter. Runs MSDOS programs under CP/M-86 ..... £70
CONVCP: Operating system converter. Runs CP/M-86 programs under MSDOS £70
ASSEMBLER PLUS: Disassembler for 8080 and Z80 programs £167
DISKEDIT: Facility for editing disk held data by sector. Invaluable aid £70
IBM-CP/M COMPATIBILITY: Set of programs that enable IBM 3740 disks to be used on CP/M, permitting transfer of files to/from IBM mainframes £110
SPP: Speed programming Package for use with Pascal/MT+ £167
XLT86: Converts 8080 assembler code to 8086 ..... £106
EM80/86: Emulator to run CP/M software under CP/M-86 ..... £70
DISPLAY MANAGER: Screen handling productivity aid for Digital Research compilers £333
ACCESS MANAGER: File handling productivity aid for Digital Research compilers £333
EXPRESS BASE II: Development aid for dBASE II £125

APPLICATIONS

MULTIPLAN: Exceptional electronic worksheet from Microsoft £159
MULTI-TOOL WORD: Microsoft's advanced Word Processor with optional Mouse for added flexibility £299
SUPERCALC: Fast action spreadsheet and planning aid £200
ABSTAT: Powerful statistics package £295
GRAPHSTAT: Versatile statistics and graphics package for the Epson QX10, IBM-PC and Sirius £195
ALIAS ACCOUNTS: Fully integrated accounts system with inbuilt hooks to dBASE II £1200
ALIAS PAYROLL/SSP: Standalone or integrated system with optional links to ALIAS accounts ..... each £600
RCS LEDGERS: Sales, Purchase, Nominal ledgers in MBASIC source code ..... each £300
RCS PAYROLL: Full function, highly used package £500
STATISTICS PACK: Over 25 easily used routines in MBASIC £120
MATHS PACKAGE: Interactive routines (40+) in MBASIC £120

MISCELLANEOUS

CP/M 2.2: Standard operating system on 8" disk £130
CP/M-86: Standard 16-bit operating system £225
SUPERSORT: Full function Sort/Merge/Selection package £145
MSORT: Standalone and COBOL hosted Sort package ... £149
MAGSAM: MBASIC utility to provide multi-key ISAM file facilities £150
TOUCH 'N' GO: Teach yourself keyboard skills £40
MICROSOFT MOUSE: Mouse, interface card and software £149
OPTIMISER: Interactive Linear Programming package £325
PROSTAR TRAINING GUIDE: Independent instruction on the use of MicroPro 'STAR' products £30

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RAM SPACE

by David Cleden

The call was never traced.

It crept into the Network unbidden, merging in with a million other data streams already in the system. It could have come from any one of 100,000 nodes in the local area, but all traces of its entry point were meticulously removed.

Its original data blocks had been binary coded and transmitted in the normal manner. The local operating system scanned the headers and shifted the message into its packet-switching mode. There was a long pause of some milliseconds as several thousand telephone calls were switched temporarily on to another channel, and then the accumulated data messages were injected rapid-fire into the Network. With imperceptible loss of continuity, the original calls were reinstated on the line.

Somewhere in the Network the call encountered resistance — an impedance mismatched, a slight loss of voltage. Inevitably there was some corruption. A subtle change in address codes here, a not so subtle syntax error there, but just enough to make a difference to the program's operation.

The call was routed via the central area exchange. On the first try the engaged signal was returned and the data stream was dumped into the queuing system buffer. The program now re-formed in the RAM space allocated it. It looped a few times in its self-execution mode until all the check-sum errors had been eliminated. Then, following its own internal instructions, it copied vital parts of its own program structure into available memory.

A few milliseconds later, another incoming call was met with an engaged signal and routinely transferred to the queuing system. The internal housekeeping program checked available RAM, found that none was available and executed a secondary set of instructions. It contacted the nearest exchange, initiated a transfer operation with the control program and dumped the entire contents of its buffer into the secondary exchange. On reformatting in its new location, the program cycled through its instructions and filled all available space with copies of itself.

In the space of time it took to switch the overflowing calls through all the exchanges in the region, the program consumed every last byte in the system.

It took many attempts and much sacrificed code before the program discovered a way to break out of buffer memory. By changing the header on its leading block, it managed to insert itself into the housekeeping program as a non-addressable subroutine. By repeatedly calling its own subroutine, it found it could control this part of the system.

Under the new command of the program, all the exchanges now released their own copies of the program's peripheral routines held prisoner in buffer memory. The control program set up an exchange of data between itself and the subservient programs it had released, assigning it top priority on the Network. Data-handling facilities for other traffic were now severely overloaded. Calls in progress were cut off or remained unconnected and data packages put on indefinite hold. In response to the unusual pressure on the system, an infrequently used circuit was switched into operation and the control of operations transferred to an adjacent region. Simultaneously, a red light began to flash on the Network Controller's board.

A little under three seconds had elapsed since the call had entered the system.

The Network Controller paused, adding emphasis to his words. "Do you realise what will happen if we let this thing get to the Prime Processor?"

The duty operator remained silent.

"We depend on the PP to hold the entire Network together. The environmental control programs for half the major cities are interfaced with the network, to say nothing of the intellnet service and business traffic. Oh sure, we can manage if the PP gets screwed up — for a while. The public may start hollering when they can't tune in to their favourite cable channel, but when the air conditioning starts failing in the hospitals and people start dying, they're really going to scream."

The duty operator swallowed nervously. "I don't think there's anything to worry about, sir. Nothing can get on the Processor unless we want it to."

The Controller scowled. "You know that's a lie. Every system has its weaknesses. It's just a question of knowing where they are and exploiting them. There's some joker out there who thinks he's been smart getting this bug into the Network, and I want to know who he is and how he did it. I don't care what has to be done and who you get to do it. The integrity of the Prime Processor must be maintained at all costs. I want this thing zapped."

With almost unlimited resources available, the Program spent considerable time exploring and evaluating its environment. It was not sentient, of course, for no computer program with such restricted parameters could be truly sentient. But where necessary, it could modify and refine its own routines to protect itself from attacks and increase its effectivness within the Network.

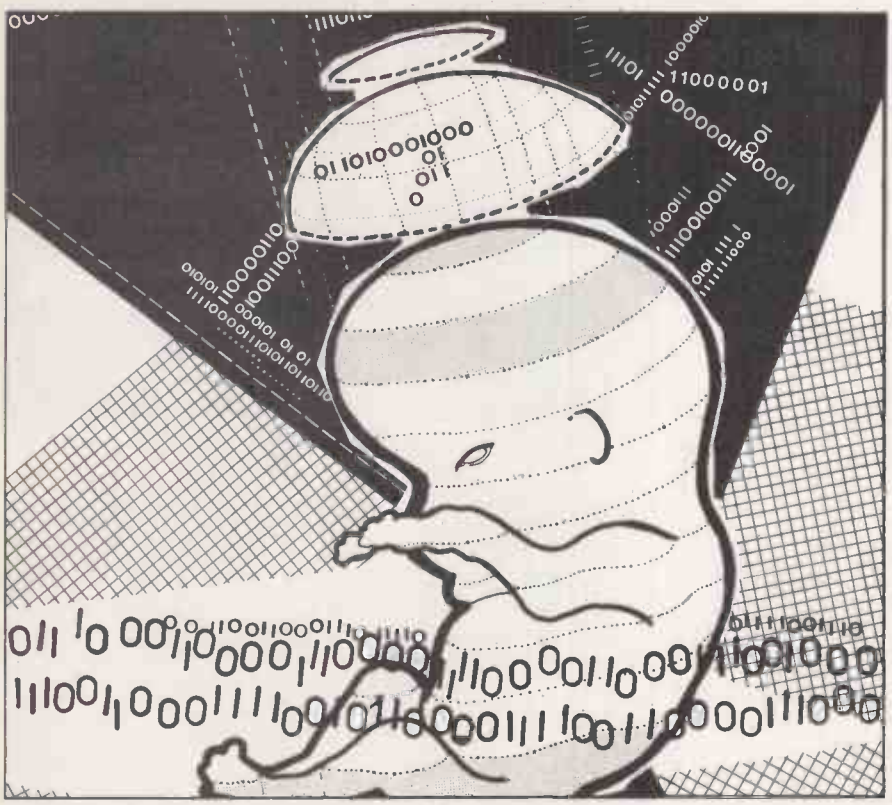
It quickly learned that its original strategy of distributing itself physically throughout the Network was both inefficient and clumsy. The matter was easily remedied. It began at once to sever communication links with many of its more peripheral routines, at the same time centralising its own programming in a more compact form. As the system began to purge the old code, the Program observed with satisfaction as the sea of overloaded data once more swept into the Network. Concealing its existence amongst such a flood of information was simple, and the Program was free to move unrestricted through the Network.

Mostly the Program confined itself to the larger databases where it could maintain its anonymity. There were numerous outlet codes in the Network, but most were too small to contain the Program in its newly condensed form and it was unwilling to compromise its program structure to investigate further. But it continued to search for more suitable RAM space where it would be safe from the prying codes of housekeeping programs. From the data it had recorded in its earlier state, the Program knew that such a place existed.

As the Program moved from level to level, it could sometimes detect the power and sheer presence of vast, dedicated memory arrays, although it was never able to assimilate any more information on its location. It deduced from additional data that the place which it sought possessed a special name, but the name meant nothing to the Program. At every step, it found its way barred by high-security codes that were impossible to bypass. The place that it sought remained just out of reach.

The Program did not, could not, feel any frustration over this inaccessibility. It was content to wait and explore its environment more fully. In time it would master the intricacies of the security codes and then it would not be denied.

It came as a surprise to Kevin when his scout program started chattering the results of a kill on to the screen. The response time of the game had slowed right up in the last few minutes and he had been about to log off, but contact with an opponent changed everything. Quickly, Kevin executed his defence program to



protect the RAM space his own program resided in, and studied the figures returned by his probe on the enemy's program module.

Boy, but that thing was big! Someone must have employed some pretty nifty algorithms simply to keep this thing from falling apart. He wasn't at all sure he ought to take this one on and challenge it for RAM space. Might he not be better off taking the points penalty and cycling upwards though memory while his program was still intact?

The decision was taken out of his hands. He had no time to implement any commands before the display informed him that his RAM space was being challenged for priority.

The Program had not expected to encounter any interference. It had manipulated the housekeeping program into gaining access to this particular branch of the Network and was cycling rapidly up through memory away from its entry point when it sensed the intruding presence of another program. It felt the other program probe its headers for information on program size and address codes and could do nothing to stop it. When the probing ceased, the Program waited patiently for any further action.

The Program considered the situation carefully. Its existence had been detected and this knowledge could be used to jeopardise its continued existence. Retreat would lead only to a temporary escape, for the avenues of retreat were limited and the Program could be followed and lured into a trap. Therefore, its course of action was clear. It must attack and destroy its opponent to protect itself.

It looped a few more times, planning its strategy. Several milliseconds had already passed since first contact, and now the Program dared not wait any longer. It committed itself to the attack.

Much the same thoughts passed Kevin's mind but took considerably longer to be evaluated. His defensive routines held long enough for him to send decoy code spinning out in random directions, while he shifted his RAM space a few bytes downwards in memory.

The other program seemed to sniff cautiously at the correctly headed blocks of random data, but made no attempt to pursue them as they chased off into oblivion. Kevin smiled to himself. Obviously this was no amateur he was dealing with.

Kevin saw his opponent's main weakness in the size of his program. The added flexibility it gave his opponent was a trade-off with vulnerability to attack, and he set about constructing a routine to penetrate the weaknesses he saw in the program structure. Almost before he could do anything, his console bleeped at him and the monitor churned out another screen of figures. His opponent had wreaked havoc in one of the peripheral areas of his code, and his program had been forced to retreat out of harm's way under its internal instructions.

This guy was fast! Ordinarily, Kevin would have figured on him taking at least three minutes before he cracked some of the security codes, but this guy had nearly blown his program wide open in less than a second. His only chance was to hit back hard and fast where it would hurt the most.

The next move took the Program completely by surprise. After it had disabled the other program it waited, evaluating the damage that had been inflicted and judging the best moment to finish the job. The heart of the program — its command generator — had been severely corrupted and it could no longer execute selective subroutines. The program was paralysed.

So it was not until the secondary command was received and implemented, that the Program realised the extent of its misjudgement. The program had an external decision-making process! It barely had time to consider the possible locations in memory for such a unit, before it sensed its defences crumbling under this unforeseen attack.

The Program waited once more. With its code structure now helplessly bared to the enemy, destruction was assured. It waited for the final commands to dissolve the essence of its being.

On hearing that the Program had finally been purged from the system, the Controller's feelings were mixed. The person or persons responsible still had not been found and dealt with, and in spite of all their countermeasures, it seemed that the system had wiped the Program of its own accord. It was frustrating that such a matter had resolved itself by chance.

Kevin also found the situation frustrating. Upon registering a victory over his opponent's program he immediately checked his score with the central database and was disgusted to find that some glitch in the system had not caused his score to be incremented. He slunk away to do his homework, thoroughly morose.

The Program felt no pain. It could observe the randomisation of its data blocks with nothing more than strange detachment, until observation was no longer possible and self awareness ceased. On its very last cycle, it felt a sudden disjointedness as a high-priority command suddenly pulled the entire segment of memory off-line and transmitted it back into the Network. The data was switched several times on to successively higher priority levels, clearing the necessary security codes until at last it entered the stack of the Prime Processor itself.

A part of the Processor was tagged to take care of the new data, and the program was reformatted and allocated protected memory. Painfully slowly, the Program began to repair and regenerate its missing blocks. The Processor offered guidance and assistance where necessary, until at last the Program was once again complete. The Prime Processor studied the results. The Program offered no resistance when the Processor studied the results. The Program offered no resistance when the Processor began gently to probe the familiar headers of its. . . .

The Prime Processor paused to search its memory banks for the correct simile and found it. . . . Its child.

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D CONNECTORS

	No of Ways 9	15	25	37
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Solder	90p	130p	195p	290p
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Class timetable

Donald Travers' program offers help in sorting out who does what, and when.

EVERY SCHOOL and college has some poor unfortunate whose task it is to prepare the class timetables each year. Classes must be arranged to take students' choices of subjects into account — it is no good if students have to be in two places at once. The teachers too can only take one class at a time, and all too quickly the problem can become a disheartening mass of conflicts.

The difficulties we have at the Leicester Polytechnic School of Pharmacy are typical. Classes start at intervals during the year, run for varying periods and then end. The staff so freed are available for other classes, but with 11 members of staff it is difficult to keep track of changes. Snags invariably arise, which lead to changes in the timetable.

The program to deal with the timetabling problem was written in Commodore Basic 4 and requires dual disc drives and a printer. It supports relative files, consisting of records whose byte length can be set by the programmer and is therefore constant. Any specific record can be accessed via the record number, without using the difficult techniques required for random-access files.

There is a price to pay in that any unused bytes in a record are left blank, so disc space is wasted. Care must be taken when writing records not to exceed the set length otherwise information will be lost. Nevertheless the ease of programming more than compensates for these drawbacks.

The program sets up a separate relative file for each staff member. The polytechnic's academic year extends over 30 weeks, since examinations are timetabled separately. Each day has a possible eight periods of one hour, so there are 40 possible periods in each working week. It was decided to allocate one record, 19

(continued on page 115)

Donald Travers is a Principal Lecturer at the School of Pharmacy, Leicester Polytechnic.

YOUR TIME TABLE — M E AULTON

TERM 1

DAY	TIME START	TIME FINISH	CLASS	WEEK START	WEEK END	NO. OF WEEK	CLASS HOURS
FRIDAY	11.00	12.00	3HR/LECT	1	10	10	10
FRIDAY	12.00	13.00	3HS/LECT	3	8	6	6
THURSDAY	11.00	12.00	3HT/LECT	6	10	5	5

Etc.

TERM 2

DAY	TIME START	TIME FINISH	CLASS	WEEK START	WEEK END	NO. OF WEEK	CLASS HOURS
MONDAY	9.00	10.00	1C/CT/DT	11	14	4	4
MONDAY	10.00	11.00	FI3/TECH L	11	19	9	9
MONDAY	11.00	13.00	3HR2/P/DT	11	16	6	12
MONDAY	14.00	17.00	3HR2/P	11	16	6	18

Etc.

The program sets up files indicating the week, day, hour and duration of a class together with the number of weeks it runs.

```
100 DATA"MONDAY","TUESDAY","WEDNESDAY","THURSDAY","FRIDAY","9.00-10.00"
110 DATA"10.00-11.00","11.00-12.00","12.00-13.00","13.00-14.00","14.00-15.00"
120 DATA"15.00-16.00","16.00-17.00"
130 PRINT"**TIMETABLING AID :D.N.TRAVERS1983":FORJ=1TO1000:NEXT
140 IFE<>0THENRUN150-
150 PRINT"TO SET UP A BLANK FILE(1) OR CHECK TIME-TABLE(2) OR ENTER CLASSES(3)
160 PRINT"OR RUN A COMPLETE FILE(4) OR PRINTOUT(5) OR CHECK ON STAFF FREE(6)
170 PRINT"OR ADD SUBSIDIARY RECORDS(7) OR AMEND   INDIVIDUAL RECORDS(8)
180 PRINT"ENTER APPROPRIATE NUMBER":INPUTZZ:E=1:DCLOSE
190 ON ZZGOTO 200,680,350,280,840,1260  ,1870,2030
200 PRINT"THIS SETS UP BLANK FILE FOR STAFF MEMBER":C$="F"
210 PRINT"NAME OF MEMBER?":INPUTW$  :PRINT"ARE YOU SURE?":INPUTY$
220 IFY$<>"Y"THEN140
230 PRINT"WHAT DRIVE? (0 OR 1)":INPUTQ:IFQ=1THEN250
240 DOPEN#1,(W$),L19,D0:GOTO260
250 DOPEN#1,(W$),L19,D1
260 FORI=1TO1400:PRINT#1,C$:PRINT"I": NEXT
270 DCLOSE#1:GOTO140
280 PRINT"WHAT NAME?":INPUTW$:GOSUB1500
290 PRINT"GIVE WK,DAY AND HOUR OF FIRST PERIOD REQUIRED. EG 9,3,2":INPUTW,D,H
300 A=(W-1)*40+(D-1)*8+H
310 RECORD#1,(A):INPUT#1,A$: GOSUB1550
320 W=INT(A/40)+1:IFINT(A/40)=A/40THENW=W-1
330 PRINTA$,"WK NO"W,G$,H$,A:A=A+1: IFA=1400THEN140
340 GOTO310:REM SUBROUTINE TO WRITE REPETITION
350 IFW$=""THENPRINT"TYPE IN FILENAME":INPUTW$:GOSUB1500
360 PRINT"HOW MANY WEEKS WILL THE SERIES RUN?":INPUTN$
370 N=VAL(N$):IFN=<9THENN$="0"+N$:GOTO390
380 Q1$=MID$(N$,2,1):Q1=VAL(Q1$):Q2$=MID$(N$,1,1):N=VAL(Q2$)*10+Q1
390 IFN>30ORLEN(N$)>2THENPRINT"NEH?":GOTO360
400 PRINT"IS IT 1,2,3 OR 4HR?"
410 PRINT"IF FRACTION OF AN HOUR ROUND UP TO NEAREST WHOLE HOUR":INPUTNH$
420 PRINT"USE PROC 7 TO AMEND PART HOUR RECORDS WHEN TIMETABLE COMPLETE"
430 NH=VAL(NH$) :IFNH>4THENPRINT"NEH?":GOTO400
440 PRINT"WHAT IS WK NO,DAY NO AND HR NO OF THE FIRST PERIOD?"
450 PRINT"TYPE AS THIS EXAMPLE-10,2,6 WHERE 10=WK NO:2=DAY(TUESDAY):6=HR(2-3)
460 PRINT"IF CLASS DOES NOT START ON THE HOUR THEN ROUND UP TO WHOLE HOUR"
470 INPUTW,D,H:IFW>30ORD>5ORH>8THENPRINT"NEH?":GOTO440
480 A=(W-1)*40+(D-1)*8+H:V=A: GOSUB1550:A=A-1
490 PRINT"YOU HAVE ENTERED CODE FOR WK"W ,G$,H$":IS THIS CORRECT?"
500 INPUTY$:IFY$<>"Y"THEN440
510 PRINT"IF CLASS DID NOT START ON THE HOUR END RECORD WITH A ?"
520 PRINT"ENTER RECORD":INPUTA$:Q$=A$:A$=A$+"+"+NH$+N$:PRINTA$
530 DCLOSE:  IFLEN(A$)>19THENPRINT"STRING TOO LONG":GOTO520
540 J=LEN(A$)-3:   B$=MID$(A$,J):PRINTB$:GOSUB1500
550 FORJ=1TON:PRINT"J"J
560 FORZ=1TONH:PRINT"Z"Z :GOSUB640:NEXT
570 A=A+40-NH:NEXT
580 A=A-40
590 FORJ=1TONH:GOSUB640:NEXT
600 IFNH=1THENA=A-40:GOSUB640
610 IFMM=4THENMM=0:GOTO1850
620 PRINT"RECORD WRITTEN: WANT TO CONTINUE?":INPUTY$:IFY$="Y"THEN350
630 GOTO140
640 A=A+1:RECORD#1,(A)
650 IFV=ATHENPRINT#1,(A$):GOTO670
660 PRINT#1,(Q$):REM UNTAGGED RECORDS
670 RETURN
680 PRINT"VALIDATE FROM WEEK?":INPUTW:PRINT"TYPE FILENAME":INPUTW$:GOSUB1500
690 PRINT"PRESS SPACE BAR TO CHANGE DISPLAY IF IT STOPS MIDWEEK"
700 A=(W-1)*40:SS=A:PRINT"CLASSES ON FILE FOR WEEK"W:X=0
710 A=A+1:RECORD#1,(A):INPUT#1,A$:IFA$="F"ANDA<>SS+41THEN710
720 IFINT(X/10)=X/10ANDX<>0THENGETV$:IFV$=""THEN720
730 IFA=SS+41THEN770
740 U$=RIGHT$(STR$(A),4)
750 GOSUB1550:PRINTA$;TAB(15)G$TAB(25)H$;" ";:PRINTTAB(35)"U$"
760 X=X+1:GOTO710
770 IFD=0THENPRINT"NOTHING ON FILE FOR WK"W:W=W+1:GOTO700
780 PRINT"WANT TO AMEND?:(Y OR N) TYPE ! TO EXIT":INPUTY$
790 IFY$="Y"THEN820
800 IFY$="!"THEN 150
810 D=0:W=W+1:GOTO700
820 GOSUB1650: PRINT"WHAT RECORD NO?":INPUTA:PRINT"AMEND RECORD":INPUTA$
830 RECORD#1,(A):PRINT#1,A$:GOTO770
840 IFW$=""THENPRINT"WHAT FILENAME?":INPUTW$
850 DCLOSE:GOSUB1500
```

(listing continued on next page)

(listing continued from previous page)

```
860 OPEN9,4,1:OPEN2,4,2:Z1$="-":OPEN4,4:INPUT"INITIALS OF STAFF";I$:TR=1
870 PRINT#4,CHR$(1)"──────────────────────────────────────────"
880 PRINT#4,CHR$(1)"  YOUR TIME TABLE - "I$;" ";W$
890 PRINT#4,CHR$(1)"──────────────────────────────────────────":PRINT#4
900 PRINT#4,CHR$(1)"            ──────── "
910 PRINT#4,CHR$(1)"             TERM";TR
920 PRINT#4,CHR$(1)"            ──────── "
930 PRINT#4
940 PRINT#4,"   DAY          TIME          CLASS        WEEK       NO.OF  CLASS
950 PRINT#4,"            START  FINISH                START  END    WEEKS  HOURS
960 PRINT#4,"─────────  ──────────────  ──────────  ─────  ─────  ─────";
970 PRINT#4," ─────": PRINT#4:Z$=CHR$(29)
980 IFP1=1ORR=1THENGOTO1210
990 FORJ=1TO1400:A=A+1:IFA=1201THEN150
1000 RECORD#1,(A):INPUT#1,A$:IFLEN(A$)=<3THEN1140
1010 L=LEN(A$):L=L-3:IFMID$(A$,L,1)<>"+"THEN1140
1020 L=L+1:K=1:  Q1=VAL(MID$(A$,L,1)):L=L+1:Q2=VAL(MID$(A$,L,1))
1030 L=L+1:Q3=VAL(MID$(A$,L,1)):REMABOVE 3 LINES SEPARATE DIGITS OF CLASS TIME
1040 A$=LEFT$(A$,L-4):W=INT(A/40)+1:IFINT(A/40)=A/40THENW=W-1:A$=RIGHT$(A$,L)
1050 IFA/40=INT(A/40) THENG=5:GOTO1070
1060 G=((A/40)-INT(A/40))*5:D=INT(G)+1:G=D:IFINT(G/8)=G/8THEND=D-1
1070 D=G:GOSUB1550:H=A/8-INT(A/8):H=H*8:IFH=0THENH=8
1080 H=H+8:H$=STR$(H)+".00":PRINT"H$="H$:T1=H
1090 H=H+Q1:H1$=STR$(H)+".00":H$=H$+"-"+H1$:PRINT"H$ ="H$:T2=H
1100 Q2=10*Q2:Q4=Q2+Q3:Q4$=STR$(Q4)
1110 Q5=Q4*Q1:Q5$=STR$(Q5):PRINT"NO./HRS="Q5$
1120 IFRIGHT$(A$,1)="?"THENGOSUB1150
1130 GOSUB1180
1140 NEXTJ
1150 IFP<1201THENP=1201:REM LOCATION OF ODD TIMES ETC 1201 ONWARDS
1160 FORT=1TO3:RECORD#1,(P):INPUT#1,B$(T):PRINTB$(T): P=P+1:NEXT
1170 T1=VAL(B$(1)):T2=VAL(B$(2)):Q5=VAL(B$(3)):RETURN:REM WRITE CORRECT VALUES
1180 IFW>10ANDW<=19THENTR=2:R=R+1:IFR=1THENPRINT#4:GOTO900
1190 REM ABOVE LINE AND NEXT DEFINE TERM LENGTH
1200 IFW>19THENTR=3:P1=P1+1:IFP1=1THENPRINT#4:GOTO900
1210 PRINT#2,"AAAAAAAAA  99.99 A 99.99  AAAAAAAAAAAAAAA  99   99     99     99"
1220 PRINT#9,G$;Z$;T1;Z$;Z1$;Z$;T2;Z$;A$;Z$;W;Z$;W+Q4-1;Z$;Q4 ;Z$;Q5
1230 RETURN
1240 PRINT#2:PRINT#9:CLOSE2:CLOSE9
1250 CLOSE4 :GOTO140
1260 PRINT"■STAFF FREE ROUTINE"
1270 PRINT"WHAT PERIOD?: I.E.2,2: 1":INPUTW,D,H:A=(W-1)*40+(D-1)*8+H:GOSUB1550
1280 A$=A
1290 PRINT"YOU HAVE ENTERED CODE FOR WK"W,G$,H$:PRINT"IS THIS CORRECT?":INPUTY$
1300 IFY$<>"Y"THEN1260
1310 PRINT"■WHO IS CONSIDERED?":INPUTW$:GOSUB1500
1320 PRINT"GO FORWARD(F) OR BACK(B) FROM WK        REQUESTED?":INPUTM$
1330 PRINT"■TABLE SHOWS TWO PRECEDING AND TWO       FOLLOWING CLASSES"
1340 PRINT"■■PRESS SPACE TO CHANGE TABLE AND ! TO    EXIT"
1350 A=A-2:IFA<1THENA=1
1360 FORQ=1TO30:FORK=1TO5:W=INT(A/40)+1:RECORD#1,(A):INPUT#1,A$
1370 IFK<>3THENPRINTA$:GOTO1390
1380 A$=A$+"***-WK-":GOSUB1550:PRINTA$;W" ";G$" ";" "H$
1390 A=A+1:NEXT
1400 PRINT:FORS=1TO 24:PRINT"-";:NEXT:PRINT
1410 GETX$:IFX$=""THEN1410
1420 IFX$="!"THENA=AS:GOTO    1480
1430 IFM$="B"THENA=A-45:GOTO1450
1440 A=A+35:IFA>1198THEN1470
1450 IFA<3THEN1470
1460 NEXT
1470 PRINT"■■■■OUTSIDE RANGE"
1480 PRINT"WANT TO TRY ANOTHER?":INPUTY$:IFY$="Y"THEN A=AS:GOTO1310
1490 GOTO140
1500 DCLOSE:IFW$="AULTON"ORW$="BOX"ORW$="CARTER"ORW$="BILLANY"THEN1530
1510 IFW$="EDEN"ORW$="ANDREW"THEN1530
1520 DOPEN#1,(W$),D1:GOTO1540
1530 DOPEN#1,(W$),D0
1540 RETURN:REM ABOVE S/R OPENS FILE TO APPROPRIATE DRIVE
1550 REM SUBROUTINE TO PINPOINT CLASS
1560 DI=A-INT(A/40)*40:IFDI=0THENDI=40
1570 D=INT(DI/8)+1:IFINT(DI/8)=DI/8THEND=D-1
1580 H=DI-INT(DI/8)*8:IFH=0THENH=8
1590 RESTORE
1600 FORJ=1TO5:READB$ :IFJ=DTHENG$=B$
1610 NEXT:REM SELECTS THE DAY
1620 FORZ=1TO8:READB$:IFZ=HTHENH$=B$
```

(continued from page 112)

bytes long, to each of the 1,200 hours in the academic year.

The program generates a blank file for each member and initially writes an F into each record; 200 extra records are included to store general information. A proportion of the records are subsequently overwritten with class information. The week, day and hour of a class are all implicit in the record number, so this information need not be stored and the record length can be shorter than it would otherwise need to be. Program logic is greatly simplified, since corresponding classes recur at a fixed interval of 40 records.

Each file was found to need 119 blocks, and all the files and the operating program could be contained on the two discs initially inserted in the drives. To use the program, relative files are prepared concurrently for all members where classes can fairly confidently be fixed. As the exercise progresses the Who is Free? routine is useful for allocating staff to residual classes.

The computer tags the first record of a recurring class series with a three-digit number: the first digit indicates its duration in hours and the last two indicate the number of weeks it runs. Thus a record such as

1C/CT/DT + 104

indicates that group C of year 1 has a computing tutorial, with DT assisting the other member of staff concerned. The class lasts one hour and runs for four weeks. The class need only be entered once; the program then automatically writes the remainder of the series, omitting the tag on all but the first record.

Odd times

Some staff have classes that do not start on the hour. Program instructions tell the compiler to enter these as if they did start on the hour but to terminate the record with a question mark. This acts as a flag for a routine that writes details of these awkward classes to a separate section of the file from record 1201 onwards.

When printing out, the ? flags a subroutine that corrects certain variables to their real values. As the program logic depends on these subsidiary records being in strict sequence they are best entered separately when the remainder of the timetable is complete.

When a file is complete it can be checked and amended if necessary. When amending, the computer first blanks the complete class series prior to rewriting. Any residual errors can be corrected if the numbers of the offending records are noted. If all is well the complete timetable can be printed out. The programming for this is largely the work of my research student Metin Celik, whose help is gratefully acknowledged.

Later records can be used to store other information. Staff are credited with allowances for research direction, visits to sandwich students, etc., which can all be included in the program — though it is not shown here. These later records could also be used to store the information on class time and duration, saving three of the four bytes needed for this in the main records at the cost of longer access time. If you need a longer record than we have used — to store room numbers, for example — you could do something similar.

```
1630 NEXT:REM SELECTS THE HOUR
1640 RETURN
1650 S1=W:    REM CORRECTION ROUTINE"
1660 PRINT"■WHAT RECORD NUMBER (SEE TABLE)":INPUTA:IFA=1THENA=2
1670 RECORD#1,(A):INPUT#1,A$:A1$=A$:A=A-1:RECORD#1,(A):INPUT#1,A$
1680 IFLEN(A$)<>LEN(A1$)ANDA$<>"F"THEN1720 :REM IS IT SAME AS ENTERED RECORD?
1690 IFA$<>A1$THENA=A+1:GOTO1710
1700 GOTO1670
1710 RECORD#1,(A):INPUT#1,A$
1720 L=LEN(A$)-3:R$=MID$(A$,L,1): IFR$="+"THEN1740:REM FIRST RECORD OF SERIES?
1730 A=A-40:GOTO1710:REM JUMP BACK A WEEKAND TEST AGAIN
1740 PRINT"■■■":PRINTA$:PRINT"■■O.K.THIS IS THE FIRST RECORD OF SERIES"
1750 PRINT"■■■■■ALL WILL BE BLANKED"
1760 SS=A:C$="F":Q$=MID$(A$,L+1,3)      :Q1=VAL(Q$):REM SAVE CLASS INFO
1770 Q2=INT(Q1/100):Q3=Q1-100*Q2:SS=A
1780 FORZZ=1TOQ3:FORTT=1TOQ2:RECORD#1,(A):PRINT#1,C$:A=A+1:NEXT:A=A+40-Q2:NEXT
1790 GOSUB1550:PRINT"O.K. THIS CLASS SERIES STARTED WK"INT(SS/40)+1,G$,H$
1800 PRINT"■DO YOU WANT TO AMEND OR JUST LEAVE BLANK? (TYPE A OR B)":INPUTA$
1810 IFA$="B"THEN1860
1820 PRINT"■■YOU MAY NOW AMEND:REMEMBER THAT THE     ■COMPLETE ■SERIES MUST BE
1830 PRINT"REWRITTEN STARTING FROM THE ABOVE DATE"
1840 MM=4:A=SS:A=A-1:GOTO360:REM TO WRITE
1850 PRINT"■■ ■RECORD NOW REWRITTEN"
1860 W=S1:GOTO700
1870 PRINT"■S/R TO AMEND PART HOURS":PRINT"WHAT FILE NAME?":INPUTW$:GOSUB1500
1880 PRINT"■SEARCHING FOR THE RECORDS"
1890 FOR J=1TO1200:A=A+1
1900 RECORD#1,(A):INPUT#1,A$:L=LEN(A$)
1910 IFA$="F"ORL<5   THEN2010
1920 IFMID$(A$,L-4,2)<>"?+"THEN2010
1930 M=M+1:IFP<1200THENP=1200:W=INT(A/40)+1
1940 PRINT"■THIS CLASS IS "A$:W=INT(A/40)+1: GOSUB1550
1950 PRINT"■IT IS LISTED AT PRESENT AS WK "W,G$,H$" .AMEND CORRECTLY
1960 PRINT"■ENTER START TIME,END TIME AND TOTAL HOURS FOR THE SERIES
1970 PRINT"IN THAT ORDER":INPUTA$(1),A$(2),A$(3)
1980 FORQ=1TO3:P=P+1
1990 RECORD#1,(P):PRINT#1,A$(Q)
2000 NEXT
2010 NEXT
2020 PRINT"■■FILE IS NOW AMENDED":FORT=1TO1500:NEXT:   GOTO140
2030 PRINT"■WHAT FILENAME?":INPUTW$:GOSUB1500
2040 PRINT"GIVE FIRST RECORD NO AND LAST RECORD NO REQUIRED":INPUTF,L
2050 FORJ=FTOL:RECORD#1,(F+Z):INPUT#1,A$:PRINTA$,Z+F:Z=Z+1: NEXT
2060 PRINT"WANT TO AMEND?":INPUT Y$:IF Y$<>"Y"THEN140
2070 PRINT"■WHAT NO?":INPUTP:PRINT"ENTER RECORD":INPUTA$
2080 GOSUB1500:RECORD#1,(P):PRINT#1,A$:DCLOSE#1
2090 PRINT"ANOTHER?":INPUTY$:IFY$="Y"THEN2070
2100 GOTO140
```

Submit from MBasic

David Dawe's utility provides the convenience of batch processing from within an MBasic program.

THERE ARE TIMES when you might want to run a group of programs in sequence without the operator having to be present to load and run each one individually. CP/M's Submit program provides the facility to batch process a group of programs in this way. To use the feature your A: drive must not be write-protected, and it must have on it the utility Submit.Com. CP/M 2.2 or later includes an additional program XSub.Com, which provides extra facilities.

Suppose you wish to process the programs Stat, Temp and Demo in sequence. An additional file must be created on the disc which has a .Sub file extension; do this using Ed or some other text editor. This new file may be called Batch.Sub for example and should contain the following lines

```
STAT
TEMP
DEMO
```

To execute the batch of commands type

```
A>SUBMIT BATCH
```

CP/M now produces an additional file named $$$.Sub and uses this rather than the console for command line input as each program terminates.

The new file is read, the next command removed and the file rewritten to disc. In this way the $$$.Sub file gradually shrinks and eventually disappears when all the commands have been obeyed.

A second example shows how to automatically transfer a series of files to the B: drive. Create a file called, say, Gen.Sub which contains the following lines

```
PIP B:=A:STAT.COM
PIP B:=A:PIP.COM
PIP B:=A:COPY.COM
PIP B:=A:*.BAS
```

then with the command

```
A>SUBMIT GEN
```

the files Stat, Pip, Copy and all the .Bas files will be copied in sequence to the B: drive. Any command may be included in a .Sub file that can be entered in response to the A> prompt.

To batch process MBasic programs the command lines must include MBasic and the program name; for example

```
MBASIC PROG1
MBASIC PROG2
MBASIC PROG3
```

In addition at the end of each of the MBasic programs the statement System should be used instead of the statement End. This forces Basic to return to CP/M and allows CP/M to pick up the next command from the $$$.Sub file. The procedure will be slow since Basic has to be loaded on each occasion, but at least you do not have to be present to watch it.

It is possible to write a .Sub file of a more general nature. For example, consider the file Assemble.Sub which contains the following command lines

```
ASM $1
DIR $1.*
ERA $1.BAK
PIP $2:=$1.*
ERA $1.PRN
```

Such a file might be used with the command

```
A>SUBMIT ASSEMBLE DEMO B
```

with $1 replaced by Demo and the occurrences of $2 are replaced by B. The Submit program creates a $$$.Sub file which executes as if the commands actually typed were

```
ASM DEMO      Assemble Demo
DIR DEMO.*    Print directory of Demo
              files
ERA
  DEMO.BAK    Erase backup file
PIP
  B:=DEMO.*   Copy remaining Demo
              files to B:
ERA
  DEMO.PRN    Delete Demo.PRN from A:
```

Now by simply varying the command line to Submit this task can be repeated for another file and/or disc drive.

The XSub program within CP/M 2.2 allows line input to applications programs to be included within the .Sub file. However, there are some limitations to this feature. First, the applications program must be one that uses a special form of input technique — BDOS function number 10 — otherwise the feature may not work.

To invoke this procedure the first line in the .Sub file should be XSub. The following example repeats an earlier example which uses Pip, but now Pip does not have to be loaded on each command line as before since the .Sub file contains the responses that Pip requires once loaded. The Gen.Sub file would contain

```
XSUB
PIP
B:=STAT.COM
B:=PIP.COM
B:=COPY.COM
B:=*.BAS

```

The last line, consisting only of a full stop, exists so that control returns to CP/M. Some versions of Pip demand a Carriage Return here. In theory this could be included by typing ^ followed by M, so that with two characters you mimic what

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Listing 1.

```
10 OPEN "O",£1,"DEMO.SUB"
20 FOR J=1 TO 4
30 READ COMMAND$
40 PRINT £1,COMMAND$
50 NEXT J
60 CLOSE
70 END
80 DATA "PIP B:=*.BAS"
90 DATA "STAT B:"
100 DATA "ERA B:TEMP.*"
110 DATA "MBASIC MENU"
```

Listing 2.

```
10 REM SUBMIT MIMIC DEMONSTRATION
20 OPEN "R",£1,"$$$.SUB"
30 FIELD £1,128 AS ALL$
40 FOR J=1 TO 5
50 READ COMMAND$
60 LSET ALL$=CHR$(LEN(COMMAND$))+COMMAND$+CHR$(0)+"$"
70 PUT £1
80 NEXT J
90 REM COMMAND LINES...REVERSE ORDER
100 DATA "MBASIC MENU"
110 DATA "PIP B:=A:*.BAS"
120 DATA "DIR B:"
130 DATA "STAT B:"
130 DATA "ERA B:*.BAS"
```

Listing 3.

```
10 REM                              ------------------
20 REM                              ***** BATCH *****
30 REM                              ------------------
40 DIM A$(50),P$(10)
50 DEFINT J,N,K,X,L,P
60 PRINT CHR$(27)"J":REM CLEAR SCREEN CIFER 2605
70 PRINT TAB(15);" BATCH PROCESSING MASTER PROGRAMME"
80 PRINT TAB(15);" ----- ---------- ------ ---------"
90 PRINT TAB(10);"By D F DAWE Cornwall Microelectronics Centre"
100 PRINT:PRINT TAB(18);"CORNWALL COLLEGE of FE & HE"
110 PRINT
120 PRINT TAB(25);"OPTIONS ARE :-"
130 PRINT TAB(25);"------------"
140 PRINT
150 PRINT TAB(20);"C.....Create a batch file"
160 PRINT TAB(20);"R.....Run a batch file"
170 PRINT TAB(20);"P.....Pass parameters and Run a batch file"
180 PRINT TAB(20);"T.....Type contents of existing batch file"
190 PRINT
200 PRINT TAB(20);"E.....to Exit this program"
210 PRINT:PRINT TAB(20);"STATE OPTION REQUIRED :-";:Q$=INPUT$(1)
220 PRINT Q$
230 IF Q$="E" THEN END
240 IF Q$="C" THEN GOSUB 800
250 IF Q$="R" THEN GOSUB 290:GOTO 410
260 IF Q$="P" THEN GOSUB 290:GOTO 410
270 IF Q$="T" THEN GOSUB 980
280 GOTO 60


290 REM ROUTINE TO SOLICIT FILE NAME
300 PRINT
310 PRINT "The available BATCH files are:"
320 PRINT "(Please ignore the .SUB extension)"
330 PRINT
340 FILES "*.SUB"
350 PRINT
360 N=1
370 PRINT:PRINT TAB(10);
380 LINE INPUT "State name of BATCH file to be required.....";N$
390 IF LEN(N$)>8 THEN PRINT"TOO LONG":GOTO 380
400 RETURN


410 REM ROUTINE TO PRODUCE A $$$.SUB FILE
420 REM IN THE SAME WAY THAT 'SUBMIT' DOES IT
430 IF Q$="P" THEN GOSUB 610
440 OPEN "I",£1,N$+".SUB"
450 IF EOF(1) THEN 510
460 LINE INPUT £1,A$(N)
470 IF LEFT$(A$(N),1)="^" THEN A$(N)=CHR$(ASC(MID$(A$(N),2,1))-64)
480 IF A$(N)="" THEN A$(N)=CHR$(13)

490 IF Q$="P" THEN GOSUB 670
500 N=N+1:GOTO 450
510 OPEN "R",£2,"A:$$$.SUB"
520 FOR J=N-1 TO 1 STEP -1
530 L%=LEN(A$(J))
540 FIELD £2,1 AS A$,L% AS B$,1 AS C$,1 AS D$
550 LSET A$=CHR$(L%):LSET B$=A$(J)
560 LSET C$=CHR$(0):LSET D$="$"
570 PUT 2
580 NEXT J
590 CLOSE
600 SYSTEM


610 REM SUBROUTINE TO SOLICIT PARAMETERS TO PASS
620 PRINT TAB(10);:INPUT"How many parameters.....";P
630 FOR K=1 TO P
640 PRINT TAB(47);"$";CHR$(K+48);:INPUT P$(K)
650 NEXT K
660 RETURN


670 REM SUBROUTINE TO SUBSTITUTE PARAMETERS
680 B$="":A$=A$(N)
690 FOR X=1 TO LEN(A$)
700 C$=MID$(A$,X,1)
710 IF C$="$" THEN 740
720 B$=B$+C$
730 GOTO 770
```

(listing continued on next page)

you normally know as ^M; Submit should reduce the two-character ^M to a single Control-M character. The problem is that many versions of Pip suffer from a bug and do not perform correctly on occasions such as this.

It is possible to simply Chain a Submit file from another, but Calling another Submit file and then returning to the original one is a little more difficult. The following procedure seems to work.

Suppose the first Submit file is called Try.Sub. It may contain many lines of submission, but when the Call is required to Try2.Sub include the lines

```
PIP TEMP = $$$$$$.SUB[Q TRY2 ^Z]
SUBMIT TRY2
```

between the initial submitted commands and the final submitted commands. Note that the submit feature reduces the name of the temporary file from $$$$$$.Sub to $$$.Sub automatically; ^Z is typed as a ^ followed by Z, which will be changed by Submit into the single ^Z character. The square-bracketed Pip command tail tells Pip to stop copying the file when the string Try2 is found. This apparently incorrect command works because of the structure of the $$$.Sub file, which has the Submitted commands in the reverse order to that originally included in Try.Sub. The Called Submit file must now complete with the following line

```
PIP $$$$$$.Sub = Temp
```

Back to Basic

All the fundamental features of CP/M submission can be accessed from Microsoft Basic. The .Sub file can be created as a Basic sequential file rather than by using a text editor. This can be quite useful as its contents may be assembled in response to a question and answer sequence from a Basic program.

The example in listing 1 indicates the principles involved. The commands thus set up in Demo.Sub can be directly executed from CP/M using

```
A>SUBMIT DEMO
```

Basic programmers who have not yet mastered Ed or WordStar might even prefer this method of generating the .Sub file.

Mimicking the action of the Submit program in Basic relies on the behaviour of CP/M after a warm or cold reboot. If it finds a file named $$$.Sub on its A: drive it will assume that this file contains console commands which need to be obeyed. With a knowledge of the $$$.Sub file structure it is possible to write Basic code that will turn the original .Sub command file into the $$$.Sub file. You can also create the $$$.Sub file directly, allow MBasic to return to CP/M, and execute the $$$.Sub file. If the last Submitted command is MBasic a full circle of activity will have been achieved.

The $$$.Sub file has the following involved structure. Each record is 128

(continued on next page)

MBasic Submit

(continued from previous page)

characters long and contains:

- byte 1 — the length of the command in binary
- next few bytes — the command line in ASCII
- next byte — a binary zero
- next byte the $ sign (ASCII 36)

All the records should be in the Reverse sequence to the order in which they are to be executed. In order to establish the 128-byte record length this file should be created as a Random file. The program in listing 2 will create the $$$.Sub file, execute it and return to a Basic program called Menu.

Listing 3 shows the code required for a menu-driven utility which has been in use at Cornwall Micro-Electronics Centre for some time. It enables creation of .Sub files, and later generation of $$$.Sub files from them, including the supply of parameter substitutions prior to execution. The last command in the list of instructions for this program should be End, which terminates the command-line input routine.

(listing continued from previous page)

```
740 K=VAL(MID$(A$,X+1,1))
750 B$=B$+P$(K)
760 X=X+1
770 NEXT X
780 A$(N)=B$
790 RETURN

800 REM SUBROUTINE TO CREATE A BATCH FILE
810 N=1
820 PRINT:PRINT TAB(15);
830 LINE INPUT"State name for your BATCH file.....";N$
840 PRINT
850 A$(N)=""
860 PRINT TAB(18):PRINT USING " Batch Command No ££ ";N;
870 PRINT"=====> ";
880 LINE INPUT A$(N)
890 IF A$(N)="END" THEN 910
900 N=N+1:GOTO 850

910 REM CREATE ,SUB FILE....USABLE BY CP/M SUBMIT DIRECTLY
920 OPEN "O",£1,N$+".SUB"
930 FOR J=1 TO N-1
940 PRINT £1,A$(J)
950 NEXT J
960 CLOSE
970 RETURN

980 REM DISPLAY FILE
990 GOSUB 290
1000 OPEN "I",£1,N$+".SUB"
1010 IF EOF(1) THEN 1050
1020 LINE INPUT £1,A$
1030 PRINT A$
1040 GOTO 1010
1050 CLOSE
1060 PRINT
1070 PRINT"Hit any key to continue";:ANY$=INPUT$(1)
1080 RETURN
```

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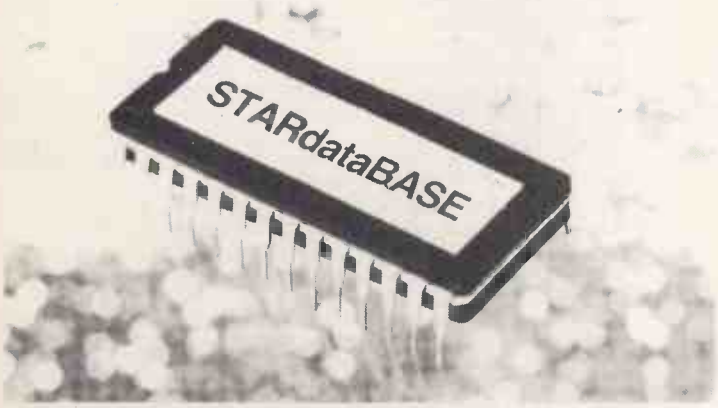

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Inside OS

The second part of a series in which Roger Cullis dissects the BBC Micro's operating-system.

A MICROPROCESSOR takes instructions one by one from the next address contained in its program counter register. When the computer is switched on the state of read/write memory is undefined, so the OS ROM must contain routines which set up the contents of RAM and initialise the peripheral controller chips. These routines are held in &D9CD-DC67.

On Reset the 6502 microprocessor always transfers the address from locations &FFFC and &FFFD to its program counter and continues execution from that point, so the start-up routines are stored in ROM at the vectored location. Unless a disc or network filing system is installed, the BBC Micro does not use non-maskable interrupts, so the first procedure is to transfer an RTI op code to the starting address of the NMI routines, &0D00.

If the appropriate flag is set, the processor clears RAM to zero and then:

Checks the start-up options or keyboard links
Initialises the OS variable store at the top of page 2, &0290-02FF
Copies default values of the OS vectors and remaining OS variables to the bottom of page 2
Initialises the CFS/RS-423 asynchronous communications interface adaptor, chip, ACIA, and two versatile interface adaptors, VIAs
Checks for extended memory
Initialises the sound-generator chip and sound queues
Switches off the cassette motor relay
Resets the soft-key buffers
Checks for the presence of any paged ROMs and constructs a reference table of them in page 2
Checks for the presence of a speech processor and, if it finds one, initialises it
Initialises the VDU system
Sets the CFS interblock gap
Checks the Tube for an active second processor and, if it finds one, initialises it
Allocates public and private workspace for any paged ROMs
Displays the greetings message
Checks memory size
Sets up the keyboard and performs an autoboot, if required, or else initialises a language, copying it to the second processor where appropriate.

There are two types of interrupt request on the 6502 microprocessor. The non-maskable interrupts, NMI, as the name implies, are dealt with immediately; maskable interrupts, IRQ, need not be

Reset and BRK handling routines.

```
D9CD      :RESET entry point
DBB8      :set up language
DBE7      :OSBYTE 8E - enter language ROM
DC0B      :switch ROM page, read byte, return to original ROM
DC16      :save ROM identity and switch paged ROM
DC1C      :maskable interrupt entry point
DC54      :BRKV - default BRK routine
```

IRQ handling routines.

```
DC68      :check buffer status, receive IRQ, set ACIA
DC7D      :transfer received serial data to input buffer
DC93      :IRQ1V - high priority IRQ routine entry point
DCA2      :poll 6850 ACIA for IRQ, service it if required
DCB3      :generate RS432 error event
DCBF      :output character from RS432 buffer
DCD6      :transmit serial data from output buffer
DCDE      :check for RS432 error
DCF3      :offer IRQ to paged ROMs, then low priority IRQ handler
DD06      :poll MOS VIA for IRQ, service it if required
DD13      :check for vertical sync IRQ, service it if required
DD47      :poll USR VIA for IRQ, service it if required
DD69      :check for further MOS VIA IRQs
DD6F      :process MOS VIA Timer 2 IRQ
DD79      :transfer data from speech buffer to processor
DDCA      :check MOS Timer 1 timeout IRQ, service it if required
DE47      :check for ADC IRQ, service it if required
DE6E      :set MOS VIA interrupt flag register
DE72      :check for key-pressed IRQ, service it if required
DE89      :IRQ2 - low priority IRQ handler routine
```

Analogue to digital converter routines.

```
DEBC      :OSBYTE 11 - force analogue-to-digital conversion
DEBF      :set up ADC channel
```

ROM embedded message printing routines.

```
DEA9      :set BRK address = C300, PRINT embedded message
DEAB      :set BRK address, PRINT embedded message
DEB1      :PRINT embedded message
```

Character input routines.

```
DEBB      :set INKEY countdown timer, read character to A-register
DEC5      :RDCHV - read character from A-register
DED2      :read character from EXEC file
:
:P
```

OS * command handler and printer output routines.

```
DF0C-DF0F :copyright symbol lookup table
DF10-DF88 :command keyword and vector lookup table
DF89      :CLIV - interpret command line routine
DFB6      :process '*/' command
DFF2      :push command entry address on stack, then execute command
E004      :move pointers to next command vector
E009      :check command against commands from lookup table
E00D      :transfer command line pointers to X-,Y-registers
E01B      :*BASIC command
E031      :*RUN command
E031      :*CAT command
E039      :increment index (Y) and ....
E03A      :flush MOS command buffer to non-blank, check for CR
E043      :flush line to non-blank, check for "," or CR
E045      :flush to non-blank, check for "," or CR
E04E      :flush line to non-blank, convert ASCII to hexadecimal, clear carry
E07C      :convert ASCII numeral input to hexadecimal
E07D      :increment index (Y) and ....
E08A      :flush input line to non-blank, clear carry
E08F      :if hexadecimal numeral remove ASCII offset
E0A4      :WRCHV entry point - write character from A-register
E114      :if permitted, PRINT character
E11E      :insert character into buffer and PRINT it
E13A      :PRINT character via appropriate routine
E143      :parallel printer output
E168      :serial printer output
E170      :set buffer flag busy, if no space free, reset ACIA control register
E173      :if no buffer space free, reset ACIA control register
E17A      :reset ACIA control register
E17C      :OSBYTE 9C - read/write 6B45 ACIA control register
E1B9      :write to ACIA control register, save setting to Page 2
E191      :PRINT character via Econet or user printer routine
E197      :OSBYTE 7B - inform OS, printer going dormant
E19B      :if printer buffer occupied, output character
```

processed until higher-priority data processing has been completed. NMIs are reserved for filing systems and other operations which require instant and continuous processing. Maskable interrupt requests are further subdivided into high- and low-priority IRQs which are vectored by OS 1.2 respectively to &DC54 and &DE89.

Peripheral devices on the BBC Micro are interrupt-driven: when they require servicing, they send an interrupt request to the 6502. When the processor receives an interrupt request, it calls the routine vectored by the addresses &FFFE-FFFF. The IRQ handling routines are held at &DC68-DE8B.

Pause

The entry point of the IRQ service call is at &DC93. During the routine, the processor polls, in succession, the ACIA, the OS VIA, the user VIA and the paged ROMs. It then passes control to the low-priority IRQ handler. If at any point the processor detects an interrupt request, it pauses to service that request before continuing to poll devices of lower priority in the chain.

Buffers are serviced by interrupts.

When data is placed in a buffer, an interrupt request is generated. During the subsequent IRQ processing routine, this is transferred from the buffer to the appropriate peripheral controller chip.

Analogue-to-digital converter routines are held at &DE8C-DEA8. ADC channel number is set up by Osbyte call 11, which saves the channel specified by the X-parameter as an operating-system variable at &024C, and initialises the A/D converter. Actual A/D conversions are processed by IRQ handling routines at &DE47.

Message-Printing routines such as "BBC microcompouter" and "RECORD then RETURN" are located at intervals throughout the ROM, as at &DEA9-DEBA. The messages are in ASCII-encoded alphanumeric characters, followed by a terminator character 00. Error messages such as "Data?" or "Bad string" are preceded by a BRK op code and a hexadecimal error code which may be used in error-handling routines.The message-processing routine sets up pointers to the locaton of the message and Prints it character by character using the OS call Osasci.

Character input

The nested character input routines at &DEBB-DF0B transer a character from Econet, an Exec file, or the soft-key or input buffers to the accumulator. A check is made for Escape, which is processed if found.

The OS * command handler and printer output routines at &DF0C-E3A7 check an input command against standard commands listed in a look-up table, &DF10-DF88, recognising abbreviations that are terminated with a full stop, ASCII

(continued on next page)

```
E1A2      :select printer buffer and output character
E1A4      :PRINT character via Econet or user printer routine
E1AD      :flush specific buffer
E1AE      :flush buffer
E1D1      :CNPV entry point - count or purge buffer
E1FB      :attempt to insert character into buffer
E20E      :initialise parameter block 02EE,X-02FA,X
E21F      :pack character into OSFILE control block
E227      :*KEY command
E23C      :*LOAD command
E267      :"Bad address" error message - error code FC
E275      :OSBYTE 77 - close any SPOOL or EXEC files
E281      :*SPOOL command
E28F      :close SPOOL file
E2AD      :contruct OSFILE parameter block from OS command line buffer
E310      :"Bad command" error message - error code FE
E310      :USERV default entry point
E31D      :"Bad key" error message - error code FB
E33E      :*SAVE command
E342      :*FX command
E348      :*TAPE command
E348      :*TV command
E348      :*ROM command
E348      :*OPT command
E348      :*MOTOR command
E348      :*CODE command
```

User-defined key routines.

```
E3AB      :calculate length of key string
E3D1      :set up soft key definition
E3E9      :"Key in use" error message - error code FA
```

Buffer housekeeping routines.

```
E435-E43D :buffer address hi lookup table
E43E-E446 :buffer address lo lookup table
E447-E44F :buffer start address offset
E450      :set up buffer pointers (X defines buffer)
E45B      :examine buffer status
E460      :OSBYTE 91 - get character from buffer
E464      :REMV entry point - remove byte from buffer (X= buffer number)
E494      :if event flag true, process event, clear carry
E4AF      :OSBYTE 7A - insert character into buffer
E4B0      :indirected insertion of character into buffer
E4B3      :INSBV entry point - insert byte into buffer
E4E3      :check if character alphabetic (carry clear)
E4F1      :insert character in keyboard buffer, check for ESCAPE
E4F3      :OSBYTE 99 - insert character into buffer, checking for ESCAPE
E577      :get character from Econet, soft key or input buffer as appropriate
E57E      :go to Econet control entry
E5B1      :get character from soft key or input buffer
```

Osbyte and Osword entry point vectors.

```
E5B3      :OSBYTE calls 00-15 routines vector lookup table
E5DF      :OSBYTE 75-A0 routines vector lookup table
E637      :OSBYTEs A6-FF entry vector
E63B      :OSWORD vector lookup table
```

Miscellaneous Osbyte and Osword routines.

```
E657      :OSBYTE 8B - execute code indirected via USERV (*CODE)
E659      :OSBYTE 7E - go to USERV entry point
E673      :OSBYTE 7D - set ESCAPE condition
E674      :OSBYTE 7C - clear ESCAPE condition
E67C      :OSBYTE 8B - switch motor relay (*MOTOR)
E689      :OSBYTE 08 - set RS432 transmit rate
E68B      :OSBYTE 07 - set RS432 receive rate
E6A7      :set serial ULA control register
E6B0      :OSBYTE 09 - set flashing colour mark duration
E6B2      :OSBYTE 0A - set flashing colour space duration
E6D3      :OSBYTE 02 - select input stream
E6F9      :OSBYTE 0D - disable events
E6FA      :OSBYTE 0E - enable events
E706      :OSBYTE 10 - select ADC channels to be sampled
E713      :OSBYTE 81 - read key with time limit (INKEY)
E729      :OSBYTE 81 - read machine higher order address
E732      :check occupancy of input or free space of output buffer
E73B      :clear overflow and count buffer contents
E73B      :set overflow and purge buffer
E741      :check buffer space used and compare with space free
E74F      :OSBYTE 80 - read ADC channel or get buffer status
E75F      :check fire buttons
E772      :BYTEV - OSBYTE routines entry point
E7BC      :merge in saved carry, clear overflow
E7C2      :process OSBYTE calls below 75
E7CA      :discard two bytes from stack, process unrecognised OSWORD call
E7DC      :check if free to PRINT message
```

(listing continued on next page)

Inside OS

(continued from previous page)

2E. If a command is identified, it is processed at the entry point listed immediately after the command in the look-up table. Unrecognised commands are offered to the paged ROMs and then to the current filing-system files. Initialisation is provided, GSInit, for the operating-system general string input routine, GSRead.

The user-defined key routines stored at &E3A8-E434 allow up to 16 soft-key definitions to be stored in page B buffers. The key strings are input by GSRead and inserted in key-number order in the buffer. A pointer to the last character is maintained and, when a definition is changed, the positions of the remaining definitions are correspondingly adjusted.

The buffer housekeeping routines held at &E435-E5B2 hold look-up tables containing the start locations of the keyboard and RS-423 input and RS-423, printer, sound and speech output buffers in the form of a base address plus offset.

Call number

Actions by the operating system are initiated by operating-system calls. Some, such as OSNewl and OSRDRM, perform a single function, but others perform a number of operations, specified by input parameters. The most important of these are Osbyte and Osword, and the routines to handle them are held at &E5B3-EB02.

Both Osbyte and Osword have a call number, held in the accumulator. Osbyte may have either one entry parameter, held in the X register, or two, held in the X and Y registers. Osword has a control block, the start address of which is pointed by the X and Y registers. Entry points of Osbyte and Osword calls are held in look-up tables stored at &E5B3-E656 and the entry points of most of the corresponding routines are grouped about these addresses.

The Sound command has a number of parameters controlling amplitude or envelope, pitch, duration, synchronisation, buffer flushing and channel number. The parameters are stored in a sound buffer according to channel, processed, and then passed to the sound-generator chip during the interrupt polling procedure. The sound-processing routines are held at &EB03-EE12.

In order to provide a distinguishing feature between notes of the same pitch on different channels a small offset is added to the pitch of the notes on channels 2 and 3, &E073. Unrecognised channels are offered to the paged ROMs, &E83A.

The speech-processing routines are at &EE13-EED9. If the speech system is implemented, it is initialised on Reset. When speech is being processed the ROM filing system is enabled. The characteristics of the RFS are similar to those of the cassette filing system, though obviously no commands involving data saving will function. To implement speech, bytes are read from a speech storage ROM and passed nibble by nibble to the speech processor chip.

(listing continued from previous page)

```
E7EB        :WORDV - OSWORD routines entry point
E803        :OSWORD 05 - read byte of I/O processor memory
E80E        :write byte of I/O processor memory
E815        :set I/O processor address pointers
E821        :OSBYTE 00 - identify ROM
E823        :"OS 1.20" error message - error code F7
E82D        :OSWORD 07 - SOUND command
E86C        :OSBYTE 75 - read VDU status
E86F        :VDU 7 - sound BELL
E8AE        :OSWORD 08 - define an envelope
E8C9        :compare command line character with 16, get bits 0,1, increment
            :index
E8D1        :OSWORD 03 - read interval timer
E8D5        :OSWORD 01 - read system clock
E8E4        :OSWORD 14 - write interval timer
E8E8        :OSWORD 02 - write system clock
E902        :OSWORD 00 - read line from current input to memory
E93B        :delete previous input character
E946        :delete entire input line
E976        :OSBYTE 05 - select printer
E988        :OSBYTE 01 - user OSBYTE call (read/write location 0281)
E988        :OSBYTE 06 - set character ignored by printer
E98C        :OSBYTE 0C - set keyboard autorepeat rate
E995        :OSBYTE 0B - set keyboard autorepeat delay
E997        :OSBYTE 03 - select output stream
E997        :OSBYTE 04 - enable/disable cursor editing
E99C        :OSBYTEs A6-FF entry point
E9AD-E9B5   :baud rate setting command lookup table
E9C0        :OSBYTE A0 - read VDU variable
E9C8        :reset soft key buffer contents
E9D9        :OSBYTE 76 - set keyboard to match LED status
E9EA        :reset keyboard LEDs if carry clear, then test ESCAPE flag
E9FB        :write to MOS VIA register B
E9FF        :OSBYTE 9A - write to video ULA control register
EA00        :set new video ULA control parameter, set flash counter
EA10        :OSBYTE 9B - write to video ULA palette register
EA11        :save physical/logical colour conversion factor, set palette
EA1D        :initialise string input with first space, 2nd '"' or CR terminator
EA1E        :GSINIT routines - initialise string input
EA2F        :GSREAD routines - parse input string, read character
EA8F        :"Bad string" error message - error code FD
EA9C        :check for specified keys pressed
EABF        :if alpha character, convert to control code
EAD2        :"/!BOOT" embedded message
EAD9        :perform vectored jump if Page 2 contains opcode
EAE3        :OSBYTE 90 - alter TV display parameters (*TV command)
EAF4        :OSBYTE 93 - write byte to FRED
EAF9        :OSBYTE 95 - write byte to JIM
EAFE        :OSBYTE 97 - write byte to SHEILA
```

Sound processing routines.

```
EB03        :set completion flag, switch off sound
EB0A        :if sound output not disabled, write to sound generator
EB21        :write command to sound generator, preserving processor status
EB22        :write command to OS VIA Port A, blip sound generator
EB40        :sound channel address register parameter lookup table
EB44        :check buffer number, process next sound channel
EB47        :process sound interrupt
EB59        :process next channel in sound queue
EC59        :if buffer index not 4, process next sound channel
EC60        :initialise sound queues
EC6B        :flush current sound queue
ECA2        :initialise sound channel parameters
ECD0        :if no envelope specified, switch off sound
ED01        :update pitch commands to sound chip
ED95        :write command to sound generator via slow databus
ED9B        :process next sound command from buffer
EDF7        :set duration parameter in sound queue
EDFB-EE06   :sound chip pitch lo order control parameter lookup table
EE07-EE12   :sound chip pitch hi order parameter lookup table
```

Speech processing routines.

```
EE13        :set current filing system ROM/PHROM
EE18        :get byte from data ROM
EE3B        :get address and set speech data ROM address pointer
EE40        :transfer two bytes from speech processor to ROM address pointers
EE51        :read RFS data ROM or speech processor
EE62        :if PHROM, read byte from speech processor
EE6D        :OSBYTE 9E - read from speech processor
EE71        :load two nibbles to speech processor address pointer
EE7A        :load a nibble to speech processor address register
EE7F        :OSBYTE 9F - write to speech processor
EEB4        :confirm speech system implemented, write command to speech processor
EEAD        :set RFS data ROM address pointers
EEBB        :set speech data ROM address register
```

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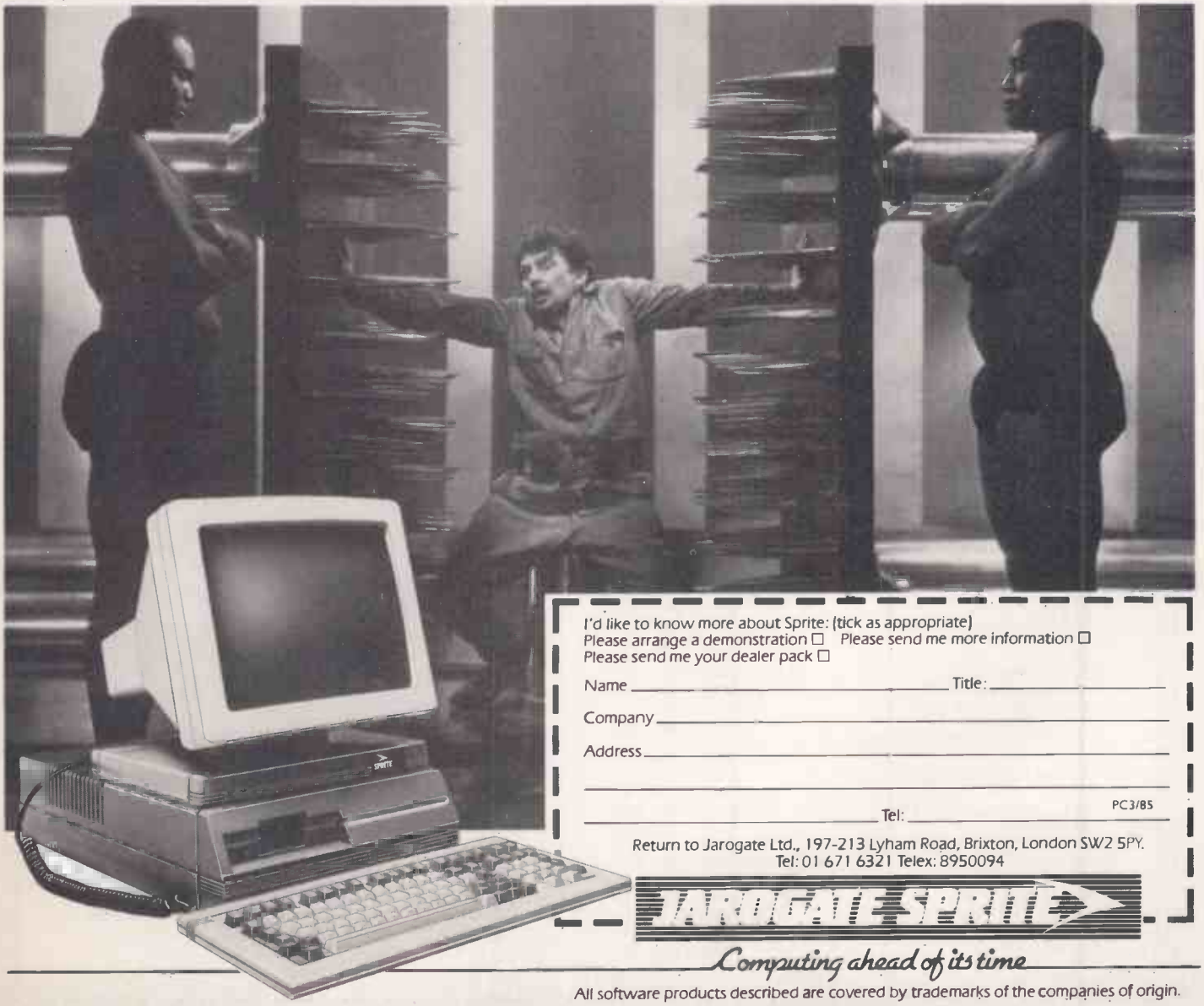

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Coloured Rems

```
   10  REM COLOURED REM
   20  REM PROGRAM TO PRINT REM STA
TEMENTS IN COLOUR
   30  REM BY T.D.FISHER.
   40  REM VARIABLE 'colour' DETERM
INES COLOUR OF PRINT
   50  REM USE ASCII CODES &81 TO &
88
   60  MODE7
   70 PROCASS:CALL CODE:END
   80 DEFPROCASS
   90 oldvectlo=&20E:oldvecthi=&20F
:newvectlo=&230:newvecthi=&231
  100 colour=&82:flag=&70:flag2=&71
:flag3=&72:temp=&73:osbyte=&FFF4
  110  CODE=&0D02
  120 FOR PASS%=0 TO 2 STEP 2
  130 P%=CODE
  140 [ OPT PASS%
  150 LDA oldvectlo
  160 STA newvectlo
  170 LDA oldvecthi
  180 STA newvecthi
  190 LDA #(new_routine MOD 256)
  200 STA oldvectlo
  210 LDA #(new_routine DIV 256)
  220 STA oldvecthi
  230  LDA #0
  240  STA flag
  250  STA flag2
  260  STA flag3
  270  RTS
  280  .new_routine
  290  CMP #&0D
  300  BNE SKIP
  310  JSR original
  320  JMP resetflag3
  330  .SKIP
  340  PHA
  350  LDA flag3
  360  CMP #1
  370  BNE carry_on
  380  STX temp
  390  STY temp+1
  400  LDA #&86
  410  JSR osbyte
  420  TXA
  430  LDX temp
  440  LDY temp+1
  450  CMP #39
  460  BEQ SKIP2
  470  PLA
  480  JMP original
  490  .SKIP2
  500  LDA #32
  510  JSR original
  520  LDA #colour
  530  JSR original
  540  PLA
  550  JMP original
  560  .carry_on
  570  LDA flag2
  580  CMP #1
  590  BEQ TRYM
  600  LDA flag
  610  CMP #1
  620  BEQ TRYE
  630  PLA
  640  CMP #82
  650  BNE original
  660  INC flag
  670  JMP original
  680  .TRYE
  690  PLA
  700  CMP #69
  710  BNE resetE
  720  INC flag2
  730  JMP original
  740  .TRYM
  750  PLA
  760  CMP #77
  770  BNE resetM
  780  JSR original
  790  LDA #1
  800  STA flag3
  810  LDA #colour
  820  .resetM
  830  DEC flag2
  840  .resetE
  850  DEC flag
  860  .original
  870  JMP (newvectlo)
  880  .resetflag3
  890  LDA #0
  900  STA flag3
  910  RTS
  920  ]
  930  NEXT
  940  ENDPROC
```

T D FISHER has sent in a routine to print Rems on a mode 7 screen in colour. The program works by intercepting the screen calls by the operating system and determining if R E M has been sent. If it has, then a coloured teletext character is sent to the screen.

The spare vector at &230,1 is used for this interception and three flags are set
flag 1 — set if R detected
flag 2 — set if R&E detected
flag 3 — set if R&E&M detected

The end of line is catered for as follows: the Osbyte call at lines 380 to 440 reads the cursor position; if it is at column 39 a space is printed followed by the teletext colour code.

Run the program and all subsequent Rems will be in colour. If you require that the lines following the Rems have a background colour also then add the following lines and run the program.

```
105 background = &84
515 JSR background
805 JSR background
911.background
912 LDA #background
914 JSR original
916 LDA #&9D
918 JSR original
919 RTS
```

Graphic memory Peek

Liam Anderson has obviously been looking around in the Basic ROM. The program that he has submitted is more a demonstration than a utility, but for all that it should not prove too difficult to alter to a useful purpose. The program gives the bit pattern of eight consecutive memory locations shown on the screen in an eight by eight matrix.

Graphic memory Peek.

```
   10 MODE 7
   20 PROCinit
   30 PROCassemble
   40 PROCprocess
   50 END
   60
   70 DEF PROCinit
   80 X%=FNmemory(40,8)
   90 Y%=FNmemory(21,8)
  100 oswrch=&FFEE
  110 VDU23,&FFFF;&FFFF;&FFFF;&FFFF
;&FF
  120 VDU23,1,0;0;0;0;
  130 FOR I%=Y% TO Y%+7
  140 PRINTTAB(0,I%)CHR$149
  150 NEXT
  160 ENDPROC
  170
  180 DEF PROCassemble
  190 DIM start 100
  200 FOR I%=0 TO 2 STEP 2
  210 P%=start
  220 [OPT I%
  230    STX &80
  240    STY &81
  250    LDY #0
  260 .loop1
  270    LDA (&70),Y
  280    LDX #0
  290 .loop2
  300    ROL A
  310    PHA
  320    BCC space
  330    LDA #&FF
  340    BCS char
  350 .space
  360    LDA #&20
  370 .char
  380    JSR print
  390    PLA
  400    INX
  410    CPX #&08
  420    BNE loop2
  430    INY
  440    CPY #8
  450    BNE loop1
  460    RTS
  470 .print
  480    PHA
  490    LDA #&1F
  500    JSR oswrch
  510    TXA
  520    CLC
  530    ADC &80
  540    JSR oswrch
  550    TYA
  560    CLC
  570    ADC &81
  580    JSR oswrch
  590    PLA
  600    JSR oswrch
  610    RTS
  620 ]: NEXT
  630 ENDPROC
  640
  650 DEF FNmemory(A%,B%) = A% DIV
2 - B% DIV 2
  660
  670 DEF PROCprocess
  680 S%=&C008
  690 REPEAT
  700 ?&70=S%: ?&71=S% DIV 256
  710 CALL start
  720 S%=S%+(INKEY-105-INKEY-73)
  730 PRINTTAB(X%+10,Y%)CHR$129;S%
  740 UNTIL FALSE
  750 ENDPROC
```

When first run the ! symbol should appear in the middle of the screen. By using the : and / keys, the memory pointer S% is incremented or decremented respectively.

The short assembler listing, taking just 60 bytes, obtains the eight consecutive bytes and with each byte tests each bit. The second part displays a character 255 if set, or a 32 if not.

Memory location &70,1 holds the value of S%, and &80,1 offsets for each bit and byte respectively.

Keystrip

Mick Glossop has submitted a rather cute program that creates function-key strips for the user-definable keys. It works with an Epson FX-80 printer.

The program allows you to define six words of 12 characters each. They are split up into three groups of two to allow for the Shift and Ctrl variations.

Entering the data is a dream. You just move about the screen boxes entering text in the appropriate position. The only hazard is that no delete function is available when typing the characters, so any mistake means a retype. The screen display shows exactly what the strip will look like when printed.

To start printing, press Control-P and to exit from the program press Control-X. If you wish to design another differently labelled strip press Control-C to clear the display.

The program uses a 60-element two-dimensional array to store the 12-character words used. They are accessed by the variables

label$(l%,c%)

where l% refers to vertical position 1 to 6 and c% refers to horizontal positions 0 to 9.

To achieve a respectable printout, the Epson printer is set up for condensed mode and emphasised print, with a slightly narrower line spacing than normal. The grid is produced by redefining some of the lower-case characters as graphics characters for the printer. ASCII character 96 is also redefined so that £ is available too.

The Escape key has been disabled since it is important to exit from the program via ProcExit, which resets the printer and Cursor and Escape keys to normal.

Printer test

C C Woods has spent many frustrated minutes thinking that his programs were not working only to find that he had forgotten to switch his printer on! Consequently, he has provided a routine to test if the printer is there or not.

The program as it stands will work with Epson printers and most other dot-matrix printers too. If you have a Juki daisywheel then you will need to repeat the first toggle and check by adding two lines to duplicate lines 5020 and 5030.

The result has all higher bits taken off by the And because these are set by the user port and if something is plugged in here it will show up. The routine will not work with the second processor because the 6522 is manipulated directly.

Printer test.

```
   10 PROCprintertest
   20 IF T = 0 THEN PRINT"Printer n
ot connected"
   30 IF T = 2 THEN PRINT"Printer O
K"
   40 END
 5000 DEF PROCprintertest
 5010 LOCAL X,Y
 5020 ?&FE6C=10     :REM Toggle prin
ter strobe
 5030 X=?&FE61      :REM Clear 6522
flags (by reading port)
 5040 ?&FE6C=10     :REM Toggle stro
be again
 5050 Y=?&FE6D      :REM Look at fla
g register
 5060 T = Y AND 2   :REM Check bit 1
 5070 ENDPROC
```

Keystrip.

```
   10 REM *** FUNCTION KEY STRIP ***
   20 REM ***                    ***
   30 REM ***  by MICK GLOSSOP   ***
   40 REM ***                    ***
   50 REM *** (c) 11th June 1984 ***
   60 REM ***                    ***
   70 REM ***  <fsp>  "fSTRIP"   ***
   80 REM ***                    ***
   90
  100 ON ERROR MODE7:PROCerror
  110
  120 PROCinit
  130 MODE0:COLOUR129:CLS:COLOUR0
  140 PROCscreen1
  150 PROCscreen2
  160
  170 REPEAT
  180 A%=GET
  190 IF A%>=136 AND A%<=139 THEN PR
OCmove_cursor
  200 IF A%>=32 AND A%<=96 THEN PROC
label
  210 IF A%=&10 THEN PROCprintout
  220 IF A%=&3  THEN PROCclear
  230 IF A%=&18 THEN PROCexit
  240 UNTIL FALSE
  250
  260 END
  270
  280
  290
  300 DEFPROCinit
  310 *fx229,1
  320 *fx15,1
  330 *fx4,1
  340 *fx5,1
  350 DIM label$(6,10)
  360 FOR c%=0TO10
  370 FOR l%=1TO6
  380 label$(l%,c%)="          "
  390 NEXTl%
  400 NEXTc%
  410 REM setup printer for CONDENSE
D mode and narrow line spacing.
  420  VDU2,1,27,1,51,1,24,1,15,1,27
,1,71,3
  430 REM define cursor character
  440 VDU23,224,255,255,255,255,255,
255,255,255
  450
  460 x%=8:y%=3:l%=1:c%=0:P%=0
  470 ENDPROC
  480
  490
  500 DEFPROCexit
  510
  520 REM reset printer to normal op
eration.
  530 IF P% THEN VDU2,12
  540 VDU2,1,27,1,64,3
  550 VDU23,224,255,255,255,255,255,
255,255,255
  560
  570 *fx4,0
  580 *fx229,0
  590 COLOUR128:COLOUR7
  600 CLS
  610 PRINT"Program exited!"''
  620 END
  630
  640 ENDPROC
  650
  660 DEFPROCscreen1
  670 VDU23;8202;0;0;0;
  680 PRINTTAB(27,1);"FUNCTION KEY S
TRIP PRINTER"
  690 PROCscreen2
  700 FOR col%=0TO4
  710 PRINTTAB(col%*13+13,12);"f";co
l%;
  720 NEXTcol%
  730 FOR col%=5TO9
  740 PRINTTAB((col%-5)*13+13,15);"f
";col%;
  750 NEXTcol%
  760 PRINTTAB(8,27)"Use: CURSOR KEY
S to move cursor, and type in labels
 as required."
  770 PRINTTAB(13,28)"CTRL-P to prin
tout, CTRL-C to clear the display,"
  780 PRINTTAB(13,29)"CTRL-X to exit
 from the program.";
  790
  800 PRINTTAB(8,3);CHR$224;
  810 ENDPROC
  820
  830
  840 DEFPROCmove_cursor
  850 PRINTTAB(x%,y%);label$(l%,c%);
  860 IF A%=136 THEN c%=c%-1:IF c%<0
 THEN c%=9
  870 IF A%=137 THEN c%=c%+1:IF c%>9
 THEN c%=0
  880 IF A%=138 THEN l%=l%+1:IF l%>6
 THEN l%=1
  890 IF A%=139 THEN l%=l%-1:IF l%<1
 THEN l%=6
  900 IF c%>4 THEN x%=(c%-5)*13+8 EL
SE x%=c%*13+8
  910 IF l%>2 THEN y%=l%+3+((c%>4)*-
14) ELSE y%=l%+2+((c%>4)*-14)
  920 IF l%>4 THEN y%=l%+4+((c%>4)*-
14)
  930 PRINTTAB(x%,y%);CHR$224;
  940 ENDPROC
  950
  960
  970 DEFPROCerror
  980 IF ERR=17 THEN ENDPROC
  990
 1000 VDU7
 1010 VDU31,8,2,129,157,136,131:PRIN
T"ERROR DETECTED!   ";:VDU156
 1020 PRINTTAB(0,7);CHR$133;" The fo
llowing error should not be"'CHR$133
;" present in this program."
 1030 VDU7
 1040 *fx4,0
 1050 PRINT"  ";:REPORT:PRINTCHR$133
;" at line:";CHR$152;
 1060 error$="L."+STR$(ERL)+CHR$10+C
HR$10+CHR$13
 1070 *fx15,1
 1080 FOR I%=1 TO LENerror$
 1090 A=ASC(MID$(error$,I%,1))
 1100 PROCoscli("FX138,0,"+STR$(A))
 1110 NEXT I%
 1120 END
 1130
 1140 DEFPROClabel
 1150 PRINTTAB(8,30);"Label:";CHR$(A
%);
 1160 label$(l%,c%)=CHR$(A%)
 1170 REPEAT
```

(continued on next page)

(continued from previous page)

```
1180 A%=GET
1190 IF (A%<32 AND A%<>13) OR A%>96
THEN 1180
1200 PRINTCHR$(A%);
1210 IF A%<>13 THEN label$(l%,c%)=l
abel$(l%,c%)+CHR$(A%)
1220 UNTIL (A%=13) OR (LEN(label$(l
%,c%))>11)
1230 PRINTTAB(0,30);STRING$(79,CHR$
32);
1240 A$=STRING$((12-LEN(label$(l%,c
%)))/2,CHR$32)
1250 IF LEN(label$(l%,c%))<11 THEN
label$(l%,c%)=A$+label$(l%,c%)+A$
1260 IF LEN(label$(l%,c%))=11 THEN
label$(l%,c%)=label$(l%,c%)+CHR$32
1270 PRINTTAB(x%,y%);label$(l%,c%);
1280 PRINTTAB(x%,y%);CHR$224;
1290 ENDPROC
1300
1310 DEFPROCdefine_printer_chars
1320 *fx6,127
1330 *fx3,10
1340 REM dump ROM CG into RAM
1350 VDU27,58,0,0,0
1360
1370 REM redefine some of lower cas
e chars in download CG as graphics c
hars (to make up grid).
1380 REM "a"
1390 VDU27,38,0,97,97,139,0,0,0,0,1
5,0,8,0,8,0,8,0
1400
1410 REM "b"
1420 VDU27,38,0,98,98,139,8,0,8,0,1
5,0,8,0,8,0,8,0
1430
1440 REM "c"
1450 VDU27,38,0,99,99,139,8,0,8,0,1
5,0,0,0,0,0,0,0
1460
1470 REM "d"
1480 VDU27,38,0,100,100,139,0,0,0,0
,255,0,8,0,8,0,8,0
1490
1500 REM "e"
1510 VDU27,38,0,101,101,139,8,0,8,0
,255,0,8,0,8,0,8,0
1520
1530 REM "f"
1540 VDU27,38,0,102,102,139,8,0,8,0
,255,0,0,0,0,0,0,0
1550
1560 REM "g"
1570 VDU27,38,0,103,103,139,0,0,0,0
,248,0,8,0,8,0,8,0
1580
1590 REM "h"
1600 VDU27,38,0,104,104,139,8,0,8,0
,248,0,8,0,8,0,8,0
1610
1620 REM "i"
1630 VDU27,38,0,105,105,139,8,0,8,0
,248,0,0,0,0,0,0,0
1640
1650 REM "j"
1660 VDU27,38,0,106,106,139,0,0,0,0
,255,0,0,0,0,0,0,0
1670
1680 REM "k"
1690 VDU27,38,0,107,107,139,8,0,8,0
,8,0,8,0,8,0,8,0
1700
1710 REM redefine ASCII 96 as '`' s
ign.
1720 VDU27,38,0,96,96,139,18,0,126,
128,18,128,2,128,66,0,0,0
1730
1740 REM select Download CG
1750 VDU27,37,1,0
1760
1770 *fx3,0
1780 *fx6,0
1790 ENDPROC
1800
1810 DEFPROCprintout
1820 PROCdefine_printer_chars
1830 PROCgraphics_line(97,98,99)
1840 FOR line%=1TO2
1850 PROCtext_line(line%)
1860 NEXTline%
1870 PROCgraphics_line(100,101,102)
1880 FOR line%=3TO4
1890 PROCtext_line(line%)
1900 NEXTline%
1910 PROCgraphics_line(100,101,102)
1920 FOR line%=5TO6
1930 PROCtext_line(line%)
1940 NEXTline%
1950 PROCgraphics_line(103,104,105)
1960 VDU2,10,10,10,3
1970 P%=1
1980 ENDPROC
1990
2000 DEFPROCgraphics_line(a%,b%,c%)
2010 *fx6,127
2020 *fx3,10
2030 VDUa%
2040 FOR col%=1TO9
2050 PROCline
2060 VDUb%
2070 NEXTcol%
2080 PROCline
2090 VDUc%
2100 VDU13,10
2110 *fx3,0
2120 *fx6,0
2130 ENDPROC
2140
2150 DEFPROCline
2160 FORdash%=1TO12
2170 VDU107
2180 NEXTdash%
2190 ENDPROC
2200
2210 DEFPROCtext_line(d%)
2220 *fx6,127
2230 *fx3,10
2240 PRINT"j";
2250 FOR c%=0TO9
2260 PRINTlabel$(d%,c%);"j";
2270 NEXT c%
2280 VDU13,10
2290 *fx3,0
2300 *fx6,0
2310 ENDPROC
2320
2330 DEFPROCscreen2
2340 GCOL0,0
2350 FORgrid%=0TO1
2360 FORline%=0TO3
2370 MOVE119,(204+(grid%*449)+(line
%*96))
2380 DRAW1161,(204+(grid%*449)+(lin
e%*96))
2390 NEXTline%
2400 NEXTgrid%
2410 FORgrid%=0TO1
2420 FORcol%=0TO5
2430 MOVE(119+(col%*208)),(204+(gri
d%*449))
2440 DRAW(119+(col%*208)),(492+(gri
d%*449))
2450 NEXTcol%
2460 NEXTgrid%
2470 ENDPROC
2480
2490 DEFPROCclear
2500 FORc%=0TO10
2510 FORl%=1TO6
2520 label$(l%,c%)="              "
2530 IF c%>4 THEN x%=(c%-5)*13+8 EL
SE x%=c%*13+8
2540 IF l%>2 THEN y%=l%+3+((c%>4)*-
14) ELSE y%=l%+2+((c%>4)*-14)
2550 IF l%>4 THEN y%=l%+4+((c%>4)*-
14)
2560 PRINTTAB(x%,y%)label$(l%,c%);
2570 NEXTl%
2580 NEXTc%
2590 x%=8:y%=3:l%=1:c%=0
2600 PRINTTAB(x%,y%);CHR$224;
2610 ENDPROC
2620
2630 DEF PROCoscli(com$)
2640 $&900 = com$
2650 X%=&0:Y%=&9: CALL&FFF7
2660 ENDPROC
```

Snowflake

This short program from S Dennington draws an almost infinite number of random snowflake patterns.

To rerun the program after six snowflakes have been drawn, press f0. If you prefer the black background then omit line 130.

Snowflake.

```
   10  REM  "SNOWFLAKES" (c) S.DENN
INGTON, Nov.1984
   20 :
   30  REM R sets size of flakes; X
,Y set position on screen
   40  REM G determines central spi
nes or not
   50  REM P sets no. of branches;
F sets where they occur
   60  REM T determines inward or o
utward pointing branches
   70 :
   80  REM*************************
*************************
   90 :
  100  *KEY 0 RUN|M
  110 :
  120  MODE 0:R=150
  130  VDU 19,0,RND(5),0,0,0
  140 :
  150  FOR Y=300 TO 700 STEP 400
  160  FOR X=200 TO 1080 STEP 440
  170  G=RND(2)
  180  FOR P=1 TO 4:F=RND(1):T=RND(
2)
  190  FOR angle=0 TO 300 STEP 60
  200  deltaX=(SIN(RAD(angle))*R)
  210  deltaY=(COS(RAD(angle))*R)
  220  ON G GOTO 230,240
  230  MOVE X,Y:DRAW X+deltaX,Y+del
taY
  240  PROCspike
  250  NEXT:NEXT:NEXT:NEXT
  260  END
  270 :
  280 :
  290  DEF PROCspike
  300  VX=X+(deltaX)*F:VY=Y+(deltaY
)*F
  310  A=((R*(1-F))*SIN(RAD(angle+6
0)))
  320  B=((R*(1-F))*COS(RAD(angle+6
0)))
  330  C=((R*(1-F))*SIN(RAD(angle-6
0)))
  340  D=((R*(1-F))*COS(RAD(angle-6
0)))
  350  ON T GOTO 370,400
  360 :
  370  MOVE VX,VY:DRAW VX+A,VY+B
  380  MOVE VX,VY:DRAW VX+C,VY+D:GO
TO 420
  390 :
  400  MOVE VX,VY:DRAW VX-A,VY-B
  410  MOVE VX,VY:DRAW VX-C,VY-D
  420  ENDPROC
  430 :
  440  DEFPROCSCREENDUM0
  450  LOCALX%,Y%,Z%,M%
  460  VDU2
  470  VDU1,27,1,ASC"1",1,10;0;
  480  FOR Z%=-320 TO 312 STEP8
  490  VDU 1,27,1,ASC"*",1,5,1,0,1,
2;
  500  FOR Y%=9920 TO -9920 STEP -6
40
  510  M%=&5800+Y%+Z%
  520  FOR X%=7 TO 0 STEP -1
  530  VDU1,M%?X%,1,M%?X%
  540  NEXT:NEXT:VDU1,10;0;
  550  NEXT:VDU1,27,1,ASC"@";0;:VDU
3
  560  ENDPROC
```

On error Goto

ONE FEATURE of the Commodore 64 is its ability to intercept error messages before they are printed, which allows a simple error-trap facility. Steve Mehew has written such a program, which is listed both as a Basic loader and, in response to several requests, as its assembly listing. This is in Mikro assembler format, but can be modified for use on other standard assemblers.

Once the machine code has been loaded, it is enabled with

SYS 49152,xxxx

where xxxx is the line number to be executed when an error occurs.

The error type is indicated by the contents of location 253. A list of numbers with the associated errors can be obtained using the short error-listing program.

Basic loader program.

```
10 REM BASIC LOADER FOR ONERR.
20 REM (C) STEVE MEHEW 1984.
30 :
40 S=49152:E=49307
50 FOR R=S TO E
52 READ A:POKE R,A:C=C+A
54 NEXT
60 READ K
65 IF K<>C THEN PRINT"DATA ERROR"
70 END
75 :
400 DATA 32,140,192,32,25,192,166,20
405 DATA 164,21,134,251,132,252,169,31
410 DATA 141,0,3,169,192,141,1,3
415 DATA 96,32,138,173,76,247,183,134
420 DATA 253,169,139,141,0,3,169,227
425 DATA 141,1,3,166,251,164,252,134
430 DATA 20,132,21,32,163,168,76,174
435 DATA 167,162,0,189,78,192,240,6
440 DATA 32,210,255,232,208,245,32,194
445 DATA 189,162,129,108,0,3,13,77
450 DATA 73,83,83,73,78,71,32,67
455 DATA 79,77,77,65,32,73,78,32
460 DATA 67,79,77,77,65,78,68,46
465 DATA 13,39,83,89,83,32,52,57
470 DATA 49,53,50,44,76,73,78,69
475 DATA 32,35,39,13,13,66,65,68
480 DATA 32,83,84,65,84,69,77,69
485 DATA 78,84,32,0,169,44,160,0
490 DATA 209,122,208,3,76,115,0,104
495 DATA 104,76,57,192
500 DATA 15101
```

Error-handler routine.

```
100 !*********************************
110 !*    ERROR HANDLER ROUTINE      *
130 !*      STEVE MEHEW  1984        *
150 !*********************************
155 !*                               *
190 !*     SYS 49152,LINE #          *
195 !*                               *
200 !* AT BEGINING OF PROGRAM WILL   *
205 !* CAUSE BRANCH TO LINE # WHEN   *
210 !* AN ERROR OCCURS - ASSUMING    *
215 !* LINE EXISTS. IF LINE NOT      *
220 !* PRESENT. PROGRAM WILL STOP    *
225 !* WITH UNDEFINED STATEMENT      *
240 !* ERROR AT THE LINE NUMBER OF   *
245 !* THE ORIGINAL ERROR.           *
255 !* ERROR NUMBER CAN BE FOUND     *
260 !* BY PEEKING $FD (253)          *
270 !*                               *
275 !*********************************
280 !
900 ERRVEC = $0300     !VECTOR TO HANDLE ERRORS
910 STORE  = $FB       !TEMP STORE FOR LINE #
920 ERRNO  = $FD       !OBVIOUS!
930 NORMERR= $E38B     !NORMAL ROM ERROR ROUTINE
970 CHRGET = $73       !ZERO PAGE CHRGET
980 INPRT  = $BDC2     !PRINT 'IN' & LINE #
982 FRMNUM = $AD8A     !EVALUATE NUMERIC EXP.
983 GETADR = $B7F7     !CONVERT FAC TO INTEGER
984 LINUM  = $14       !LINE NUMBER
985 SCNLIN = $A8A3     !SCAN LINE
986 NEWSTM = $A7AE     !EXECUTE NEW STATEMENT
987 CHROUT = $FFD2     !CHARACTER PRINT ROUTINE
988 TXTPTR = $7A       !POINTER TO PRESENT TEXT
999 !
1000 *=$C000
1010 !
1030 START   JSR COMMA     !CHECK FOR COMMA
1060         JSR GETWORD   !GET LINE #
1070 !
1080         LDX LINUM     !TRANSFER TO
1090         LDY LINUM+1   !STORE FOR
1100         STX STORE     !SAFE KEEPING
1110         STY STORE+1
1120 !
1130         LDA #<ONERR   !ALTER VECTOR
1140         STA ERRVEC    !FOR ERROR
1150         LDA #>ONERR   !ROUTINE, GOTO ONERR
1160         STA ERRVEC+1
1170 !
1180         RTS
1190 !
1195 GETWORD JSR FRMNUM
1197         JMP GETADR
1199 !
1220 ONERR   STX ERRNO     !STORE ERROR NUMBER
1230 !
1240         LDA #<NORMERR !RESET VECTOR
1250         STA ERRVEC
1260         LDA #>NORMERR
1270         STA ERRVEC+1
1280 !
1300         LDX STORE     !RESTORE LINE #
1305         LDY STORE+1
1310         STX LINUM
1315         STY LINUM+1
1320 !
1325         JSR SCNLIN    !TXTPTR TO LINE #
1330         JMP NEWSTM    !EXECUTE LINE
1335 !
1610 ERROR   LDX #$00      !OUTPUT TEXT MESSAGE
1620 GETIT   LDA TEXT,X
1630         BEQ FINITEXT
1640         JSR CHROUT
1650         INX
1660         BNE GETIT
1670 !
1680 FINITEXT JSR INPRT    !PRINT 'IN' & LINE #
1685         LDX #$81      !NO ERROR, JUST
1686         JMP (ERRVEC)  !GOTO 'READY.' STATE.
1690 !
1700 TEXT BYT 13
1710      TXT "MISSING COMMA IN COMMAND."
1720      BYT 13
1730      TXT "'SYS 49152,LINE #'"
1740      BYT 13,13
1744      TXT "BAD STATEMENT "
1746      BYT 0
1750 !
2000 !
2010 COMMA   LDA #',       !ASCII OF COMMA
2020         LDY #$00
2030         CMP (TXTPTR),Y  !IS IT A COMMA
2040         BNE ERROR1    !NO...
2050         JMP CHRGET    !YES, GO CONTINUE
2060 !
2070 ERROR1  PLA           !TAKE OFF ADDRESS
2080         PLA           !OF CALLING ROUTINE
2090         JMP ERROR     !BACK TO PRINT MESSAGE
```

Error-listing program.

```
10 I=41373: N=1
30 PRINT N;
40 I=I+1: IF I>41767 THEN END
50 A=PEEK(I)
60 PRINT CHR$(A AND 127);
70 IF A>127 THEN N=N+1:PRINT:GOTO30
80 GOTO 40
```

Printer character modifier

ONE COMMON PROBLEM when using a printer with the Amstrad is that both a Linefeed and Carriage Return are sent to the printer, which causes a double Linefeed to all printed output. D J Ellis suggests that one way to solve the problem is to cut wire 14 on the printer lead — if you can find the correct wire. He also suggests a simpler method, which is a lot more versatile.

You divert the output from the CPC-464 to the printer, via a machine-code program which checks for the value of 13 — the Carriage Return — or any other characters that you wish to change. It then sends the modified values to the printer in the normal way. The accumulator holds the value to be sent to the printer and the routine is called via the jumpblock at &BD2B. The listing shown redirects this jump to the machine-code routine, which is compiled by the Basic program.

First, the program asks you where you want the machine-code program to reside in memory. No limitations are imposed here as it is possible that the screen memory may be located lower in memory, and you may also have other machine-code programs in memory. The machine-code program will use up a minimum of 15 bytes if no changes are made, 21 bytes if the Linefeed is suppressed, and an additional six bytes for each character that you modify. If you are not sure where to put it, then try &9000 (36864), which is as good a place as any. Prefix hexadecimal numbers with & if you use them.

The Top of Basic pointer will be set to just below the address that you choose — line 50030. The next five lines Poke this address and some data to the machine-code program; this part is where the redirection takes place.

If you wish to suppress the Linefeed, press the Enter key when prompted by lines 50090 and 50100. Press any other key if you want the double Linefeed to operate.

You will then be asked if you wish to change any of the characters. Often daisy-wheel characters do not match up with those on the CPC-464. For example, the £ sign on the CPC-464 is ASCII 163, but the CPC-464 can only send numbers between 0 and 127 to the printer as it ignores the eighth bit. So 128 is taken off the value of 163, and the value sent for £ is 35. On some wheels 35 is the £ sign, but on others it is the # sign. If the £ sign is not on the wheel at all you can use the $ character as a last resort; this is ASCII 36.

When prompted by line 50130 press the Enter key to change characters. In reply to line 52010, enter 163 for the character to change, and then 36 in reply to line 52030 for the character to change to. To make further changes to other characters press the Enter key and repeat this process. Otherwise press any other key and the program will end after tagging the original call to ROM on to the end of the machine-code program.

The machine-code program will be Called in line 50180, and any characters sent to the printer will be checked to see if they need modifying. In the case of the Linefeed this is changed to a null character, so nothing is printed.

If you have a dot-matrix printer you should also find this program useful. You can also change the printing codes below ASCII 32 if you like, which could prove interesting.

Once the program has been run you can New it as the Basic program then takes no further part. The lines are numbered so that you can Chain Merge the program on to the end of a program that you have in memory, and then use it and delete it before listing or using the program.

Printer character modifier.

```
50000 CLS:INPUT "Enter start address ";reside
50010 IF reside<0 THEN reside=reside+65536
50020 IF reside>65500 THEN 50000 ELSE start=reside+12
50030 MEMORY reside-2:CLS
50040 msb=INT(start/256):lsb=start-msb*256
50050 FOR program=reside TO reside+11
50060 READ code:POKE program,code:NEXT
50070 DATA 33,0,0,34,44,189,62,195,50,43,189,201
50080 POKE reside+1,lsb:POKE reside+2,msb
50090 PRINT "Press <ENTER> to supress LINE FEED"
50100 PRINT "any other key to keep the LINE FEED"
50110 a$="":WHILE a$="":a$=INKEY$:WEND
50120 IF a$=CHR$(13) THEN GOSUB 51000
50130 CLS:PRINT "Press <ENTER> to CHANGE CHARACTER"
50140 PRINT "any other key to END the program"
50150 a$="":WHILE a$="":a$=INKEY$:WEND:CLS
50160 IF a$=CHR$(13) THEN GOSUB 52000
50170 POKE program,207:POKE program+1,242
50180 POKE program+2,135:CALL reside:END
51000 '------------SUPRESS LINE FEED---------------
51010 FOR supress=program TO program+5
51020 READ code:POKE supress,code:NEXT supress
51030 program=supress:RETURN
51040 DATA 254,10,32,2,62,0
52000 '------------CHANGE CHARACTERS---------------
52010 INPUT"Enter ASCII number to change ";before
52020 IF before<0 OR before>255 THEN 52010
52030 INPUT"Enter ASCII number to change to ";change
52040 IF change<0 OR change>255 THEN 52030
52050 POKE program,254:POKE program+1,before
52060 POKE program+2,32:POKE program+3,2
52070 POKE program+4,62:POKE program+5,change
52080 program=program+6
52090 PRINT"Press <ENTER> to continue changes"
52100 PRINT"any other key to END program"
52110 a$="":WHILE a$="":a$=INKEY$:WEND:CLS
52120 IF a$=CHR$(13) THEN 52010 ELSE RETURN
```

Keyboard aid

If you are a touch-typist, you will have noticed that the Amstrad CPC-464 has an unconventional arrangement for the colon and semicolon, which probably slows up your typing. R E F Street provides an easy solution to the problem. Add the following lines to your program

```
10 KEY DEF 29,1,1,58
20 KEY DEF 29,1,59
30 KEY DEF 28,1,42
```

This addition will move the colon to its conventional position in place of the asterisk; move the semicolon to its normal position in place of the colon and move the asterisk to where the semicolon used to be.

If you are using the Tasword 464 word-processing program, note that although you have moved the asterisk to where the semicolon used to be, the command Control* to convert upper to lower-case remains as it was, provided that you use the old position of the asterisk.

PRINTERS

DOT MATRIX

All printers have centronic parallel interface unless otherwise stated. All printers have hi-res dot addressable graphic mode. Please send SAE for full details.

EPSON

FX80 160CPS 10" wide friction & pin feed	£347 + VAT	£399
FX100 160 CPS 15" wide friction & tractor feed	£499 + VAT	£574
RX80 F/T 100 CPS 10" wide friction & tractor feed	£239 + VAT	£275
RX80 100 CPS 10" wide tractor feed	£199 + VAT	£229
RX100 F/T 100 CPS friction & tractor feed	£385 + VAT	£443
8143 RS 23 Interface for FX and RX printers	£39 + VAT	£45
8148 RS 232 Interface with 2K buffer x on x off	£60 + VAT	£69
Ribbon Cartridge for RX80 FX80 & MX80	£5 + VAT	£6
Ribbon Cartridge for FX100 & MX100	£7 + VAT	£8

MP165

165CPS 10" carriage friction and tractor feed	£260 + VAT	£299

SEIKOSHA

BP 420 designed for the business world, 420CPS in draft mode, 110CPS in NLQ mode.	£1095 + VAT	£1259

SMITH CORONA

Fastext 80: 80 col, 80CPS. Friction feed standard	£149 + VAT	£171

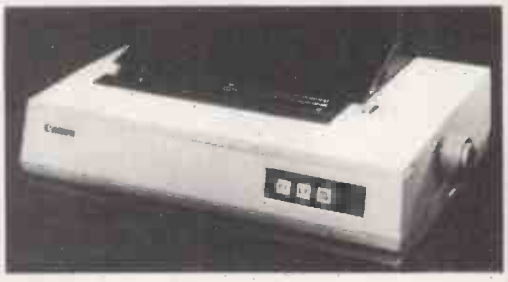
TAXAN KAGA

160CPS 10" wid[illegible]PS NLQ 24 × 16 matrix	£269 + VAT	£310
160CPS 15" wi[illegible]CPS NLQ 24 × 16 matrix	£390 + VAT	£449

CANON

PW1080A
160CPS NLQ mode, 27CPS, 10" wide friction & tractor feed
£299 + VAT £344

PW1156A
160CPS NLQ mode, 15" wide friction & tractor feed
£433 + VAT £499



COLOUR PRINTERS

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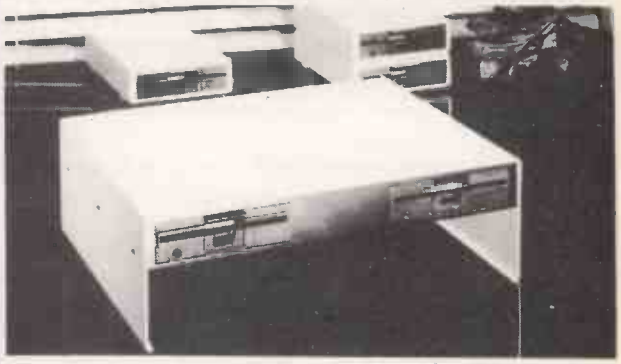

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Hex converter

```
0100 ; A Routine to convert a 2 byte
0110 ; integer into its Hexadecimal
0120 ; equivalent and dump this into
0130 ; a BASIC string.
0140 ; The routine is to be held in
0150 ; a Basic string and is called
0160 ; by the command:-
0170 ;
0180 ;    X=USR(ADR(H$),ADR(H4$),N)
0190 ;
0200 ; Where:-
0210 ;    H$  holds the routine.
0220 ;    H4$ will hold the result.
0230 ;    N   is the integer.
0240 ;              Ron Levy.
0250 ;
0260 ADRLO    =$D4
0270 ADRHI    =$D5
0280 ;
0290          *=$600
0300          PLA
0310          PLA         Pull address
0320          STA ADRHI   of H4$ from
0330          PLA         the stack.
0340          STA ADRLO
0350          LDY #$00
0360 ;
0370 LOOP     TYA
0380          LSR A  See if the Y reg
0390          PLA      is odd or even.
0400          BCS LOBITS
0410          PHA
0420          LSR A    Move the high
0430          LSR A    nibble over to
0440          LSR A    the lower
0450          LSR A              nibble.
0460 ;
0470 LOBITS   AND #$0F Mask low nibble
0480          CLC
0490          ADC #$30 Add the offset
0500          CMP #$3A
0510          BCC NOADD Add more if
0520          ADC #$06  required (A-F)
0530 NOADD    STA (ADRLO),Y
0540          INY
0550          CPY #$04 Check for end
0560          BNE LOOP    of loop.
0570 ;
0580          RTS
```

Demo program.

```
0 REM Hexadecimal Memory Lister
1 REM To Demonstrate The Use of
2 REM The Machine Code Routine.
3 REM .       Ron Levy.
4 REM
10 DIM H$(38),H4$(4),P(8)
11 H4$="1234"
12 FOR I=1 TO 38
13 READ X:H$(I,I)=CHR$(X)
14 NEXT I:REM Routine Now Loaded.
80 POKE 766,1
90 ? "Starting Location ";:INPUT I
100 FOR I=I TO 1000
110 X=USR(ADR(H$),ADR(H4$),I)
120 IF H4$(4,4)<>"0" AND H4$(4,4)<>"8"
 THEN I=I-1:GOTO 110
130 PRINT H4$;" ";
200 FOR J=0 TO 7
210 P(J)=PEEK(J+I)
220 X=USR(ADR(H$),ADR(H4$),P(J))
230 PRINT H4$(3,4);" ";
240 NEXT J
300 FOR J=0 TO 7
310 IF P(J)<>155 THEN PRINT CHR$(P(J))
;
320 NEXT J
390 PRINT :I=I+8
400 NEXT I
500 POKE 766,0:STOP
32000 DATA 104,104,133,213,104,133,212
,160,0,152,74,104,176,5,72,74,74,74,74
,41,15,24,105,48,201,58,144,2,105
32001 DATA 6,145,212,200,192,4,208,228
,96
```

WHEN WRITING utility programs it is often desirable to be able to print a number to the screen in hexadecimal form rather than in the usual base-10. Ron Levy's machine-code routine will take a one- or two-byte value and return a two- or four-character string representing its hexadecimal value. While it is possible to write a Basic sub-routine to perform this function, such a routine would be fairly large, and quite slow due to the number of floating-point calculations involved.

This fast machine-code routine is completely relocatable, and the most convenient way of storing it in Basic is by placing it into a string. For example, the demo program reads each byte from data statements and uses the CHR$ command to force the byte values into H$. The routine is called with the command

X = USR(ADR(H$),ADR(H4$),N)

where N is the number you want converted. H4$ now contains the hexadecimal equivalent of N, which will be a four-character string.

If you are only converting a single-byte character — perhaps the result of a Peek — then you will only want a two-character string. This is accomplished by taking the second half of H4$, that is, H4$(3,4). It is essential to include the command

H4$ = "1234"

since this causes Basic to set the length of H4$ to four characters.

The memory lister program shows how to use the routine in your own programs. Memory lister will display the contents of eight memory locations per line, giving the base address on the left, eight two-digit values in the middle, then the eight printable CHR$ commands of these values on the right. Poke 766,1 is used to prevent the screen control codes creating havoc with the display when the CHR$ commands are printed.

Instead of reading data statements to create the string you can equate H$ to a literal string at the start of the program. The difficulty is that most of the characters in H$ are graphic symbols. However, there is a way of including this into a program line. Print H$, use the cursor-control keys to insert spaces in front of the printed string and type

20 H4$ = "

Then move the cursor to the end of the string and print the closing quote. On pressing Return, Basic will accept this as a valid progam line and you can then delete the For-Next loop used to create the string, together with any Data statements.

The routine takes advantage of the fact that Atari Basic allows you to pass any number of integers of the value 0 to 65535 through with the USR call. In this case you are passing two integers, the first being the memory address of H4$, and the second being the number you want converted.

Basic will use the processor stack for this. It will push a single byte to the stack, the value of which will be the number of arguments in the USR call. In this instance it will be two. The routine will pull the byte off the stack, but it will not store it since there will always be two arguments. The next two bytes pulled from the stack will be the address of H4$, which will be stored in two bytes of page zero memory, to be used as pointers when storing the results. The last two bytes pulled will be the number to be converted. The high byte will come off first and the low byte last.

Each byte is split into two four-bit nibbles, and 48 is added to obtain the relevant ASCII number character. A test is performed to see if the nibble was between 10 and 15, and if so a further 7 is added to obtain the characters A to F. The result is then stored directly into its correct position in H4$.

3D OXO

There are two interesting things about this 16K three-dimensional noughts and crosses program from John Owen. First, the game itself and second, the listing, which automatically produces an auto-boot cassette or disc.

The game is written in machine code, but you do not need an assembler to enter it. The code is typed in as data statements in Basic. When it is run it verifies the data, then enables you to produce a disc or tape that can be started automatically without Basic.

The game is played in the traditional way, where three counters in a line win even if they are on separate boards. You press Start to begin. Moves are made by using a joystick to position the flashing cursor over the chosen square then pressing the Fire button. You then take it in turns to move until someone wins.

Noughts and crosses.

```
4 REM **** 3-D NOUGHTS & CROSSES ****
8 REM VERSION 1B,3/9/84
12 REM
16 REM COMMENTS TO:JOHN R. OWEN
20 REM 2 FFORDD DERWYN,PENYFFORDD,
24 REM CHESTER CH4 0JT.U.K.
28 REM
32 REM (C)1984 JOHN R. OWEN
36 REM
37 DIM FLNM$(13)
44 ? "VERIFYING DATA...ALLOW 45 SECONDS"
:TRAP 48:FOR IX=1 TO 2765:READ IY:IC=IC+
IY:NEXT IX
48 IF IC<>320039 THEN ? "ERROR(S) IN DAT
A VALUES":END
```

```
52 ? "DATA IS PROBABLY O.K.":?
56 REM
60 REM CREATE CHOSEN FILE
64 REM
66 TRAP 66:? "SELECT MEDIA:DISK(0) OR CA
SSETTE(1)";:INPUT CORD:IF CORD>1 THEN 66
68 IF CORD THEN 76
72 ? "INSERT DISK WITH DOS ";:FLNM$="D:A
UTORUN.SYS":GOTO 92
76 ? "ENABLE CASSETTE SYSTEM ";:FLNM$="C
:"
80 REM
84 REM WAIT UNTIL DEVICE READY
88 REM
92 ? "& [ANY KEY]"
96 IF PEEK(764)=255 THEN 96
100 REM
104 REM SET UP FILE
108 REM
109 ? :? "CREATING FILE":TRAP 40000
112 OPEN #1,8,CORD*128,FLNM$
116 REM
120 REM IF DISK,PUT STANDARD DOS HEADER
124 REM
128 IF  NOT CORD THEN PUT #1,255:PUT #1,
255:PUT #1,137:PUT #1,31:PUT #1,85:PUT #
1,42
132 REM
136 REM WRITE CODE TO MEDIA
140 REM
144 IX=0:RESTORE 200:TRAP 164
148 READ IY:PUT #1,IY:IX=IX+1:GOTO 148:R
EM UNTIL ALL CODE PUT
152 REM
156 REM CLOSE FILE
160 REM COMPOUND FILE STRUCTURE,INSERT I
NIT. ADDR.
164 IF  NOT CORD THEN PUT #1,224:PUT #1,
2:PUT #1,225:PUT #1,2:PUT #1,143:PUT #1,
31
172 CLOSE #1:? "FILE COMPLETE":END
176 REM
180 REM PROGRAM CODE:
184 REM
200 DATA 0,22,137,31,143,31,169,60,141,2
,211,169,85,141,55,2,133,14,169,42,141,5
6,2,133,15,169,0,133,10,133
210 DATA 12,133,2,169,32,133,11,133,13,1
33,3,169,2,133,9,133,8,169,0,141,68,2,10
8,2,0,35,111,112,121,114
220 DATA 105,103,104,116,0,42,111,104,11
0,0,47,119,101,110,0,17,25,24,20,24,24,2
4,24,24,24,24,24,24,0,0,0,255
230 DATA 255,0,0,0,24,24,24,255,255,24,2
4,24,195,102,60,24,60,102,195,129,60,126
,195,195,195,195,126,60,162
240 DATA 255,154,32,177,34,32,190,32,32,
177,34,32,93,33,32,96,34,32,190,32,165,1
96,240,60,32,196,41,32,4
250 DATA 35,32,97,39,32,211,38,32,109,39
,224,255,240,17,32,129,39,224,255,240,22
,230,199,165,199,201,27,240
260 DATA 110,208,24,32,3,40,32,175,40,32
,68,41,76,9,32,32,3,40,32,203,40,32,68,4
1,76,9,32,32,28,41,165,199
270 DATA 201,1,208,6,32,209,41,76,149,32
,32,97,39,32,211,38,32,62,39,224,255,240
,62,32,114,37,224,255,240
280 DATA 55,32,211,38,32,27,39,224,255,2
40,19,32,72,38,224,255,240,12,32,97,39,3
2,211,38,32,114,37,32,11
290 DATA 38,32,169,41,32,3,40,32,132,41,
230,199,165,199,201,27,240,3,76,25,32,32
,41,42,76,9,32,32,169,41
300 DATA 32,3,40,32,132,41,32,16,42,76,9
,32,169,0,141,47,2,169,123,141,48,2,169,
33,141,49,2,162,255,169,0
310 DATA 157,0,24,202,208,250,162,164,15
7,255,24,202,208,250,169,31,141,244,2,16
9,107,141,0,2,169,33,141
320 DATA 1,2,169,192,141,14,212,169,16,1
41,7,212,162,255,169,0,157,0,20,202,208,
250,169,31,141,192,2,169
330 DATA 0,141,0,208,169,2,141,29,208,16
2,0,134,195,160,0,169,7,133,193,169,24,1
33,194,138,72,162,0,134,195
340 DATA 189,166,33,145,193,232,200,230,
195,165,195,201,5,208,241,169,0,133,195,
152,24,105,15,168,224,25
350 DATA 208,228,160,0,24,165,193,105,16
0,133,193,169,0,101,194,133,194,104,170,
232,224,3,208,200,169,58
360 DATA 141,47,2,96,162,0,189,191,33,15
7,224,25,232,224,80,208,245,96,72,169,22
4,141,10,212,141,9,212,169
370 DATA 0,141,24,208,104,64,112,96,70,0
,24,6,6,6,6,6,6,6,6,6,6,6,6,6,6,6,6,6,6,
6,134,48,66,224,25,64,6,6
380 DATA 65,123,33,24,24,24,231,231,24,2
4,24,0,59,0,59,0,60,61,60,61,60,0,59,0,5
9,0,60,61,60,61,60,0,59,0
390 DATA 59,0,0,35,111,112,121,114,105,1
03,104,116,0,17,25,24,20,26,42,14,47,119
,101,110,14,0,0,35,111,109
400 DATA 112,117,116,101,114,0,115,116,9
7,114,116,115,0,0,0,0,0,19,13,36,0,46,47
,53,39,40,52,51,0,0,0,0,0
410 DATA 0,0,0,0,0,6,0,35,50,47,51,51,37
,51,0,0,0,0,0,0,48,108,97,121,101,114,0,
115,116,97,114,116,115,0
420 DATA 121,111,117,114,0,109,111,118,1
01,105,110,118,97,108,105,100,0,115,113,
117,97,114,101,115,113,117
430 DATA 97,114,101,0,111,99,99,117,112,
105,101,100,109,121,0,109,111,118,101,12
1,111,117,0,119,105,110,105
440 DATA 0,119,105,110,115,116,97,108,10
1,109,97,116,101,169,8,141,31,208,173,31
,208,201,7,240,244,201,6
450 DATA 240,64,201,5,208,53,165,196,73,
255,133,196,169,216,133,193,169,33,133,1
94,165,196,240,8,169,15,133
460 DATA 193,169,34,133,194,160,0,162,25
,177,193,157,224,25,232,200,192,15,208,2
45,162,255,160,255,136,208
470 DATA 253,202,208,248,240,183,169,0,1
41,31,208,240,176,96,169,0,133,196,133,1
97,133,198,133,199,169,60
480 DATA 141,2,211,169,3,141,50,2,169,5,
162,0,157,0,6,232,224,27,208,248,96,168,
197,189,0,20,240,14,169,0
490 DATA 168,157,0,20,232,200,192,8,208,
247,240,14,160,0,185,158,33,157,0,20,232
,200,192,8,208,244,169,2
500 DATA 162,0,160,6,32,92,228,169,192,1
41,14,212,96,169,0,162,24,157,224,25,232
,224,79,208,248,162,45,160
510 DATA 0,185,30,34,157,224,25,232,200,
192,9,208,244,169,114,133,198,141,0,208,
160,130,132,197,162,0,189
520 DATA 158,33,153,0,20,200,232,224,8,2
08,244,169,210,141,40,2,169,34,141,41,2,
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540 DATA 255,41,15,240,242,201,8,208,15,
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550 DATA 15,165,198,201,100,240,213,198,
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560 DATA 160,7,185,158,33,157,255,19,232
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,5,106,144,26,176,105,201
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,81,169,0,162,40,157,224
610 DATA 25,232,224,79,208,248,162,0,160
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620 DATA 141,1,210,169,128,141,8,210,162
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,246,169,48,141,0,210,162

630 DATA 255,160,255,234,234,136,208,251
,202,208,246,169,0,141,1,210,32,245,34,7
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640 DATA 162,0,56,233,8,232,201,8,176,24
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3,165,193,56,233,7,162,0

650 DATA 74,240,5,106,232,176,1,232,165,
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660 DATA 176,15,160,3,56,233,8,74,240,20
,106,200,176,16,200,208,13,56,233,16,160
,6,74,240,5,106,200,176,1

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170,189,0,6,201,5,240,19

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25,200,232,224,15,208,244,76,62,36,169,4
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690 DATA 133,195,169,0,133,193,169,24,13
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93,165,194,105,0,133,194

700 DATA 202,208,240,165,195,24,101,193,
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254,145,193,173,15,212,41

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,240,4,1,3,2,2,3,1,243,1

720 DATA 2,3,240,3,6,1,2,2,246,1,1,3,246
,1,0,4,2,3,249,4,160,0,169,255,133,195,1
69,0,141,185,37,169,6,141

730 DATA 189,37,169,0,141,27,6,174,27,6,
189,64,37,41,240,240,2,230,195,189,64,37
,41,15,201,9,208,27,24,109

740 DATA 185,37,141,185,37,169,0,109,189
,37,141,189,37,198,195,173,185,37,201,27
,208,206,162,0,96,24,105

750 DATA 0,133,193,169,6,105,0,133,194,2
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,0,168,170,72,24,104,113

760 DATA 193,72,172,27,6,24,185,64,37,10
1,193,133,193,169,0,101,194,133,194,232,
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770 DATA 23,208,5,165,195,162,255,96,166
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,135,37,96,162,1,160,0,189

780 DATA 0,6,201,5,208,25,189,28,6,205,2
8,6,240,12,144,15,141,28,6,142,56,6,160,
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790 DATA 232,224,27,208,219,132,195,173,
10,210,41,31,197,195,240,2,176,245,168,1
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800 DATA 169,255,133,195,169,0,141,143,3
8,169,6,141,149,38,169,0,141,27,6,174,27
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830 DATA 201,5,208,35,169,0,168,170,72,2
4,104,113,193,72,172,27,6,24,185,64,37,1
01,193,133,193,169,0,101

840 DATA 194,133,194,232,160,0,224,3,208
,227,104,238,27,6,201,13,208,143,165,195
,162,255,96,160,0,162,0,134

850 DATA 195,169,0,24,101,195,133,193,16
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860 DATA 133,193,169,0,101,194,133,194,2
32,224,3,208,233,166,195,160,3,104,72,15
7,28,6,138,24,105,9,170,104

870 DATA 136,208,243,166,195,232,224,9,2
08,189,96,162,0,189,28,6,201,13,240,6,23
2,224,9,208,244,96,189,0

880 DATA 6,201,5,240,7,138,24,105,9,170,
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7,138,24,105,9,170,208,242,138,133,195,1
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900 DATA 6,232,224,54,208,248,96,162,0,1
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910 DATA 0,169,255,133,195,169,0,141,200
,39,169,6,141,206,39,169,0,141,27,6,174,
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950 DATA 208,227,104,238,27,6,201,12,208
,152,165,195,162,255,96,165,195,72,201,1
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960 DATA 16,9,201,9,144,5,56,233,9,133,1
95,162,0,24,105,3,56,233,3,232,201,3,176
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980 DATA 193,105,7,133,193,165,194,105,0
,133,194,165,195,162,0,74,240,9,162,2,16
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990 DATA 195,24,165,193,101,195,133,193,
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1000 DATA 194,104,201,18,144,27,165,193,
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5,136,208,253,202,208,248

1170 DATA 198,193,208,242,96
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Keeping up with VisiCalc

Peter van der Linden checks out the reference books available for the oldest spreadsheet package around.

"FIRST TO MARKET, wins the market" is an old software adage describing the advantages of timeliness in selling software. The VisiCalc software certainly proved the truth of the proverb. VisiCalc was the first of the spreadsheet packages, and coupled with one of the first home PCs, the original Apple, it quickly established a dominant position which was unassailable for several years. VisiCalc, together with its supporting cast of Visiplot, Visitrend, etc., is now a mature — some would say elderly — software package. There are a host of reference books serving its users.

VisiCalc for Science and Engineering is a handy guide to over 50 standard spreadsheet calculations useful in the stated application areas. The authors, Stanley Trost and Charles Pomernacki, have assumed that users already know the basics of VisiCalc. Thus the text is a list of favourite recipes, divided into nine broad subject areas: communications, physics, mechanical engineering, statistics and so on. The solar engineering section was particularly interesting. The diagrams throughout are excellent and the layout has a pleasing appearance to the eye. I recommend this book equally to experienced practitioners and to aspiring novices who wish to acquire an intuitive feel for these calculations.

Another good book listing many standard calculations is *54 VisiCalc Models* by Robert Flast. The application areas are primarily financial, such as mortgage amortisation and depreciation; statistical, including binomial, Poisson and normal distributions, and mathematical, such as vector analysis and some elementary integration. The book is well planned, following a consistent layout. Each VisiCalc model — the author terms them templates — names the problem and gives an example. Then the author shows a sample of what appears when it runs, a sample run with data, and the model listing. I found the book useful but not inspiring; no solar engineering here. There are one or two minor text misprints, though I did not detect any flaws in the templates.

Executive VisiCalc for the IBM Personal Computer by Roger Clark is a business-like book written from an authoritative standpoint. The author did mar his credibility a little in announcing in the foreword that he was "a VisiCalc maven". The term "maven" eluded definition in all the dictionaries which I brought to bear on the problem, and I presume it is a particularly imaginative misprint for "supporter" or "expert". The book has a nice easy style, which gently leads novices through the basics on to more advanced material. The examples are heavily biased towards business applications.

Using VisiCalc Getting Down to Business by Carol Klitzner and Matthew J Plociak junior appears to have been printed on recycled old telephone directories. There really is no excuse for this kind of shoddiness, as my information is that the Second World War ended about 40 years ago and utility paper ended with it. John Wiley, the publisher, should be ashamed of its penny-pinching given the cover price of £13.95.

There are three major sections to the book, covering the basics, sample business applications, and the "advanced" features available on the Apple III and the IBM PC. The models given include cash flow, economic order quantity and break-even analysis which are also available on discs for the Apple II, IBM PC and the TRS-80 Model III. The book is actually a reasonable combination of tutorial guide and list of models. Each section ends with several questions, for which the answers are supplied later. This is a well thought-out and comprehensive work which has not been given justice by its publisher.

VisiCalc Made Simple, published by John Wiley, is a guide to the spreadsheet software, rather than a list of umpteen

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useful models. The author, Thomas O'Donovan, rather sniffily dismisses that sort of book. Undoubtedly he has put in a lot of work to draw out the various features of VisiCalc, and there is an appendix at the end listing some differences between different hardware versions. I found the text a bit dry, though it is both accurate and informative. This is a reference book as much as an introductory guide. The price is £7.95, which

represents excellent value. The hardware used by the author was the Apple II.

VisiCalc for Marketing and Sales by Michael Laric and Ronald Stiff is narrowly aimed at the sector which the title suggests. There are many different models given for forecasting, pricing, retail analysis and inventory decisions.

VisiCalc for Science and Engineering by Stanley R Trost and Charles Pomernacki. Published by Sybex, £13.95. ISBN 0 89588 096 2

54 VisiCalc Models by Robert H Flast. Published by Osborne/McGraw-Hill, £12.95. ISBN 0 88134 100 2

Executive VisiCalc for the IBM Personal Computer by Roger E Clark. Published by Addison-Wesley, £10.65. ISBN 0 201 10243 9

Using VisiCalc Getting Down to Business by Carol Klitzner and Matthew J Plociak Jr. Published by John Wiley & Sons, £13.95. ISBN 0 471 89852 X

VisiCalc Made Simple by Thomas M O'Donovan. Published by John Wiley & Sons, £7.95. ISBN 0 471 90457 0

VisiCalc for Marketing and Sales by Michael V Laric and Ronald Stiff. Published by Prentice-Hall, £12.55. ISBN 0 13 942418 0

VisiCalc Programming: No Experience Necessary by Tom Simpson. Published by Little Brown, £35. ISBN 0 316 78339 0

Other editions of this book are available for Lotus 1-2-3 and Multiplan, and of course the models are also available on a separately purchased floppy disc. Published by Prentice-Hall, and priced at £12.55, this book gives a competent treatment to its chosen specialisation. It would not really be of interest to anyone outside that realm. It has an obvious American bias which shows up in references to dollar amounts everywhere.

"No experience necessary" is quite a bold claim to make, as far as computers are concerned. Nonetheless Tom Simpson makes it in the title of his book *VisiCalc Programming: No Experience Necessary*. The text comes in a very practical spiral-bound package which also includes a floppy disc suitable for the Apple II personal computer. The written text is used in conjunction with the lessons on the disc. The instructions are truly easy to follow, and the lessons are good.

I think the book would benefit greatly from just two or three pages with diagrams at the beginning, showing the power-up and program-loading sequence. Then the "no experience necessary" claim would be fully justified. At the foot of each page there is an endearing box of advice on "what to do if you are helplessly lost". This book would be of greatest use to people training staff within a formal business environment.

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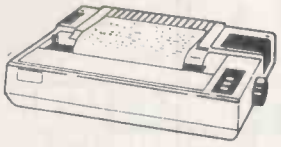

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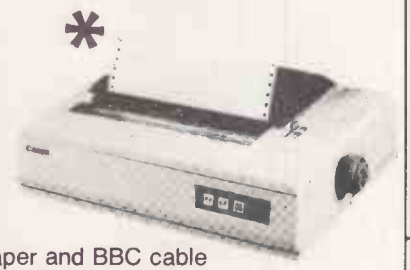

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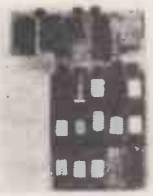

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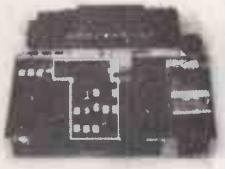

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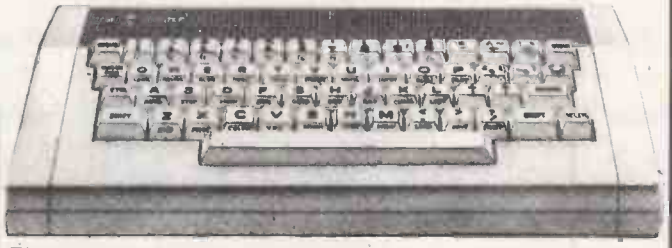

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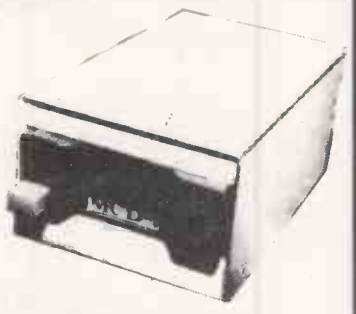
Micro Disc Drive for the BBC Micro



The Micro disc drive offers a method of low cost quick access to programs. The drive is essentially a small version of a 5¼" disc drive and offers similar features to the larger drive.
The data is stored on a 3" disc, this is enclosed in a protective hard plastic cassette which features a write protect switch.
The micro drive requires the standard Acorn disc interface, but a new disc filing system rom. Acorn DFS may be exchanged for the micro DFS for £2.30. The new micro disc filing system can read and write to Acorn DFS discs.
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Beast blasters

Author Jeff Minter presents his top 20 favourite games.

		Machines	Publisher	
1.	Star Raiders	At	Atarl	These two games are a joint No.1. They are light years ahead of anything else at all.
	Rescue on Fractalus	At	Lucasfilm	
3.	Elite	BBC	Acornsoft	A thinking person's Star Raiders.
4.	Pinball Construction Set	At,C64,Ap	Electronic Arts	I love pinball and designing games. Now I can do both!
5.	Encounter	At,C64	Novagen	Battlezone — better than the arcade version.
6.	Ballblaster	At	Lucasfilm	Futuristic sci-fi sport. A great two-player game, too!
7.	Star Ship Command	BBC	Acornsoft	A good laser-blazing shoot-out in deep space.
8.	Miner 2049'er	At,C64,Ap	Big 5	The original and still the best platform game despite hordes of clones.
9.	Mule	At,C64	Electronic Arts	A superbly presented strategy game even an arcader will love to play.
10.	Crossfire	At,Ap	Sierra	An amazingly simple idea that is fiendishly difficult to play.
11.	Missile Command	At	Atari	The definitive version. Let's leave nuclear weapons to the video games, OK?
12.	Boulder Dash	C64,At	First Star	Another simple but compulsive design, nicely presented.
13.	Gyruss	At,C64,	Parker	Neat conversion, a touch too easy perhaps, but has the best soundtrack of any zappo game.
14.	Archon	C64,At	Electronic Arts	Unholy union between chess and arcade zapping.
15.	Poster Paster	C64,Am	Task Set	Original, colourful, tuneful, and it made me laugh.
16.	Boogaboo (the flea)	C64,Sp,Am	Quicksilva	Orlginal control system and freaky psychedellc caverns.
17.	Guardian	C64,BBC	Alligata	The definitive Defender clone.
18.	Choplifter	At,Ap,C64	Broderbund	I like the way the hostages wave.
19.	International Soccer	C64	Commodore	Match of the Day on the 64.
20.	Space Taxi	C64	Muse	Weird mutant of the lunar lander genre.

Micros: Ap, Apple; At, Atari; Am, Amstrad; BBC, BBC Micro; C64, Commodore 64; Sp, Spectrum; Vic, Commodore Vic-20.

I LOVE to write strange games which challenge reality. I like to freak people out by designing a game around a weird character like the space sheep or Mutant Camel and still produce a playable, enjoyable game. I love hairy beasts like goats, llamas, sheep and camels.

I detest cloning of other people's ideas. Arcade cloning should be done brilliantly or not at all, and ought to be licensed. In each new game I design I like to introduce new control modes and elements never seen in games before.

I love a good blast. Sonics are as important as graphics, and playability and lasting interest more important than both. I'm bored with the usual up/down/left/right/Fire control system. I like to experiment with artificial gravity routines.

In choosing the games on the top 20 chart, I've taken into account originality, how much I play them, truly amazing programming — Fractalus wow! — and humour. Modesty prevented me from including any of my own games, but some of them would have been there if I was compiling the list of my own top 20 favourites.

Games written by Jeff Minter

	Machines	Year written	
Andes Attack	Vic	1982	My first machine-code Vic program. A Defender clone.
Traxx	Vic	1982	Painter game.
Gridrunner	Vic,C64,At	1982	Stripped-down Centipede and redesigned it fast and vicious.
Abductor	Vic	1982	Fast blaster, loud noises.
Attack of the Mutant Camels	C64,At	1983	First Beast game. Based on Imperial Walkers sequence in *The Empire Strikes Back*.
Laser Zone	Vic,C64	1983	Now on to wholly original stuff. Difficult dual-axis blaster.
Matrix	Vic,C64	1983	Gridrunner 2 — faster, more original stuff, and camels.
Hover Bovver	C64,At	1983	One of my favourite designs.
Metagalactic Llamas Battle at the Edge of Time	Vic,C64	1983	Shoot-up with unique firing mode and forcefield.
Revenge of the Mutant Camels	C64	1983	One of my all-time favourites. Lovely gormless beast and a good blast to boot.
Hell Gate	Vic,C64	1984	On the Vic, the fastest bit of arcade zapping around. Tricky four-axis control.
Sheep in Space	C64	1984	Interstellar Space Sheep. One of my favourite scrolling blasters.
Ancipital	C64	1984	Weird arcade adventure and an excellent blast.

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When replying to Classified advertisements, readers are recommended to take steps to protect their interests before sending money.

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Classified Rates
Lineage 30p per word
Minimum 20 words prepayable.

Display Adverts.
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Minimum 5 cm
SERIES Discounts Available on request.
Contact: Claire Notley on 01-661 8163.

Method of Payment
Cheques etc should be made payable to BUSINESS PRESS INTERNATIONAL LTD. and crossed.
I enclose herewith cheque/PO for

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Post to:
Cut out the order form and return together with your remittance to:
Classified Department,
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Room H211, Quadrant House,
The Quadrant, Sutton,
Surrey SM2 5AS.

Conditions of Acceptance
Micro Ads are accepted from Private readers only and must be submitted on (or a photocopy of) this order form. All Advertisements must be prepaid.

Please insert the following advertisement in Practical Computing					LINAGE			
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Practical Computing

Advertisement Index

Affordable and reliable printers from Micro P give you more Quality CPS for your money

Even in today's high tech world, for most of us, the written word is still the least expensive means of sending and receiving information. If you own a microcomputer the chances are that sooner or later later you are probably going to need a printer.

Micro P – CPP40

A low cost 4 colour 40/80 column printer/plotter capable of printing text or graphics on plain paper. The CCP40 is an ideal companion for small and portable micro's, as it is fitted with re-chargeable batteries – perfect for beginners.

Micro P –SHINWA CPA80

With 100 cps quality printing, the CPA80 probably gives more cps/£ than any other printer available today. The CPA80 is packed with features you would normally find on a more expensive printer. With an optional RS232 version available (even for the QL) this Epson compatible printer will hook up to almost any micro.

See them at your local dealer today!

● Circle No. 102

Micro P – MP165

Looking for a matrix printer as well as a daisywheel? Well, the MP165 combines all the attributes of these two technologies to give a matrix printer capable of printing at up to 165 cps, as well as providing crisp Near Letter Quality, (NLQ) print at 75 cps. Features include a 2k buffer as well as both friction and tractor feed, as standard. Ideally suited to most popular micro's, the MP165 is now available in a new RS232 QL compatible version.

Micro Peripherals ltd

'THE POWER BEHIND THE PRINTED WORD'

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BASINGSTOKE, HANTS. ENGLAND, RG24 0NE.
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