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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.

All together

WE ARE about to enter the third era of microcomputing. The first began in 1977 with the Apple II. For the first time, personal computing power was available to the general public, and not just to enthusiasts who could wield a soldering iron. Furthermore, you could actually do something useful with your micro.

Of course, Apple was not alone in pioneering the market. The Commodore Pet micros and the Tandy TRS-80 machine all catered for the new and hitherto unsuspected demand. But the open architecture in particular of the Apple II singled it out as the leading and representative machine of its time.

The second era was ushered in by the arrival of the IBM PC in America at the end of 1981. When IBM ate its corporate words about micros being a passing consumer fad, and got in there with its own version, micros had become respectable. Businesses no longer needed to worry about taking risks with these newfangled devices. IBM had put three letters on the front of a microcomputer, and they spelt "OK".

As a result, the business micro market boomed and is still booming, with vast numbers of IBMulators and other 16-bit machines. Corporations that had initially been sceptical now started to install micros across the whole company. Correspondingly, a flood of serious software started to come through to meet the enormous demand for packages that could be used in a business environment.

The third era is now upon us, the era of the local area network. That, at any rate, is the view of Roger Foster, managing director of ACT, speaking at the launch of Microsoft Networks on his company's computers.

Backing up Foster, the ever-youthful Bill Gates, chairman of Microsoft, claimed that at present less than 10 percent of office micros were wired up in LANs. He predicted that within two years this figure could reach over 40 percent. Even allowing for sales hype and other varieties of wishful thinking, there is no doubt that LANs are becoming a major interest. Microsoft's arch-rival, Digital Research, has also entered the market with DR-Net, and both are keen to stake out early claims in this field.

If LANs gain the sort of penetration Gates has indicated, it would certainly signal a radical change in the way we use computers in the office. For most people the stand-alone business micro represented an emancipation from the tyranny of the data-processing department. Gone were the days of being told that your job was in the queue, but probably wouldn't surface until well after the results would be any use. You could sit down with your spreadsheet and get them on the spot.

Even better, you could play around with What Ifs to your heart's content. You also had the option of simple word processing, something unheard of on mainframes. So micros started sprouting on executive and professional desk tops everywhere.

This distributed power did have one drawback: it encouraged isolation. People worked away on their own, blissfully unaware of what the person at the next desk might be up to. Transferring data was an effort. Either you produced reams of hard copy — which meant finding the office printer, hooking it up and then adjusting all those parameters — or you put it on a floppy disc, which took time, was unpopular the other end, and might even be incompatible with the other person's formats.

LANs change all this. Data can be exchanged quickly and effortlessly between different machines, avoiding unnecessary duplication of effort. Using electronic mail, information can be requested and obtained with a few keystrokes. There are financial advantages too, such as shared printer and database resources.

But the most important benefit will undoubtedly be that of letting people work with technology in a way that is analogous to conventional office practice. Micros will be totally integrated into all aspects of the business environment, not bolted on as glorified typewriters and calculators. Then we will start to see what office automation and information technology are really about.

5 Years ago...

The new TRS-80 Model II has been shown in the U.K. and Tandy has announced that it will start taking orders, although the first shipments are not expected until April 1980. Ted Russell, director of Tandy's computer division, claims that the Model II is comparable, in performance, with the IBM 5110, the Hewlett-Packard H9800, and the Wang WCS15. A basic configuration with 32K of RAM and ½MB of additional storage capacity will sell for around £2,000. This can be expanded to 64K RAM with 2MB of storage for around £4,000.

Model II has been designed as a business system starting at the upper limit of the Model I, the old TRS-80. The entire computer and 80-character monitor is housed in one box which includes a ROM disc, two serial and one parallel ports. It is claimed that the Model II will operate at 2½ times faster than the Model I.

Although the Model II incorporates new features which must have been included to some degree in response to criticism of the Model I, such as a lower-case facility for word processing, the Model I will continue to be sold. As if to emphasise the point, the Model I prices have been reduced by about 10 percent. The TRS-80 4K RAM level I Basic will now sell at £385.

PC Volume 3 Issue 1

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● Circle No. 185

Disc controllers and drives

I AM WRITING in connection with John and Timothy Lee's response to G Bates of Lancaster in the November 1984 issue. Mr Bates enquired regarding alternative disc controllers and drives for the Apple II.

The Eicon disc controllers are available from a number of suppliers, including P&P Micros, and will work with all Shugart-compatible 8in. drives. The recommended prices of the SDC1 single-density controller and the DDC2 double-density controller are £295 and £365 respectively, excluding VAT. Two drives can be handled by each controller.

The Tera-Drive is a single or dual 5.25in. drive with a formatted capacity of 1Mbyte per disc, which is packaged in a unit 2in. high and fits between the Apple and its monitor. It is powered from the Apple and requires no mains connection. The prices are £649 and £1,095 for the single and dual drives respectively, including controller. They are available from P&P Micros, Wharncliffe and several other dealers.

S R Hodge,
Eicon Research Ltd,
Cambridge.

Not a pin-up

I CANNOT let Ray Coles' blatant rave review of the MC680XX family, and the 68020 in particular, go unchallenged. Not content with praising the 68000, he describes the iAPX-286 as a "groaning 8086 chassis with goodies bolted on"!

First, the so-called "complex intricacies" of the 8086 make it very efficient on memory usage. I have often read of people complaining that the Macintosh has little memory. The operating system takes up quite a bit, but that applies to any system. However, what is left is rapidly gobbled up by the 68000's clumsy machine code, even for simple tasks. The 8086's machine instruction set is neat and sophisticated.

Second, the 68000 is not beautiful; it is a 64-pin dinosaur. The 68020's pin grid array is awful; the 80286's 68-pin leadless chip carrier is neat.

Thirdly, the instruction set isn't much better. There is something to be said for its regularity, but this makes for inefficient code in the majority of applications. In any case, the 8086 has 24 addressing modes compared to the 68000's 14 and the 68020's 20. The only real superiority the 68000 possesses to the 80X86 family is its internal word length. However, there are two floating-point maths processors readily available that can handle 32-bit integers, and much more besides; there are none for the 68000. In any case, even without a maths processor the 80286 is between 1.06 to 1.4 times faster than the 68000 for the majority of applications.

Martin C Howe,
Canterbury,
Kent.

CompTV

YOU AND YOUR readers may be interested in a use of the computer which I have not seen used elsewhere as yet. I have coined the phrase "compTV" and it describes using various programs chained from disc recorded directly to video tape.

What makes it so versatile is that now there are a wide variety of programs available allowing data input, such as graphs and charts, as well as pictures. Coupled with teletext screens, etc., even a novice can create a fairly low-cost communication scheme. To date, compTV is limited to prototype versions because of limited resources, but we are looking at its potential for the Hartlepool Teachers' Centre.

The idea developed originally as a possible communication idea within a school, using a BBC model B with disc drive. With this system you can build up a very sophisticated package. It can be further refined using a video-tape editor to allow other features.

N Freer,
Hartlepool,
Cleveland.

8087 chip

THE INFORMATION given in the Ask PC column, November 1984 issue, regarding the 8087 chip and software is misleading:

(a) The 8087 can process, in addition to real numbers, integer 16-, 32-, or 64-bit lengths and 80-bit decimal format numbers.
(b) MS Fortran, DR Fortran 77, Gino and Framework are some of the packages available which can make use of the 8087 co-processor.
(c) For number-crunching programs the 8087 may speed execution time by a factor of about 10.

H G Trevor,
London W9.

Dr John Lee replies: I agree with your estimate that the 8087 gives an improvement of about 10 in speed on CPU-bound arithmetic processes. I could not go into the architecture of the 8087, but since it has eight registers several numbers can be held at one time, and it is very quick to do arithmetic with numbers already in the registers, without having to get them from memory. The registers are 80 bits wide and there is no time penalty for using all 80 bits once the numbers are in the registers. Thus the saving in time is greater when you use double precision, Real*8 or whatever. The technical data sheets from Intel have a lot of interesting information on the 8087.

BBC exchange

I AM a 17-year-old student studying in Rome at Saint George's English School. Even though our school has several BBC B machines, and a number of students also have BBC machines at home, we have no way of exchanging information and experiences with other English-speaking BBC users.

BBC users are welcome to write to us if they wish to exchange information, pass on tips, swap programs, etc.

J S Reynolds,
c/o Australian Embassy,
215 Via Alessandria,
00198 Rome,
Italy.

Multi-column text

I WONDER if you or any of your readers know of a package that can be used with WordStar to produce multi-column printed text, as in magazines and newspapers. At present, physical cutting and pasting is required.

R M Tobin,
Edinburgh.

● **The editor replies:** We don't know of such a package, but Dr John Lee is writing an article to provide a solution to this problem. We will publish it as soon as space allows.

Home micros

I STRONGLY AGREE with Mr P A S Craddock — Feedback, November 1984 — that manufacturers' practice of quoting total RAM alone is thoroughly misleading.

It would be more informative if it were quoted as Basic program RAM plus dedicated video RAM, as this is the way micros are used. This way the buyer can see both how much space is available for programs and the graphics resolution/colour capability.

In fact, most manufacturers quote the maximum resolution without stating that only two colours are available at that resolution. There is inevitably a trade-off between RAM size and resolution/colours; a high colour resolution will always use lots of RAM. Conversely a

(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)
micro with most of the RAM available to programs will have a low graphics resolution.

As a rough rule-of-thumb for a reasonable high resolution 256 by 256 or 320 by 196 pixels: 8K RAM gives two colours, 16K RAM gives four colours, 24K RAM gives eight colours, 32K RAM gives 16 colours. For a particular sized RAM halving the resolution will double the number of colours.

On this basis the 48K Lynx, which Mr Craddock instances, is really a 16K machine with a 32K video RAM. As such it has an excellent colour resolution at the expense of limited program space. Compare this with the 48K Spectrum, which is really a 40K machine with an 8K video RAM, as confirmed by the fact that it can have only two colours in one character block. It is more suitable for the many extensive commercially written programs.

However, the rest of Mr Craddock's letter does seem to be a pathological hate relationship with the Lynx, which is totally unjustified, particularly for the reasons stated, which seem to be nit-picking and not unique to the Lynx.

Colin I Clayman,
Reading,
Berkshire

Reverse Rems

YOUR PROGRAM Reverse Rems in November's Commodore Open File uses locations 00/01 for indirect addressing. This means that you can't run it on a Commodore 64, which uses $00 as a data-direction register and $01 as the processor port. So you will have to use locations $FB and $FC.

You should use these two in your program Relocating machine code too, instead of $55 and $56. In this case there will be no need to Poke 84,56.

Besides this, one program doesn't run correctly. Memory-location $408F should read $F0 instead of $D0, because it is necessary to branch on zero.

F Paulsen,
Kiel,
West Germany.

AI books

HAVING LIVED on a diet of exclusively American computing magazines for the last few years, I have been aware for some time that my knowledge of the world of popular computing in Britain is sadly lacking. What has finally spurred me into taking a regular subscription to *Practical Computing* is the appearance of the survey of Artificial Intelligence in your October 1984 issue, which I found to be very good.

I would like to suggest that its usefulness would have been considerably enhanced by the inclusion of a list of recommended further reading for those whose interest has been fired by the articles, and who may not have studied this topic in the past.

J M Wheadon,
Bensheim,
West Germany.

Tony Durham replies: Here is a highly personal list of books on AI. I've left out some famous ones simply because I haven't read them.

Margaret Boden's *Artificial Intelligence and Natural Man,* Harvester Press 1977, is a big, thorough book, nicely written but getting a little out of date. It approaches the subject from psychology rather than programming.

Bertram Raphael's *The Thinking Computer,* W H Freeman 1976, shows insight, is occasionally hard going, but worth it if you want to know how the techniques work.

Tim O'Shea and Marc Eisenstadt's *Artificial Intelligence; Tools, Techniques and Applications,* Harper and Row 1984, is an up-to-date British anthology for the serious student, with Lisp listings.

The Handbook of Artificial Intelligence, in two volumes by Avron Barr and Edward A Feigenbaum, and with a third volume by Paul R Cohen and Edward A Feigenbaum, from Pitman, is the heavyweight reference book, with a heavy price, too. If you've had a brilliant idea, consult the handbook and avoid reinventing the wheel.

Chris Naylor's *Build Your own Expert System* from Sigma Technical Press 1983, and Tim Hartnell's *Exploring Artifical Intelligence on your Microcomputer,* from Interface Publications 1984, are two hands-on books which introduce simple AI concepts, with Basic listings. Naylor's book points towards serious applications. Hartnell's is more in the "amaze your friends" style. It may not be the MIT postgraduate course but it's fun and quite informative.

AI pioneer

THE IDEA of publishing a survey of artificial intelligence was excellent, but I was surprised that even a brief account made no reference to Samuel's work on computer draughts. His pioneer achievement is still, in some ways, unsurpassed though it dates back to 1959.

Samuel first chose a set of criteria by which the quality of a move might be judged — mobility, capture threats and so on — and assumed that the value of a proposed move could be measured by computing a polynomial whose terms represented one each of the chosen features and whose coefficients were initially of unknown values. These values, assigned arbitrarily initially, were progressively adjusted in the course of games between Samuel and the computer.

He went on to construct a program in which the computer played against itself, with one side using the current best polynomial throughout, and the other adjusting its coefficient values after each move. If the fixed set won, it was retained for the next game; but if it lost then the adjusted set was adopted as the new fixed set.

Eventually the program was able to beat its creator easily, and I believe succeeded in drawing against a U.S. champion. The process is not readily adapted to chess because in that game the function contains a singularity — the capture of the King — which has no counterpart in draughts.

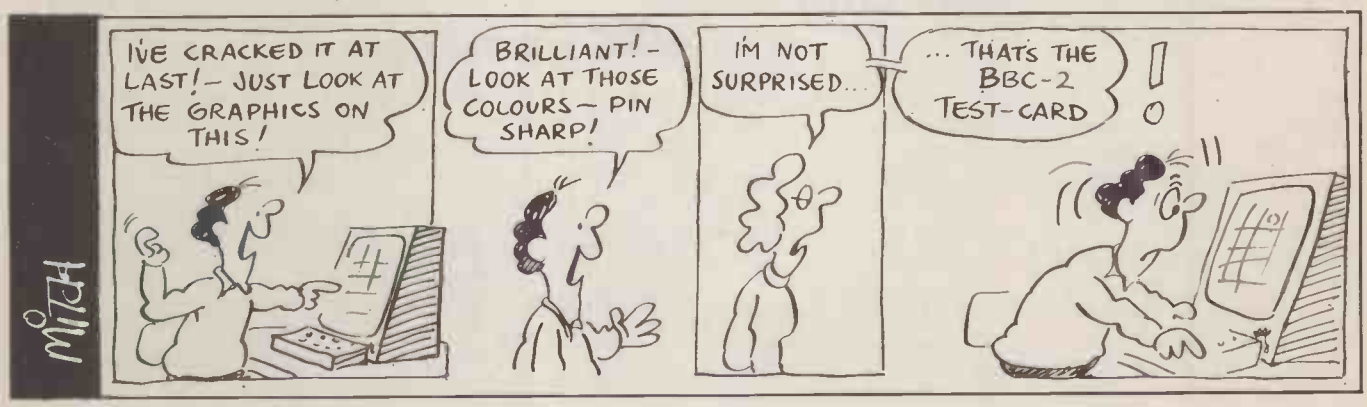
H J Gawlik,
Muir of Ord,
Ross-shire.

More MZ-700

I WOULD LIKE to congratulate John Hooper on his brilliant review between the Tatung Einstein and the Sharp MZ-700 in the November issue. I own an MZ-700 and think that the review was good except I think it was a bit harsh on the MZ-700 — I'm biased.

Could you please include more MZ-700 programs as no magazine does so regularly.

M Bewick,
Dinas Powis,
South Glamorgan.



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PIXELS GALORE.

Any idea what high-resolution sixteen colour graphics mean, resolved to 640 x 256 pixels?

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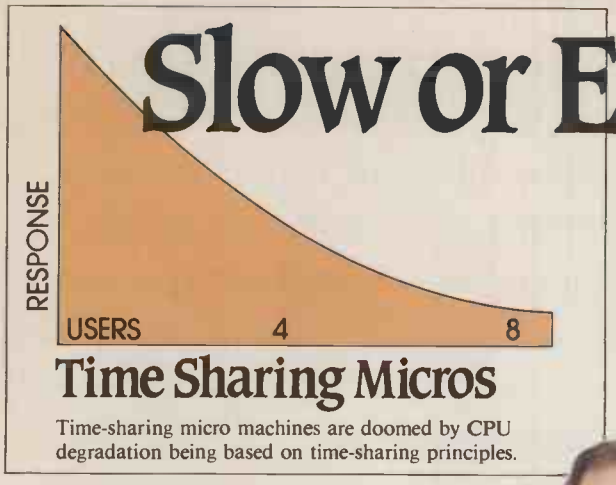
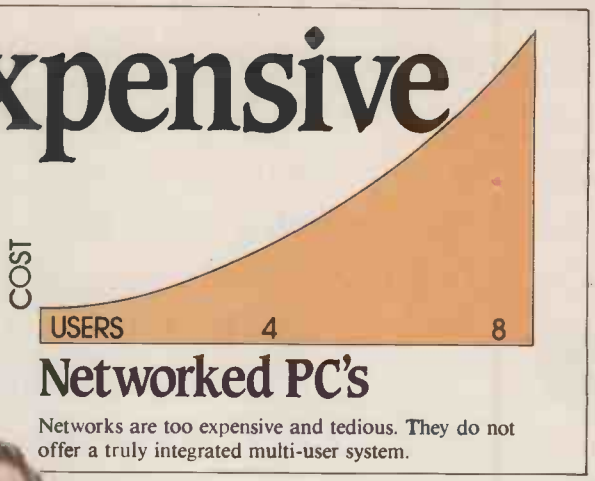


Time Sharing Micros

Time-sharing micro machines are doomed by CPU degradation being based on time-sharing principles.



Networked PC's

Networks are too expensive and tedious. They do not offer a truly integrated multi-user system.

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

Mr Wise chose Multi-Processing

SuperStar

In Multi-processor Superstar, each work-station has its own dedicated processor with up to 1Mbyte of RAM each, working at full CPU speed regardless of the number of work-stations on the system. Because it is a network on an internal bus (or highway), 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 (workstations). The huge increase in power resulting from having up to sixteen 16-bit processors compared with time-sharing a single processor must be plain.

SuperStar is a genuine multi-user system with record and file locking 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.

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- ★ *Genuine Multi-user Data Processing, such as Stock Control, Order Processing, and Integrated accounts.*

Besides Mr Wise, many companies are choosing multi-processing to meet their multi-user requirements, including:

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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. 167

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.

Quest QL add-ons

QUEST HAS PRODUCED a range of hardware additions for the QL to extend the machine's basic specifications. A 200K floppy costs £249, an 800K floppy £425, and a 7.5Mbyte Winchester is £995. All prices exclude VAT. A twin 400K floppy is £499 and twin 800K is £599.

RAM upgrades are also available. They start at 64K for £99, and then cost £159 for 128K, £299 for 256K and £499 for 512K. They are all fully buffered, have automatic refresh and offer 150 nano-second access to RAM contents. As with the disc drives, a one-year warranty is offered.

Quest has also produced a large black tin box which acts as a wrist rest when typing, a monitor stand and expansion unit. Various plug-in additions can be stowed away neatly inside, out of sight and harm's way. It costs £109 plus VAT.

At the launch of these products, Quest gave a tantalising glimpse of what the future might eventually hold. It showed a 2Gbyte optical disc, which it claims could theoretically be available for the QL in a year's time. The price would be "under £13,000" — surely the ultimate add-on.

Quest is at School Lane, Chandlersford, Hampshire SO5 3YY. Telephone: (04215) 66321.

Mains LAN

THE IDEA of plugging the mains into your RS-232 may sound unappealing, but Nectar has produced a safe way of utilising ordinary mains power circuits to act as a local area network. The micro is protected by two levels of isolation, and frequency modulation of a 200kHz carrier is used. It is claimed that there is no radio interference.

Signals will pass through smoothing units, but can be isolated by transformers. Nectaring units cost from £125, and can transmit at up to 4,800 baud.

Anyone willing to take the plunge can contact Nectar 091-482 3745.

Mr Fixit

COMPUTER-FIX is a company specialising in repairing home micros. It now offers all-inclusive deals for most of the leading names. Costs include labour, spares, postage, insurance and VAT. Prices range from £19.55 for the Spectrum to £37.50 for the Commodore 64 and £40.25 for the BBC. All parts and labour are guaranteed for 90 days.

Computer-fix has set up a national network of 500 dealers offering this service. It promises repairs within 48 hours plus postage time from the dealer to its headquarters in Camberley. Details on the service can be obtained on (0276) 66266.

Micronet info

THE WONDERS OF Micronet can be sampled free by anyone with a micro and a modem working at 1,200/75 baud. In an effort to win new converts, Micronet has set up a sample database available by asking the operator for Freephone 2043, then for your local Prestel telephone number. Dial up and key in 4444444444 as the identity number and 4444 as the password.

British Telecom is also getting in on the act with its Home Computer Line, a three-minute tape giving various information on home micros. It is updated twice weekly and provided by Information Unlimited, a small company specialising in information provision. There is no charge for the service apart from the telephone costs. At the moment the only number carrying the Computer Line is Bradford (0274) 722622. It is expected that other numbers will be set up nationally shortly.

New Opus

OPUS is offering a 100K 5.25in. disc drive for £119.95. The unit is attached to a micro via the RS-232 port. There is a two-year guarantee on the drive, but operating systems are extra. The drive is made by the Japanese firms Alps, and assembled by Opus. Details on 01-701 8668.

U-Man micro

U-MAN is a 6800-based machine with a 6809 second processor, 128K RAM, dual 800K floppies, mono, colour and graphics output, and serial and parallel ports as standard. It also has a sound generator, speech synthesiser, 10-bit A/D converter, 16 parallel I/O lines, a keyboard and four-slot expansion bus.

The U-Man is also claimed to be one of the first open-architecture 68000 systems, following in the great tradition of the Apple II. U-Micro says it will provide full information

(continued on page 15)

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(continued from page 13)

on the internal workings of the computer for third-party software and hardware houses.

Prices start at £2,499 for the basic system. Increasing the RAM to 256K pushes the cost to £2,749, and the 1Mbyte version costs £3,999; all prices exclude VAT. U-Micro is on (0925) 54117.

British interference standard

UNLIKE AMERICA, the U.K. has had no standard laid down on how much radio interference may be caused by computers. This has been changed by BS 6527 which specifies acceptable limits. Copies may be obtained for £10.20 from the Sales Department, BSI, Linford Wood, Milton Keynes MK14 6LE.

Slow, Slow, Slomo

WHILE EVERYONE else is trying to speed up micros, Nidd Valley Micro Products has produced Slomo to slow everything down. As well as letting you get the hang of those tricky bits in shoot-'em-ups, it could also be useful for freezing frames.

The Slomo plugs into user ports or the equivalent, and is available for the Spectrum, BBC, Electron and Commodore 64. It is claimed to work with all Spectrum games and 95 percent of others. The cost is £14.95. Information can be obtained on (0223) 214451.

QL interfaces

MORE ADD-ONS for the QL —this time interfaces. Cambridge Systems Technology has produced an IEEE-488 port for use with scientific equipment. The Q-488 transmits data at up to 70 bytes per second, and works with SuperBasic, Pascal, C, Forth and assembler. The cost is £170 plus VAT. CST has also announced that its QL Centronics interface has been reduced from £75 to £50 plus

VAT. CST is on (0223) 323302.

A Centronics printer interface for the QL is also available from Downsway Electronics. It costs £31.95 including VAT. Details on (03727) 27222.

Wrist directory

WITH ITS Data Bank 500 Casio has produced yet another variant on the digital watch theme. This one allows you to store up to 50 sets of six letters and 12 figures. Typically these might be telephone numbers, timetable information or diary notes.

Entries are arranged in alphabetical order automatically, and can then be searched through using a Fast Forward and Reverse button.

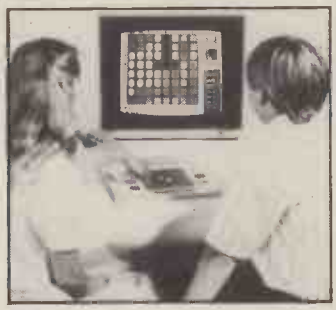
The Data Bank 500 costs £41.95. Information from Casio on 01-450 9131.

Intel evaluation kits

INTEL has produced three Microsystem Designer Kits designed to allow evaluation of the 80186, 80188 and 80286 chips, along with their associated peripherals. Each kit includes a two-volume components handbook, the CPU and peripherals. For example the 186 kit includes the 80186 itself a DRAM controller, a text co-processor, a video interface controller, a graphics controller, a LAN co-processor and a Winchester disc controller. The kits cost £117.10, except for the 286 which costs £207.50. Details from Rapid Recall on (0494) 26271.

Touchmaster

THE TOUCHMASTER is a pressure-sensitive surface, boasting a resolution of 256 by 256 across its A4 surface. It is



claimed to be robust enough to be used by children.

The first release works with BBC, Spectrum, Commodore 64 and Vic-20 machines. The cost is £149.95. More from Touchmaster on (0656) 744770.

CP/M for the QL

PCML's extension to the Sinclair QL includes a 4MHz Z-80 CPU and 64K of RAM to provide CP/M capability and thus, in theory, access to a huge supply of useful programs.

It should be possible to run

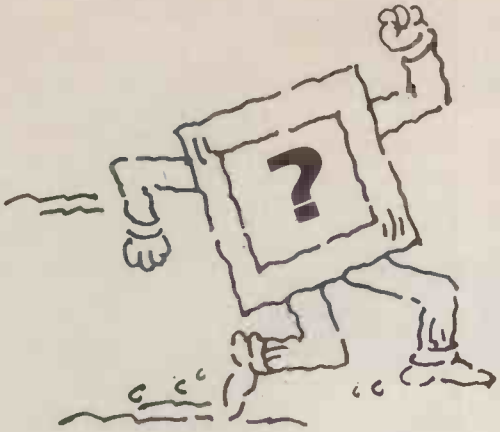
CP/M-80 and another operating system concurrently.

The expansion box also provides two programmable eight-bit ports, one of which is configured as a parallel printer port. Interface drivers can be written to connect other devices. It will be launched in January 1985 with a recommended price of £199.

For further details contact PCML Ltd, Royal Mills, Esher, Surrey KT10 8AS. Telephone: (0372) 67282.

Hardware shorts

- The Osborne 1 continues to sink in price. The 52-column version costs £499, the 80-column version £659. The same bundled software is offered. Details on (0908) 615274.
- Watford Electronics has produced a ZIF — zero insertion force — socket to allow ROMs to be changed quickly and easily on the BBC. It is fitted externally to the left of the keyboard. Price is £16. More on (0923) 40588.
- Tatung has released a second integral disc drive for its Einstein micro. The 500K 3in. drive costs £149, and slots into its allocated space in the micro housing. More information on (07462) 15721.
- The Kaypro 4 has been reduced in price by £100 to £1,485. The processor speed has also been doubled, slimline disc drives used and dBase II bundled in addition. Details on (06286) 67547.
- The grandly named Hayes Mach III joystick is claimed to be a superior model. It costs £46.95. More information from P&P on (0706) 217744.
- Tandy has cut the cost of its Color Computer 2. Entry price is now £99.95; top-of-the-range version with OS-9 costs £169.95.
- Graphics and colour facilities are available on the Future FX range with new boards. More on 01-686 2233.
- Up to 63 Macintoshes can be hooked together using the Corvus Omninet system. Details on (U.S. area code 408) 559-7000.
- The Sinclair Vision QL colour monitor is claimed by its maker MBS DE to have been developed in conjunction with Sinclair for the QL. The cost is £299. More information on (0442) 60155.
- Apple micros can be kept cool with the Apple Saver, which also includes a power-smoothing unit. It costs £106. More details can be obtained on (09285) 67551.



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MICROWARE

Bernoulli Box arrives

A FEW YEARS AGO the Bernoulli disc drive was all the rage. The idea was to use aerodynamics to keep gunge away from the read/write head, and thus provide hard-disc capacities of seven million bits per inch without the disadvantages of a sealed-box system. The design made sense on paper, but somehow never made it to market. Now it has, it is made by Iomega in the U.S. and distributed in the U.K. by DRG. The price is £3,250 plus VAT.

The Bernoulli Box comprises two 10Mbyte disc drives. Because they are encased in plastic cartridges, the discs can be removed just like micro-floppies, so a box of 10 discs provides 100Mbyte of storage in convenient form. With Winchesters, 100Mbyte would be prohibitively expensive, while with floppies and tapes it would be unusably tedious.

Contact DRG Business Systems at Black Arrow House, 2 Chandos Road, Park Royal, London NW10 6UP. Telephone: 01-961 6955.

IBM mainframe connections

IN APRIL, IBM's AT micro will be available in a mainframe version as the AT/370. Like the XT/370 this can run many programs under the VM/CMS mainframe operating system. It costs £8,197 plus VAT, or an existing AT can be expanded for £2,506 for the two expansion cards, and £985 for the 3278/9 emulation adaptor.

In the U.S., IBM has announced two new programs, Displaywrite 3 and Personal Services/PC. Displaywrite 3 is an enhanced Displaywrite 2 with numerous extra features. Personal Services/PC is a mail manager for use with PCs connected to a Dissoss system.

In addition, IBM has launched two new printers for the PC, the Quietwriter and the Wheelprinter. The Quietwriter uses resistive ribbon/thermal-transfer technology, which is the same as on IBM's new Thermotronic typewriters. The Wheelprinter is a 25cps daisy-wheel model. Both printers have the same price of £1,316.

Electric Desk

MULTI-FUNCTION packages tend to be bulky and inconvenient, but Harvard-based Alpha Corporation's is neither. Electric Desk offers a word processor, spreadsheet, database and communications but they all come on a single disc and the system is claimed to be easy to learn and use.

Electric Desk is a multi-tasking package that allows very rapid switching between screen displays from different sub-programs and different documents. Nine jobs can be held simultaneously, memory permitting, and any two shown on the screen at once.

Electric Desk requires a minimum of 256K, and costs £285, which makes it one of the cheaper integrated packages to buy and implement.

Contact U.K. distributor Reflex Ltd at Wellington Industrial Estate, Basingstoke Road, Spencers Wood, Reading RG7 1AW. Telephone: (0734) 884611.

Slaves to the PC

A SINGLE-USER IBM PC or look-alike can now be turned into a multi-user system by plugging in an accessory board and hanging a dumb terminal on the end.

The board that does it has been designed by Advanced Digital of California, and is called PC-Slave. It has an 8MHz 8088 chip, from 256K to 768K of RAM, two serial ports, and costs from £995.

If you want to buy a large quantity — hundreds or thousands — then Advanced Digital has just opened a U.K. office at 27 Princess Street, Hanover Square, London W1R 8NQ. Telephone: 01-409 0077.

If you just want one or two, then contact Sirton Computer Systems, 7 Greenlea Park, Prince George's Road, London SW19. Telephone: 01-640 6931.

Free software

GRAPHICAL SOFTWARE has come up with a new way of selling its Softwords word-processing package: dealers can give it away. Users who are suitably impressed with the program can then pay £295 plus VAT for a password which unlocks the program's filing system, buys a user guide, hot-line support and updates for six months.

Contact Graphical Software Ltd, 3 Cambridge Place, Cambridge CB2 1NS. Telephone: (0223) 312210.

Ultra-cheap software

THE IBM PC Special Interest Group, PC-SIG, based in Santa Clara, California, has published a book listing many hundreds of non-copyright and user-supported programs circulated among American PC users. Programs are available for word processing, communications, utilities and games in assembler, Basic, Pascal, Forth and C.

The PC-SIG library now contains over 100 discs, with up to about 40 programs on each. User-supported programs cost from $3 to $75 each. Library discs cost $6 each. A set of 10 most popular discs is available for $59, and a set of all 135 costs $814. U.K. buyers must add a $10 handling charge per order. The directory itself costs $5.95 including postage.

Contact Judy Rosenthal at PC-SIG, 1,556 Halford Avenue, Suite 130J, Santa Clara, Ca 95051. Telephone: (area code 408) 730-9291.

Shorts

- Graphix Partner is a £130 utility program that sits in the background with other programs, like Lotus 1-2-3. It provides graphics enhancements such as fancy founts or adding your company logo. Contact Softsel for details on 01-844 2040.
- The Integrator is an open-ended American program that integrates other programs such as WordStar, Multimate, Lotus 1-2-3, Multiplan and dBase II. For European and U.K. availability contact Modtech AG, Mühlegasse 25, CH-8025, Zurich, Switzerland. Telephone: 252 04 20.
- Microsoft's Chart graphics add-on for Multiplan is now available for the IBM PC for £235 plus VAT. Telephone: (07535) 59951.
- Buy an IBM PC without a keyboard, and buy the Keylynx 3170-style 122-key keyboard. You still have a PC, but with Blue Lynx 3270 and 5251 emulators you also have a fully functioning mainframe terminal. At £395, the Keylynx has a far superior layout to the standard PC keyboard too. Phone Techland Systems at (06285) 26535.

RAMROM 15

The Sideways RAM & ROM Expansion Board for the BBC

The GCC RAMROM 15 board adds to the BBC Micro another eleven sideways ROM sockets plus the necessary hardware for sideways RAM.

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- The board can be powered by an external 5 Volt power supply, available as an optional extra.
- The unit comes in a case of its own and resides outside the BBC Micro, giving easy access to the resident ROMS.
- For those involved in development work, most of the 6502 processor signals are made available outside the BBC Micro.
- Priority or selection can be assigned to either RAMS or ROMS.
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- Can be installed together with most other BBC add-on boards.
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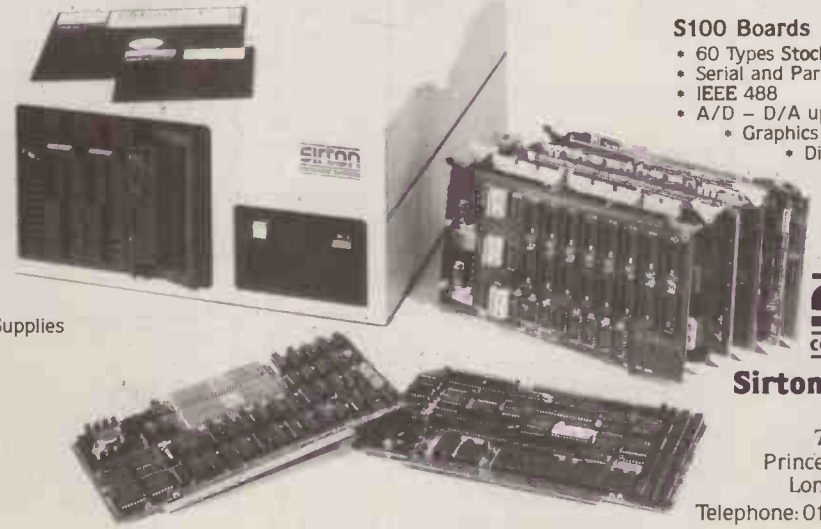

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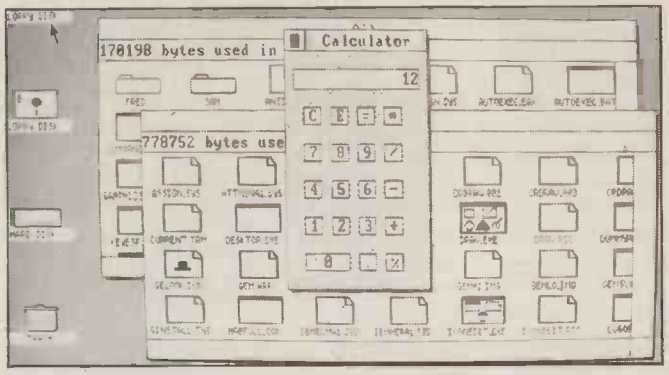
Mac-like front end for Concurrent CP/M

DIGITAL RESEARCH has announced Gem, an extension to Concurrent CP/M which gives it a Macintosh-like graphic user interface. Gem shows on-screen the same user-friendly paraphernalia of graphic icons, pull-down menus and overlapping multiple windows as the Macintosh, and supports mice and other pointing devices in the same way.



Gem in fact consists of three main products: Gem Software, the operating system extension; Gem Desktop, the user-friendly interface; and Gem Programmers Toolkit, which lets system developers build applications using mice, icons, pull-down menus and so on. These are not intended as end-user products, but will be sold to computer manufacturers, who will probably offer them bundled with Concurrent CP/M on their machines.

At the press launch Gem was shown running on the ACT Apricot F1, Acorn's new ABC 300, various IBM compatibles and the IBM PC itself. IBM has announced no plans to adopt this Digital Research product yet, though. Gem will work as a front end to single-tasking versions of MS-DOS, as well as with Concurrent CP/M.

The beauty of Gem is that it is compatible with existing software running under Concurrent CP/M.

Details from Digital Research (U.K.) Ltd, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB. Telephone: (0635) 35304.

BBC Logo

ACORNSOFT'S LOGO costs £69 including VAT and runs on both cassette- and disc-based systems. The Logo interpreter itself comes on two ROMs. You also get various utilities on disc or cassette and two books: a beginners' guide and a reference manual.

With this product Acornsoft has managed to pip its rivals to the BBC Logo winning post. Other versions of the educational language have often been announced and are obviously very near to being delivered — notably Logo Systems Ltd's Logo and Logotron's LCSI Logo.

At the time of writing we have a complete Logo from Acornsoft, but only bits and pieces from Logo Systems and Logotron. We have nothing at all from BBC Publications, which will be distributing a fourth Logo, Open University Logo, probably later in 1985 for the machine. We therefore have to declare Acornsoft the winner, at least in getting a BBC Logo to market. We will be reviewing the rivals in a future issue.

For Acornsoft Logo contact Vector Marketing, Denington Industrial Estate, Wellingborough, Northamptonshire NN8 2RL. Telephone: (0933) 79300.

Commodore language tutors

THE FRENCH MISTRESS, The German Master and The Spanish Tutor, are self-education programs newly released for the Commodore 64. BBC Micro, Electron and Spectrum versions have been available for some time.

There are two cassettes for each language, at two levels of difficulty, covering different areas of grammar and vocabulary. Each cassette costs £8.95. Contact Kosmos Software Ltd, 1 Pilgrim's Close, Harlington, Dunstable, Bedfordshire LU5 6LX. Telephone: (05255) 3942.

PC-to-Mac

DILITHIUM PRESS has launched a PC/Macintosh communications package which includes two discs, a book and a cable for £129.55 plus VAT. It provides all you need to link an IBM PC and an Apple Macintosh and move files between the two. You can also use either the IBM disc or the Macintosh disc for other communications — for example, with a modem for electronic mail — if you add the correct null modem cable.

The PC requires at least 128K of RAM and either a communications adaptor or internal modem. The book provides a comprehensive and clear explanation of that and a number of other things you can do. Cable-wiring details are also provided.

Contact Softsel on 01-844 2040.

Microsoft's Networks

MICROSOFT has launched Microsoft Networks to provide the software to link micros together, as long as they have at least 192K of RAM and MS-DOS 3.1.

(continued on next page)

Software shorts

● Stop is a utility program for the Sinclair QL which lets you compress Microdrive files to about half size. The price is £17.95 including VAT. A Spectrum version, price £12.95, will be available soon. Contact Digitex Computers Ltd, 4 Amwell House, The Woodlands, Isleworth, Middlesex TW7 6NX.

● AmsForth is Skywave Software's initial version of Forth for the Amstrad. It implements the standard Forth Interest Group command set and also supports the machine's sound and graphics. Skywave also intends to release a more powerful ROM-based Forth, similar to its MultiForth for the BBC. AmsForth is supplied on cassette, price £18 plus VAT mail order. Contact Skywave Software, 73 Curzon Road, Boscombe, Bournemouth BH1 4PW. Telephone: (0202) 302385.

● Lisp and BCPL are now available for the QL. Lisp is an AI language, BCPL a compiled systems programming language. The QL versions, written by Metacomco, support graphics and windowing and cost £59.95 each. Details from Metacomco on Bristol (0272) 428781.

● Spreadsheet Auditor for the Apple II and IBM PC lets you check your spreadsheet models by displaying all the formulae you have used. The IBM PC version works with Lotus 1-2-3, VisiCalc and Supercalc, the Apple version with just VisiCalc. Spreadsheet Auditor costs £82.95 plus VAT. Details from Pete & Pam on (0706) 217744.

● Expert Systems International Ltd has launched a new version of the AI language Prolog. Prolog-2, initially available for the IBM PC and ACT Sirius, costs £2,000. ESI's less advanced Prolog-1 is still available for £390. Details from ESI Ltd, on (0865) 242206.

(continued from previous page)

The network provides file locking and record locking, and is claimed to be compatible with all software which runs under version 2.0 of MS-DOS. The network also requires that at least one micro be designated as network server and dedicated to running the network. Each individual micro must have the Microsoft redirector software in RAM. The common files can then be accessed using an extension of the director/sub-directory naming system in MS-DOS.

Microsoft Networks does not provide for the physical linking of the network. The cards and device drivers that provide the four physical layers of the ISO networking protocol must be implemented by the manufacturer. Consequently Networks will only be sold to manufacturers, not to end-users.

The first version of Microsoft Networks to be implemented is ACT's Point 32 Apricot local area network. This uses the Corvus Omninet system to provide the physical connections between different micros, but not the Corvus software. ACT says the cost of installing Point 32 is "typically £20,000 for a 10-user system".

From Microsoft's point of view the important thing is to establish a software standard. Microsoft claims that IBM's forthcoming network PC-Net is actually Microsoft Networks. If this proves to be the case, and if it allows — as should be possible — the networking of IBM PCs, Apricots and other micros running MS-DOS, then it could well succeed.

Contact Microsoft Ltd, Piper House, Hatch Lane, Windsor, Berkshire. Telephone: (07353) 59951.

Micropro launches a brand-new WordStar

MICROPRO, producer of WordStar, has launched a totally new word-processing program called WordStar 2000. It has a completely different command set, multiple on-screen windows and other features absent from WordStar — still the brand-leader among word-processing programs for personal computers.

Micropro does not intend WordStar 2000 to replace WordStar, which will still be available in its current 3.4 form. WordStar 2000 will be promoted as the more up-market and at the same time easier-to-use product.

The program's windowing facility lets you have up to three documents on screen simultaneously. WordStar 2000 incorporates mailing, sorting and arithmetic functions, and has a spelling corrector. A utility program lets you convert existing WordStar files to WordStar 2000 format.

WordStar 2000 will be available in the U.K. in January, initially for the IBM PC, XT and AT, price £440 plus VAT. It requires at least 256K to run and preferably a hard disc, although two floppies will do. Existing WordStar users can upgrade for £200.

Contact Micropro International Ltd, Haygarth House, 28/31 High Street, Wimbledon Village, London SW19 5BY. Telephone: 01-879 1122.

VisiCalc package

VISICALC used to be distributed by Visicorp. Now Visicorp has dropped out and it is being distributed by Software Arts, its originator. Software Arts also handles TK!Solver and the Spotlight desk-management program.

The VisiCalc Package includes VisiCalc, Advanced VisiCalc, The VisiCalc Book and six home-management and financial programs. The original VisiCalc has also — at long last — variable column widths, support for 40 and 80 columns, and full-word prompts. Advanced VisiCalc has also been improved. The VisiCalc Package costs £149 including VAT for Apple II computers.

Visicorp has sold its Visi On technology and the Communications Solutions Inc. company to Control Data, and is planning to merge with Paladin Software, a new company which has yet to launch a product. It now has no connection with Software Arts.

Contact Software Arts International, 43 Buttermarket, Ipswich, Suffolk. Telephone: (0473) 221552.

Lap-computer software

THERE HAS recently been a spate of software for the Olivetti M-10, Tandy 100 and NEC 8201A lap portables.

Olivetti has launched a suite of software for its M-10 lap computer. The programs include a sort of Welcome cassette, a keyboard tutor and a data-capture program that works with the keyboard or bar-code reader.

M-10/Edit and M-10/Texted are word-processing and text-formatting packages. Texted is WordStar-compatible and can be used with the M-10's built-in address file to provide a mail-merge facility.

M-10/Store enables you to take over the disc drives of an Olivetti M-24, an IBM PC or IBM-compatible desk-top micro, Apple II or Tandy TRS-80 model 4. It allows for fast file transfer at 9,600 baud with error checking. The package includes a disc for the micro, a cassette for the M-10 and a manual.

M-10/Calc and M-10/Multiplan are both spreadsheets. M-10/Calc comes on cassette and is VisiCalc compatible. It handles up to 364 cells, depending on the amount of RAM available.

M-10/Multiplan comes on a 32K ROM chip which fits into a spare socket in the M-10 — which means it doesn't take up an any RAM at all. The program looks and works just like the full-size Multiplan, but with a 63-column by 99-row capacity. It lacks only a few features such as variable column widths and sorting, but as an ever-present ROM it adds enormously to the power of the system.

In addition, Olivetti now provides a free mailbox on Telecom Gold. Contact British Olivetti Ltd, Olivetti House, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

NEC 8201A users can make use of Pasocalc from Microtime International. This program, from Tokai Create, comes on a ROM Chip and provides a Multiplan-compatible spreadsheet with up to 99 rows by 14 columns. It can also be used in a Memo mode where text can be written to the spreadsheet regardless of the column widths. Pasocalc does not run on either the Olivetti M-10 or Tandy 100.

Microtime has also announced a whole fleet of programs which run on the NEC 8201A, Tandy 100 and Olivetti M-10 lap computers. They include MPlan, MSolve, MBrain, MLabel, MMailer, Autopen, Autopad, Travelling Writer, T-base, T-File, Expense Manager, Book, Cheque and Trip.

MBrain is a 5K Reverse Polish calculation package. Autopen is a 2.5K package that formats text created using the built-in Text program. Autopad is a 5K spreadsheet. Book provides single-entry book-keeping in 3.8K of RAM. T-File is a tape-file management system.

Most remarkable of all is T-Base, a three-part program which adds up to a relational database manager. As well as T-Base, the other two programs are T-Base Report Generator and Memory Manager.

Prices range from £25 plus VAT for programs like Chequebook, to £80 plus VAT for T-Base.

Contact Microtime International, 106A Bedford Road, Wootton, Bedfordshire MK43 9JB. Telephone: (0234) 767758/766351.

COMMODORE 64

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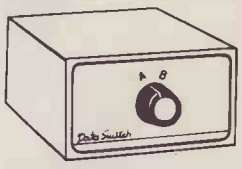

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The Touch Pad is a low-cost graphic plotting aid for the BBC micro. This compact display cursor moving device simplifies programming with the touch of the stylus.

The product comes complete with an instruction booklet, basic software, stylus and connecting cable. Its uses are in graphics, computer aided design, education and games.

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Cumana have spent years on research, development and marketing a range of drives second to none. Their drives are compatible with BBC, Spectrum, Dragon, Oric, Tandy Models I,II, III and 4 and Video Genie. They are fully guaranteed for 12 months and approved for electrical safety by the D.M.E.E. and are extensively used in GLC and ILEA establishments. Cumana were the first independent disc drive supplier and are now Europe's market leader. Their products have been proven in the schools, universities and homes throughout Europe. Let us drive you in the right direction, send now for further details of the Cumana range, or see them at our distributors and at selected branches of W.H. Smith, Lasky's, Greens, Currys, and Spectrum UK.

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The Acorn Electron Computer
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Disk interface now available for the Acorn Electron, details from Cumana.

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CD800/S 2 x 80 Track double sided (800K)	£414.95

Cumana disk drives with independent power supply, mains lead and plug. Excluding other accessories.

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CS400E 80 Track double sided (400K)	£208.95

Cumana disk drives supplied with formatting diskette and comprehensive user manual. Power supply taken from BBC Microcomputer, with lead supplied.

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Compec A to Z

COMPEC, held at Olympia in November, was a fascinating show with lots of new products — thus offering a contrast with the PCW show which was, unfortunately, boring. What the two shows had in common was an outstanding display from Acorn.

Acorn showed the ABC range again, but also launched eight new products for the BBC B. These were the 32016 second processor, 10Mbyte and 30Mbyte hard discs, Acornsoft ISO Pascal and Logo languages, the Music 500 add-on synthesiser, and three Econet products. Logo

costs £69, has 220 commands and comes on two 16K ROMs. In addition there was a huge add-on to the Electron, the Plus 3, which provides a 300K microfloppy-disc drive and Advanced Disc Filing System to handle it, and costs £229. Also displayed were an RS-423 interface and an Electron data cassette recorder. Telephone: (0223) 245200.

British Micro launched the Mimi 805 desk-top micro with the OS/M operating system, which is claimed to be fully CP/M compatible, but faster. With its 6MHz Z-80B, 400K or 800K floppies and 12Mbyte to 32Mbyte hard discs, the Mimi 805 looked a useful performer. Prices start at £1,390 plus VAT. Telephone: (0923) 48222.

Comart had one of the most impressive displays of the show. The basic S-100 bus Communicator range is little changed, but it has been recased in a set of steely-grey boxes. In addition Comart launched a smart new work station with a tiny footprint, which uses an 80186 chip and a choice of 720K floppy and 10Mbyte hard discs. The WS-20, WS-30 and WS-40 models are intended to be networked to either the 8086-based CP-1000 or 80286-based CP-2000 series of Communicators. Telephone:. (0480) 215005.

Datatech, part of Thorn EMI, suddenly revealed itself as Britain's largest modem manufacturer, and launched a range of three. Telephone: 01-890 1477.

Epson's stand was dominated by the PX-8 portable with a neat range of add-ons. They included the CX-21 modem, P-40 and P-80 printers, and PF-10 portable disc drive. Phone: 01-902 8892.

Fortune launched an even meatier version of its desk-top model, the 32:16. The designation XP-45 identifies it as one of the expanded performance series with a 45Mbyte hard disc. It is claimed to support up to 13 users and costs £13,195. Telephone: 01-741 5111.

Hantarex launched the Boxer, a 12in. monochrome monitor with a black screen, costing £99.50 including VAT, which looked smart and pin-sharp. Hantarex claims to be "the name behind the screens in over 90 percent of professional video games machines". Telephone: 01-778 1414.

ICL was busy launching its OPD, One Per Desk, on Regent Street, but did not have one on its Compec stand for our visit. Telephone: 01-788 7272.

Jarogate launched its amazingly fast Sprite desk-top micro using an 80286 chip and 64K or 256K of cache memory. The single-user version has a 790K floppy disc and 5Mbyte hard disc. The multi-user version has 512K to 2Mbyte of RAM and a 21Mbyte or 42Mbyte hard disc. The British-made Sprite has a five-slot S-100 bus construction with two spare slots, yet the dimensions of the system box are only 329mm. wide by 118mm. high by 521mm. deep. It uses 256Kbit RAM chips and the boards are packed flat. Telephone: 01-671 6321.

Micropro showed the new WordStar 2000, with its use of function keys and "dramatically simplified user interface" — enough said. Telephone: 01-879 1122.

Newbury Data has a prototype 3.5in. hard-disc drive called Penny which was, as you might expect, small. The storage capacity of 50Mbyte was not. Telephone: (0784) 61500.

Olivetti's stand had multi-user Xenix for the M-24, an Oli-Mouse, 3270 communications and a range of software for the M-10. As the mouse plugs into the keyboard it does not need special software and does not take up an expansion slot or RS-232 port. Tel: 01-785 6666.

Philips (Austria) showed the 16-bit version of its P-2000 transportable, with built-in 10Mbyte hard disc, running Open Access. Telephone Kingsway Data Systems on (09328) 68911.

Quest was showing a 1,000Mbyte optical disc, the Shugart Optimem. On another stand was the Executive series of hardware and software for

the Sinclair QL: RAM expansion to 512K, floppy-disc drives, the Firefly 7.5Mbyte hard disc, monitors, printers, CP/M-68K and some business software. Telephone: (04215) 66321.

Research Machines launched the Mynah multi-purpose soundbox with a Texas Instruments sound chip plus a unique speech system for the 480Z. The speech system uses analogue-to-digital conversion. Quad-density discs and the Chain network were also on show. Telephone: (0865) 249866.

Symbiotic demonstrated its hard disc and network systems with the Macintosh, Apple IIc, and the BBC Micro. The Symbfile goes up to 42Mbyte. Under Symbnet, up to 127 micros can be linked in a tree-and-branch network with fibre-optic and twisted-pair cable. Tel: 01-683 1137.

TDI, whose fast Pinnacle micro is reviewed on page 74 of this issue had a model with 6Mbyte of RAM — beyond the dreams of avarice. A more affordable demo was a Sinclair QL running the p-system. This makes available such goodies as UCSD Pascal, Fortran 77 and Basic. Fortran on a QL Microdrive? What will they think of next? Telephone: (0272) 742796.

U-Microcomputers showed its new U-Man 1000 micro, an affordable 68000-based system running CP/M-86 and the p-system. Phone: (0925) 54117.

Vaser launched a special scientific version of the excellent Volkswriter word processor for the IBM PC. It provides over 400 bit-mapped characters including the Roman and Greek alphabets and a mind-boggling array of scientific symbols and technical characters. Telephone: (02404) 5434.

Whitechapel Computer Works showed its 32016-based graphics work station. Telephone: 01-377 8680.

X-Data showed the powerful Microline 84SX IBM-compatible dot-matrix printer with a wide range of features from bar-coding and plotting to near letter quality printing. Phone: Slough 72331.

Zenith exhibited its IBM-compatible desk-top micro and Zip portable. The old faithful semi-IBM-compatible Z-100, with its S-100 bus construction and Z-80/8088 chips, found a new life as a multi-user a host running MBOS/5 with a Z-29 terminal. Tel: (0452) 29451.

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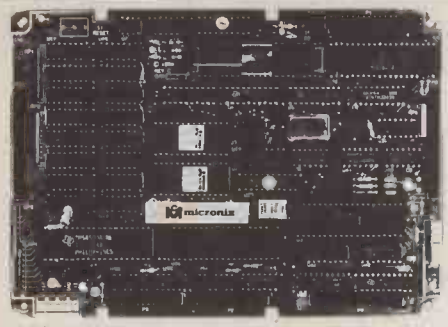

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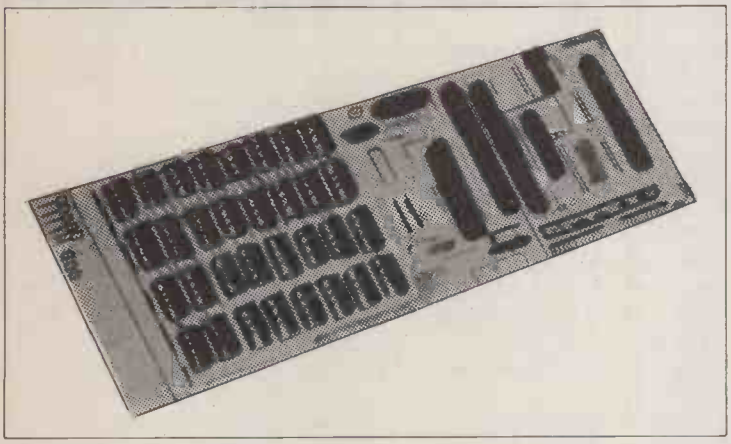

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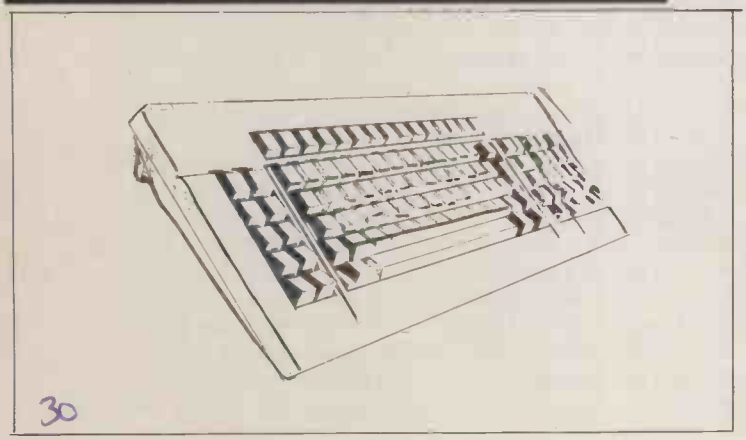

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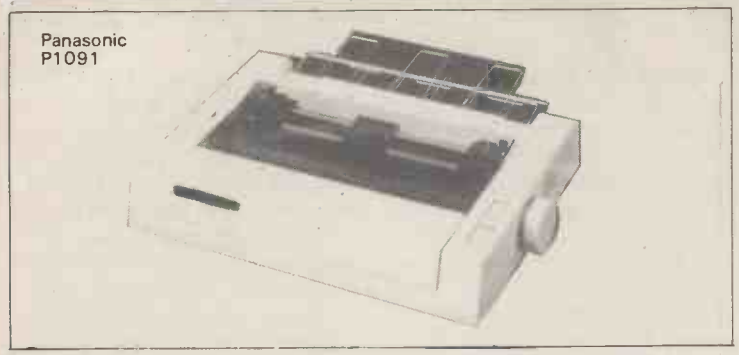

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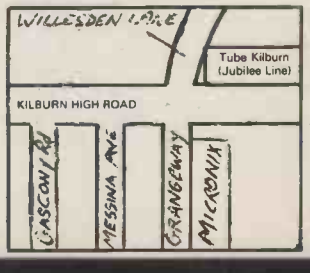

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The piracy problem

A RECENT SURVEY estimates that software piracy is costing the industry £24 million per year in the U.K. alone. Games manufacturers appeared to be more vulnerable than business software houses, nine of the 10 most seriously affected companies being games suppliers.

These results were presented by Anne Staines, a barrister, to a meeting of the Technology of Software Protection Group of the British Computer Society. They are based on 467 replies from 2,000 questionnaires sent out to organisations covering a wide cross-section of the computer industry.

Of the respondents 56 percent of the producers were conscious of piracy of their products and 30 percent felt able to put a figure on their financial loss. The total annual loss of £24 million was broken down into four categories: counterfeiting £4.8 million; disguised imitation, where the basic idea was copied, £2.45 million; seeping, where an extra copy is made for a friend or another member of the user group or the branch office, £14.4 million; and other forms such as extra copies made by dealers, organised seeping by schoolchildren, employee moves, etc. £2.2 million.

Of the software houses which replied, 12 percent were producers of games, 65 percent supplied business packages and the remainder were in industrial activities such as CAD/CAM. Hardware manufacturers provided 61 replies. The responses showed that the industry is maturing — over half of the firms were more than five years old.

Games appeared to be 80 times more likely to be copied than business software. This was reflected in differing attitudes. Games manufacturers tended to adopt a very aggressive attitude and were far more ready to go to law; business software producers, on the other hand, tended to accept a degree of piracy as an occupational hazard.

Johnny Johnson, managing director of Pegasus Software, revealed his company's approach to the problem. Pegasus had tried and abandoned dongles because they were inconvenient and not universal in application. They also had a tendency to get lost when not in use. The method he favoured was detailed recording of licence number on each disc supplied. With a product which required ongoing support, this provided an accurate method of finding the source of delinquent copies.

Michael Edwards of the International Federation of Phonogram and Video Producers outlined the lessons to be learned from the experience of the entertainment industry. Trade associations and national groups were the basis of the success which had been achieved. He proposed a threefold approach — education of the users and of the government, strengthening of legislation, and increased penalties for infringement and greater vigilance with enforcement through national groups.

Gates' way to the future

A PERSONAL COMPUTER on every office worker's desk was seen as a desirable and achievable objective by most of the speakers at the *Financial Times* Second Professional Personal Computer Conference held in London early in November.

It was also widely though not universally accepted that a large proportion of those computers would be supplied by IBM, whose 40 percent share of the U.S. retail market, achieved in only three years, was an underlying factor in most speakers' ideas about the future of personal computing. The means whereby this objective of market saturation would be achieved went, thankfully, beyond the $100 million a year currently being spent by IBM and Apple to secure a market share for their products.

User-friendly software, high-resolution graphics — with associated concepts such as the widespread use of icons — and networking on a universal scale throughout large and small organisations, were identified as the main ways in which acceptance of personal computers would be accomplished.

Opening the conference Bill Gates, chairman of Microsoft, spoke of intuitive computers which would build up a picture of an individual user's work patterns, enabling the machine to adapt to the user's needs. In this way the computer would come to be regarded not as just another office appliance but as a machine endowed with common sense which would give it some of the characteristics of a human assistant.

This goal, Gates hazarded, was two years away, but Microsoft was already involved in the development of what might be termed "softer software", which would help to make the idea of the intuitive computer into a reality. Other factors which would play a part in this development would be the incorporation of an inherent graphics capability, such as Microsoft's windows concept, into the machine.

Meanwhile the development of industry standards and of better ways of linking computers in networks would create an environment in which widespread user acceptance of personal computers would emerge. A strong measure of agreement with this view of the future came across in a paper delivered by Paul Bailey, vice-president of European Operations with Digital Research. He saw strong continuing growth in the personal computer market up to 1989 when the number of units installed in the U.K. would be 10 times the current level.

However, for this to happen new classes of user without the motivation to learn about computers — which characterises most current users — would have to accept them. Key factors in achieving this acceptance would be an improved man/machine interface through the use of high-resolution graphics, multi-tasking as embodied in software such as IBM's new Topview package, and the provision of improved networking facilities.

Louise Kehoe, the *FT's* West Coast correspondent had no doubts as to who is making the running in the personal market. Asserting that the letters IBM are synonymous with FUD — Fear, Uncertainty and Doubt — she said that the announcement of the PC/AT had sent a shock wave through the industry.

What is more, there are signs that this dominance will extend to software. Not only is IBM taking a stronger proprietory interest in software products but announcements such as Topview, which is seen as an alternative to Microsoft's Windows, demonstrate its intention to control all aspects of personal computing.

For the manufacturers of IBM PC compatible computers the future looks just as bleak. Compaq has achieved an unprecendented rate of growth to make it number 3 in the market but, asserted Ms Kehoe, it is playing a dangerous game and has already been hit in the U.S. by price cuts from IBM. "Compaq is dancing with a gorilla," she said "And when you dance with a gorilla you don't get to choose when to stop."

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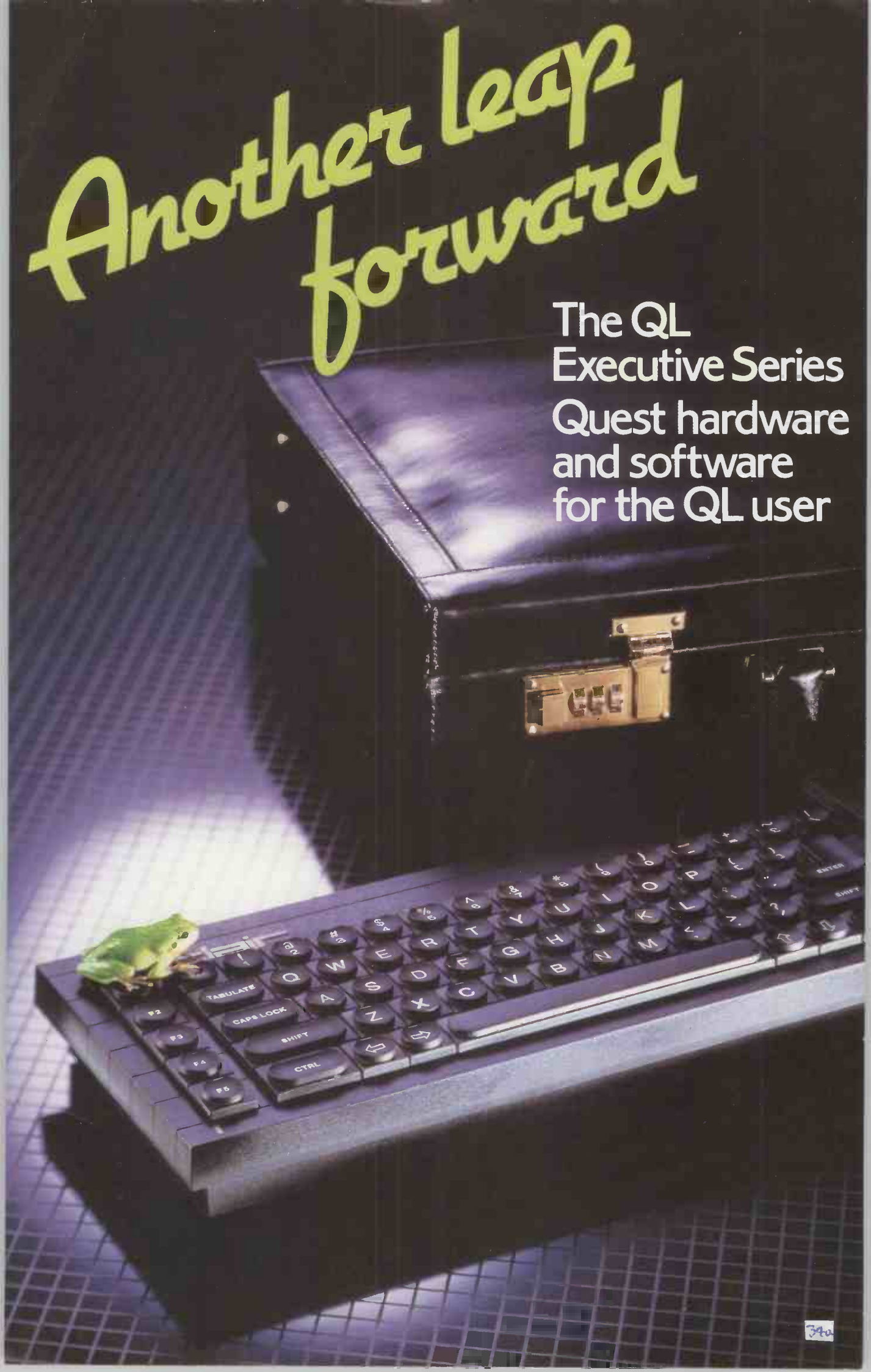
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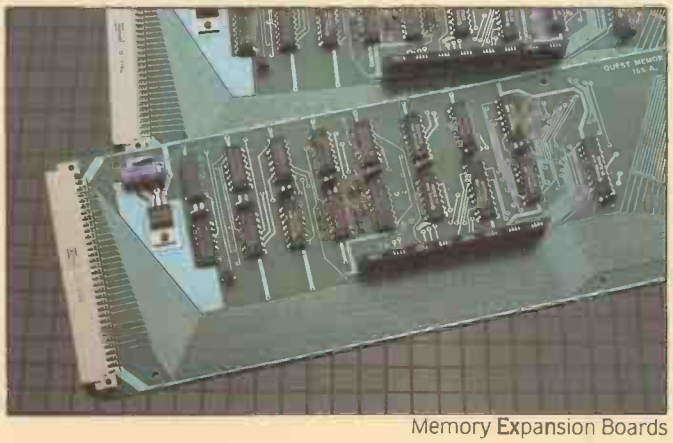
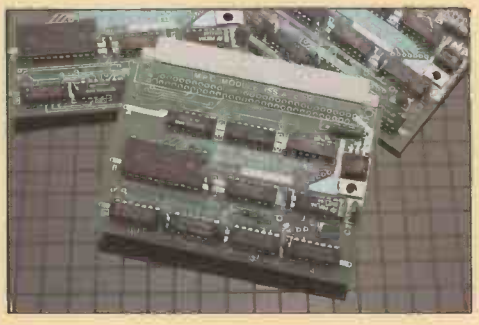


Memory Expansion Boards



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OScard

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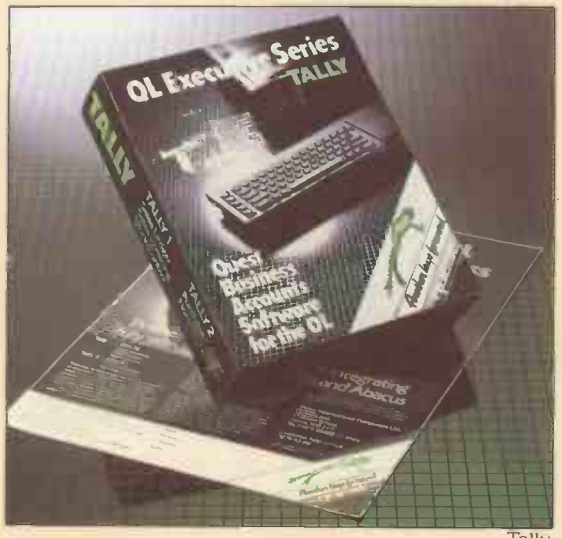

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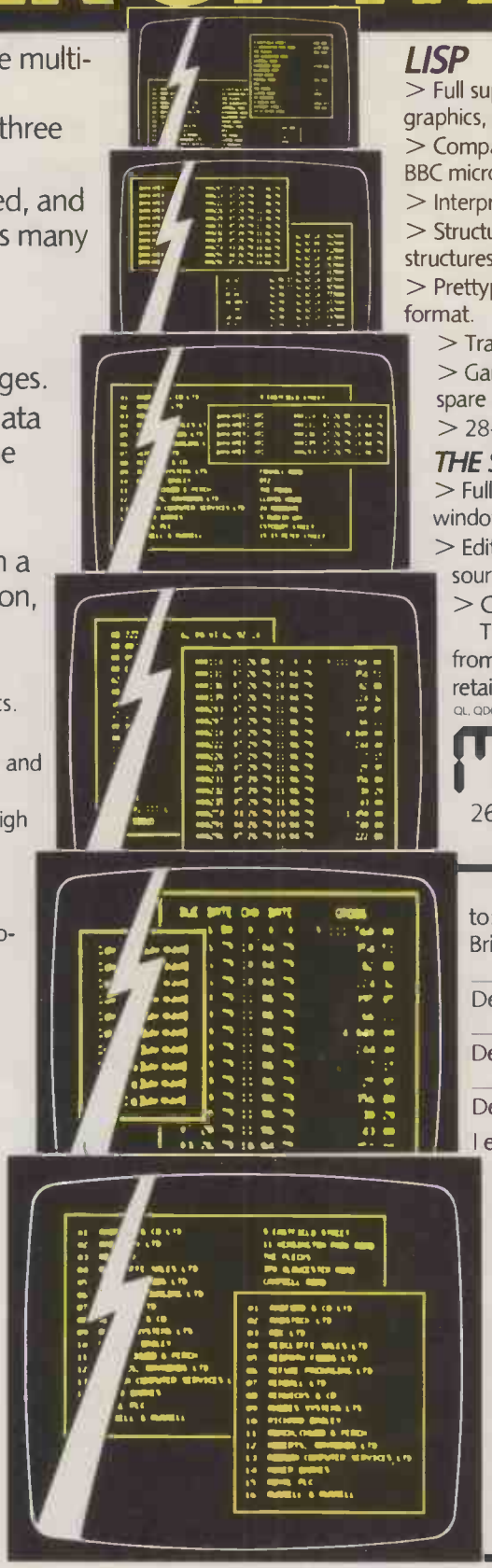

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U.S. Gold on the attack

RONALD REAGAN and Kenny Everett fans will enjoy U.S. Gold's new games Raid over Moscow and Nato Commander. Both are available for the Commodore 64 and Atari micros, with a Spectrum version of Raid over Moscow promised for late 1984.

Raid over Moscow is a multi-screen game with seven different screens. They go from a satellite view of the earth, through take off — inside the hangar — and the flight to the heart of Moscow. Whatever it plays like, the graphics are fantastic.

Nato Commander is a war game, of the same genre as Atari's famous Eastern Front. The game is played in real time on a scrolling map of Europe, with everything happening at once. Fortunately there is a freeze button so you can take a few moments to plan your strategy for global obliteration. If you like war games, Nato Commander is extremely well done.

Raid over Moscow and Nato Commander are very reasonably priced at £9.95 on cassette and £12.95 on disc. They are available from most home computer stores, or telephone 021-359 3020.

Two of the seven screens from U.S. Gold's war game.

Commodore 64 shorts

Commodore 64 conversions of other — mainly Spectrum — games now include many old favourites. . . .

● Zaxxon, modestly described as "the unsurpassable experience", is now available from U.S. Gold. On the Atari, Zaxxon was the 1983 arcade game of

the year in the U.S. The Commodore 64 version is slower and easier but has some extra fancy graphics to compensate.

● Digital Integration's flight simulator Fighter Pilot is one of many ex-Spectrum games that benefits from the enhanced sound capabilities of the Commodore 64. It costs £9.95 on cassette and £14.95 on disc.

● Quicksilva has released 3D Ant Attack with joystick control, and Fred.

● Durrell Software has launched enhanced versions of Harrier Attack and Jungle Trouble at £6.95.

● If you fancy starting life as a humble molecule and working your way up, In the Beginning is now out on the 64 from Mosaic. It costs £6.05.

● Melbourne House has released Hungry Horace and the original Classic Adventure.

● Virgin has released Falcon Patrol and the follow-up FPII.

● Other Spectrum favourites on the Commdore 64 are Micro-Gen's Automania or Manic Mechanic, Design Design's Halls of the Things, Richard Shepherd's Ship of the Line, DK'tronics' Dictator, Software Projects' Jet Set Willy, Legend's Valhalla, and Addictive's Football Manager

Ghostbusters

AND NOW, the game of the film: Ghostbusters is claimed to follow the plot of the film closely. It was written by David Crane, who produced the Pitfall and Decathlon games, and is available from Activision for the Commodore 64 and Spectrum micros, with other versions to follow. On cassette it costs £9.99 for the Spectrum and £10.99 for the Commodore 64.

Micro go

BBC AND ELECTRON owners can now play the Japanese national game, go. The implementation from Edge Computers is a micro version played on a nine-by-nine board, but offers numerous educational features including a demo mode and warnings of imminent capture. The progam is on tape and costs £9.95 from dealers or direct from PO Box 175, Reading RG1 5JS.

CBS brings in Epyx

CBS ELECTRONICS, distributor of the Colecovision game and the Adam home micro, has entered the software arena with eight games from Epyx.

Most of them have been available for some time for the Atari and/or the Apple, but at import prices of over £20. However, the CBS series is being produced in the U.K. for sale at only £8.95.

So far CBS has selected only eight of the extensive Epyx range. These include the excellent motor-racing game Pit Stop, the hoary old favourite Gateway to Apshai, plus Silicon Warrior, Dragon Riders of Pern, Lunar Outpost and Jumpman. Sorry, no Jumpman Junior yet.

Two new games are Impossible Mission and Breakdance. Both have brilliant graphics. The animation of the somersaulting figure in Impossible Mission is, in terms of both definition and speed, streets ahead of anything else on the Commodore 64.

If the initial offerings are a huge success, CBS itself has a catalogue of about 25 programs on sale in the U.S. They are all available for the Commodore 64, and most for the Atari or Apple too. They include several Sesame Street games, such as Ernie's Magic Shapes and Big Bird's Special Delivery, plus other educational programs developed by the Childrens' Television Workshop.

Return to Eden

LEVEL 9 has finally produced a graphics adventure in Return to Eden. It is the sequal to Snowball and features 250 locations and up to 240 pictures in versions for the Amstrad, Commodore 64 and Spectrum. The BBC version gets round the memory problem by having a separate demo progam to show the pictures, while the Atari, Memotech and other versions are text only.

The price is £9.95 on cassette, with BBC and Commodore 64 disc versions at £11.95. The next adventure after Return to Eden will be The Worm in Paradise

Record for Projects

SOFTWARE PROJECTS could be aiming for a record in having the most games launched for the Christmas rush.

Thrusta, a new game for the Commodore 64, and Lode Runner for the Spectrum, both use colour card anti-piracy protection just like Jet Set Willy. Other new games are Fatty Henry and Dodo Lair for the unexpanded Vic-20, and The Perils of Willy, which requires a 16K expansion.

Software Projects has also entered the market for cheap games. Two of these, California Gold Rush and Faces of Haarne, are for the Commodore 64. Titles for the 48K Spectrum are Fred's Fan Factory, Freex, Flip Flap, Loony Lander, Moonlighter, Shuttle Shock and Ziggurat. All of them cost £2.99.

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A rapidly expanding range of programs is already available. The high quality software takes full advantage of the CPC464's high specification and speedloading capability. Which means even complex programs can be loaded quickly.

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>SKILLS OUT OF SCHOOL

The February special section of *Practical Computing* looks into learning, and the skills you can acquire through a microcomputer with suitable programs. If you want to learn a foreign language, improve your typing or acquire business skills, a micro can make a contribution outside the formal educational system. We look at the programs available for adults — and some of the many offerings aimed at young children.

>REVIEWS

After extended use, it looks as though Ashton-Tate's Framework and Lotus Development's Symphony are the two integrated software packages to consider . . . so that's what we do. But this is no point-by-point comparison: forget the hype in the computer comics, the two are so different that comparisons are not very useful. We tackle each on its own merits.

>AND MUCH MORE

Do you believe in the standard Benchmarks? If so, you're in for a rude shock: Boris Allan's statistical analysis is essential reading.

If you program a BBC Micro there's another feature you must not miss: Roger Cullis provides some real inside information.

Plus, David Levy and Mike Lewis continue their outstanding series on programming techniques. Mike Todd will be reviewing Commodore books. And there will be all the latest news, reviews and regular columns, not to mention lots of free software in Open File.

Don't miss the February issue of

Practical Computing

On sale at W H Smith and all good newsagents after January 16.

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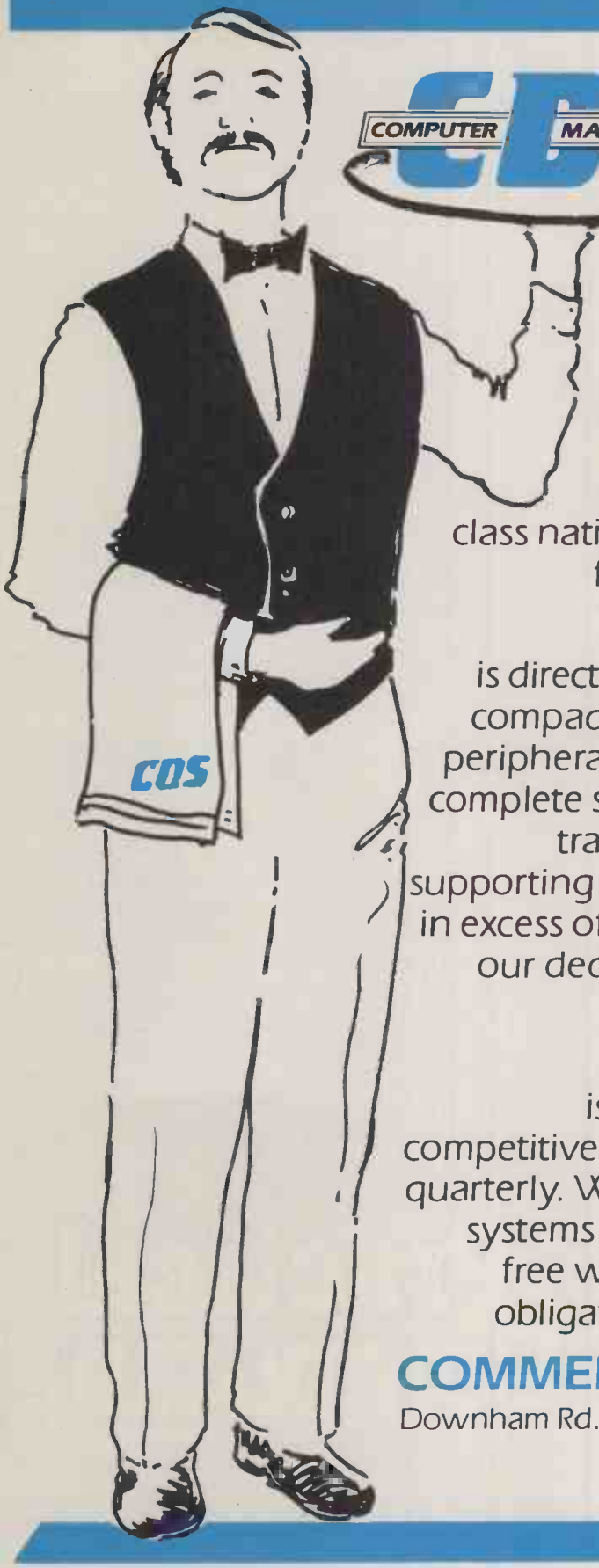

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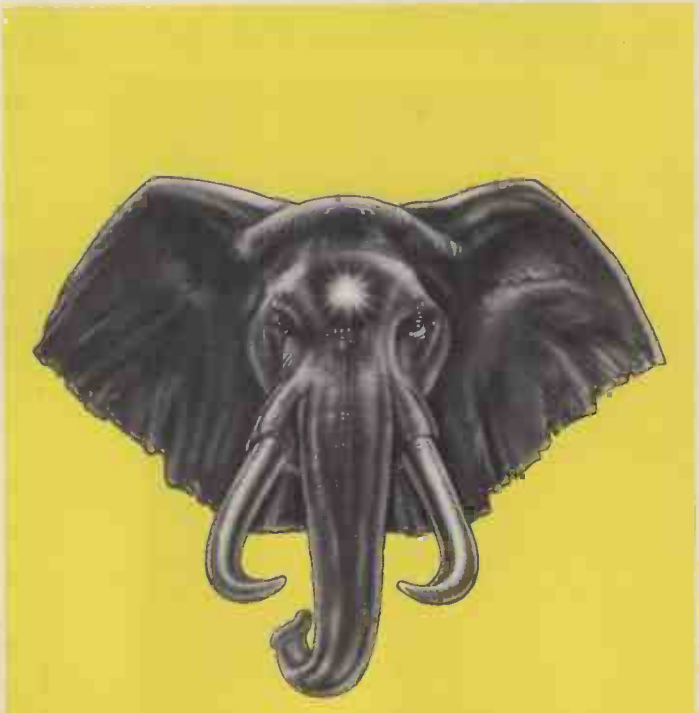

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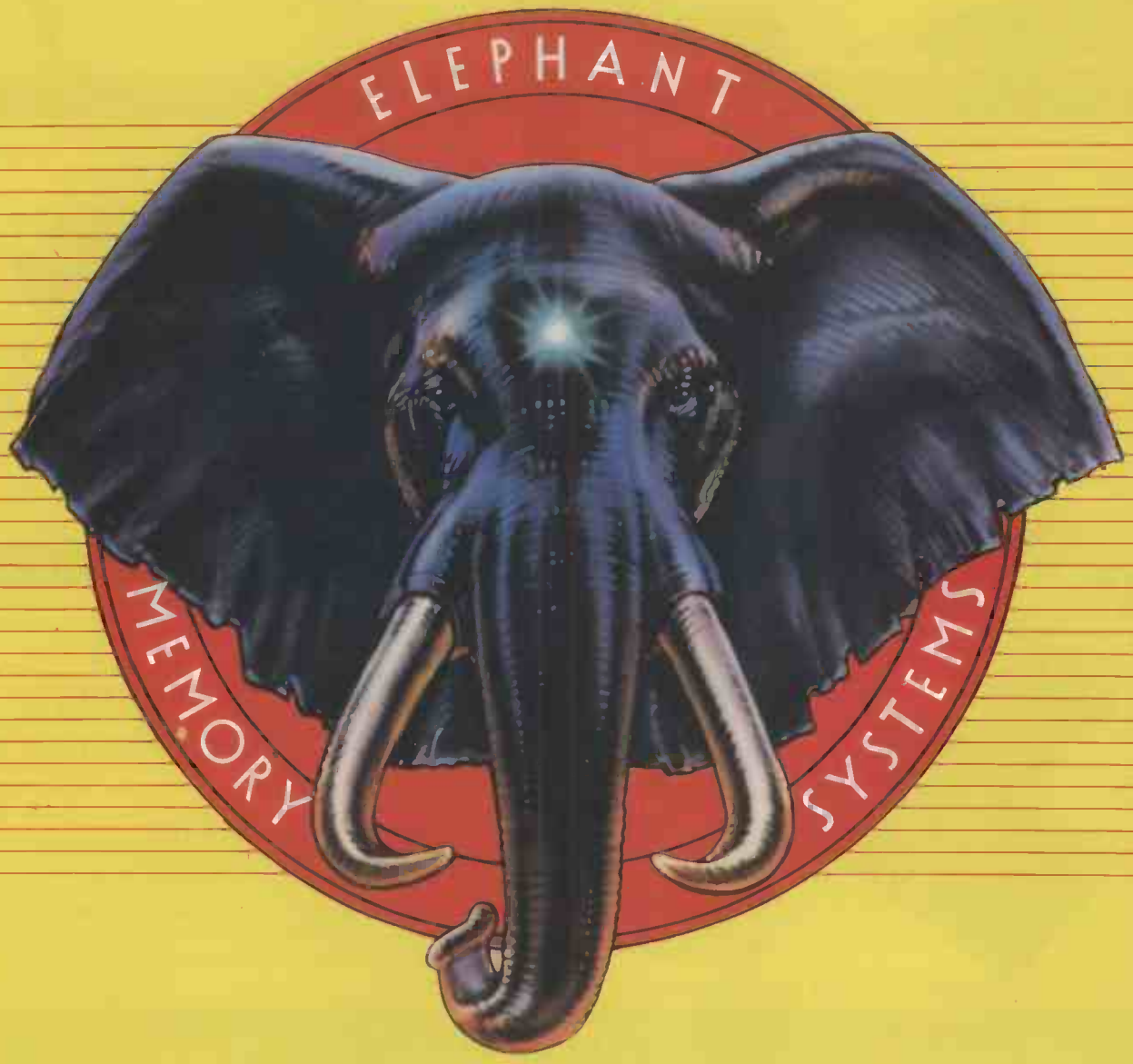

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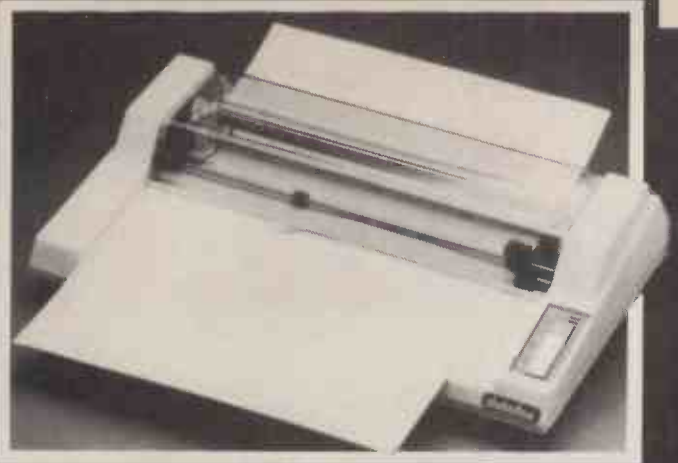

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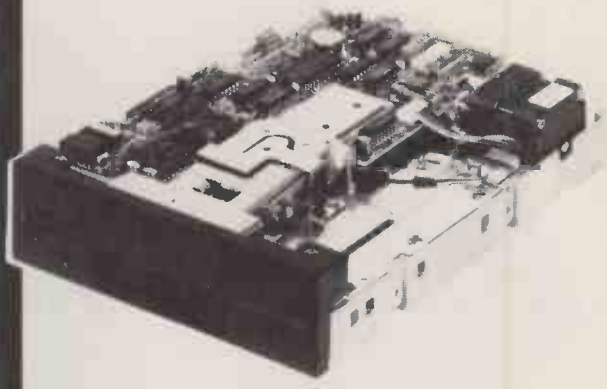

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by Ray Coles

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Heyday

In this, the heyday of the personal computer, it is easy to forget that microprocessors can be used for many other tasks than those with which this magazine usually concerns itself. In many of these other applications the microprocessor may stand virtually alone. Even stranger to some may be the revelation that most microprocessors have never seen the inside of a personal computer.

Numerous specialised microprocessor chips have been designed to cater specifically for the very healthy non-computer market. Unlike pampered celebrities such as the Z-80, 6502 and 8086 these devices are destined to spend their days in lonely anonymity. Even the humans who make use of their services are likely to be quite unaware of their existence, still less their part number. Not for these microprocessors the warm companionship of a row of 64K RAMs or the excitement of a game of Space Invaders. Instead, the icy isolation of a car-park ticket dispenser, or the humid shake-rattle-and-roll of an automatic washing machine.

Cruelty

In case you think I have finally come off my trolley, or that I am about to ask you for a generous donation to the Royal Society for the Prevention of Cruelty to Chips, let me hasten to add that my motive for bringing to your attention the plight of these poor underprivileged devices is purely technical. To me there is something rather appealing about a microprocessor designed for control applications which comes as a completely self-contained unit with RAM, ROM and interface circuitry on the same chip, and all in the same package as an emotionally insecure Z-80.

Intel was the first to produce such a design, the eight-bit 8048 which appeared way back in 1977. With 1K of ROM and only 128 bytes of RAM, this single-chip microcomputer — as Intel called it — was hardly suitable for use in personal computer applications. For controlling door chimes, coffee percolators, pocket computer games and dish washers it was dynamite. The 8048 is now made in 18 different versions by about a dozen different manufacturers, and its relatives still sell by the tens of millions each year. That's an awful lot of *Colonel Bogie* door chimes for a device which still manages to remain largely incognito.

The basic 8048 device used a masked ROM, with all the operating software programmed in at the manufacturing stage. The process is only cost effective when thousands of devices with the same code are ordered at the same time. To cater for users who were building prototypes or small production runs, Intel also introduced the 8748 in which the ROM was replaced by user-programmable EPROM. Code could also be erased, when required, by shining high intensity ultraviolet light through a quartz window in the package lid.

Competition

Following the initial success of the 8048, other versions evolved with more memory, or based on low-power CMOS technology for battery-powered applications. Competitive devices also appeared from the other semiconductor giants such as Zilog and Motorola. The Zilog Z-8 has carved out a niche for itself in real-time applications such as computer disc controllers because it is powerful and very fast.

Motorola decided to produce two separate single-chip microprocessor families, coded 6801 and 6805, aimed respectively at the high and low ends of the single-chip applications spectrum. Unlike Intel and Zilog, Motorola kept a large measure of software compatibility with its multi-chip processor family, the 6800.

To suit the enormous variety of potential applications, single-chippers are now manufactured with all sorts of on-chip goodies, such as the serial communications controller on the Motorola 6801, and the analogue to digital converter on the Intel 8022. Package sizes also vary from 20 pins for the Intel 8020 device for jelly-bean consumer applications, up to 64 pins or more for the all-singing all-dancing versions with everything on board bar the kitchen sink.

The ultimate chip

For my money, the Japanese Hitachi company has produced just about the ultimate in single-chip processors with its new HD-63701X. Built using CMOS technology, this device uses a 64-pin shrink-DIP package, whose 1.78mm. pin spacing makes it no larger than the standard 40-pin Z-80 package. It incorporates a powerful 88-instruction on-chip processor which is an improved version of the Motorola 6801. The chip also carries a 4K CMOS EPROM program memory, 192 bytes of RAM, 48 I/O lines, five dedicated outputs, an eight-bit timer, three 16-bit timers, and a serial communications interface with a programmable baud-rate generator.

Thanks to the CMOS technology used, the HD-63701X can be battery powered. It consumes only 30mW in operation and can be put into a 5mW Sleep mode or a 20μW Standby mode. The EPROM section can be programmed just like a stand-alone 4K-by-eight 2732 device, using a pinout adaptor on a conventional EPROM programmer. Erasure is achieved as usual with high-intensity UV light.

Underused

I have always felt that single-chip devices could be very useful for computer hobby applications, and that they have been underused in this area. Most personal computers can be interfaced to EPROM programmers, and no doubt a cross-assembler could be written in Basic to allow simple program encoding. The only difficulty is finding appropriate applications and the design of any necessary interface circuitry.

In a typical 10-user network, each user can send over 150 messages per second.

Medium data rate (2.5 megabits per second) avoids esoteric electronics and allows use of standard coaxial cabling.

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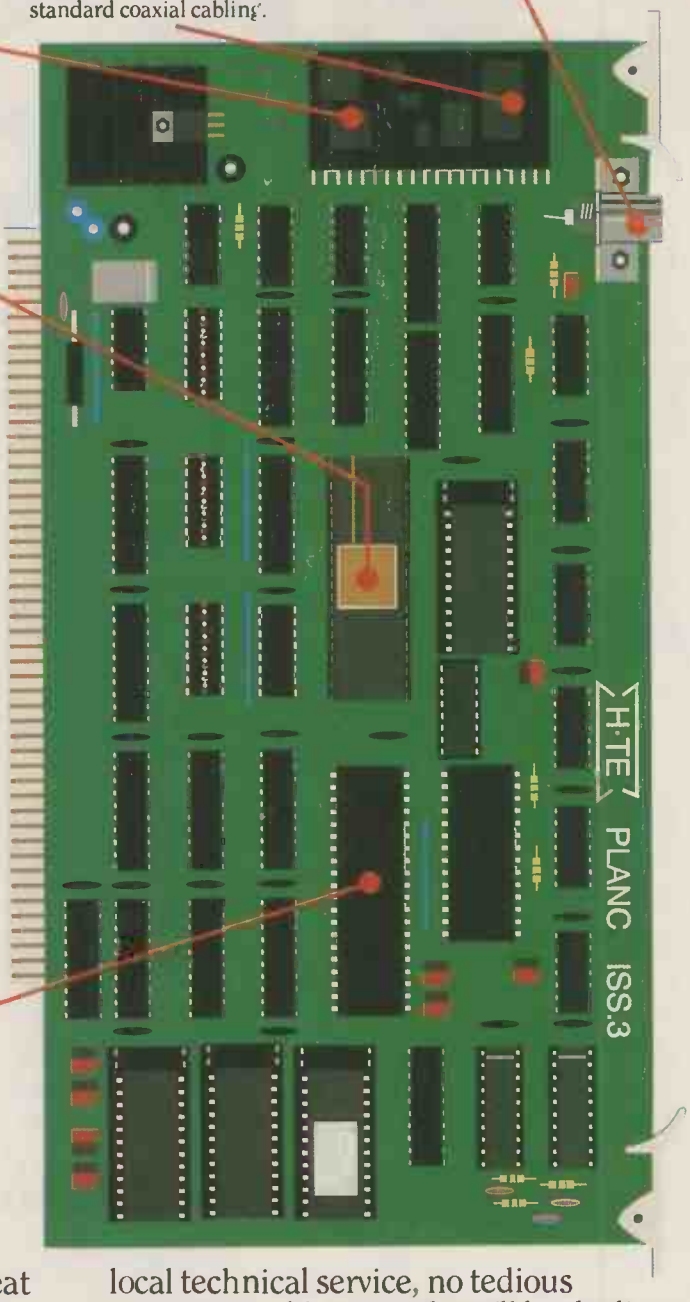

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Users can be added to or removed from an active network at will. The network self-reconfigures without loss of data.

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We don't need to nail home the great value of our S100 Programable Local Area Networking Card. It's evident. It supports a VLS1 Arcnet controller, network cable interface, and local 8085 processor for message formatting and network support and it's only £695 retail.

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S100 PROGRAMABLE LOCAL AREA NETWORKING CARD AT ONLY £695

by Mike Lewis

Binary trees

If a shortage of storage space is not one of your problems, this method of structuring may be well worth considering.

ONE OF THE MOST useful devices in the programmer's toolkit is the set of data structures known as trees. Like their common or garden namesakes, trees come in many shapes, sizes and varieties. Programmers talk about top-down, multi-way, 2-3-4, AVL, and even red-black trees.

The binary tree is the simplest of these structures. As well as being a useful introduction to the subject, the binary tree is a handy tool in its own right, which lets you look up values in a table. In this respect it is similar to three other data structures already investigated in previous months' Software Workshops: the unordered list, the sorted list and the hash table.

Each data structure has its pros and cons. The unordered list is very easy to build: you just add new values to the end. Retrieving a value is easy but slow, involving an examination of each entry in turn until you find the one you want. Printing the list in sequence is impossible except by sorting it first. Once the list is sorted, insertion is slow but retrieval and printing in sequence are both fast.

As for hash tables, insertion and retrieval are very fast, but printing in sequence is slow because this again involves sorting. You also have the disadvantage of the not knowing in advance how many entries you can store in a table of a given size.

With binary trees, insertion, retrieval and printing in sequence are all reasonably fast. The main disadvantage of trees is that they need considerably more storage space than straightforward lists.

Figure 1 shows the general shape of a binary tree. The values are stored in nodes, shown in the diagram as circles. The lines joining the nodes are called links. Nodes can be linked upwards to parent nodes or predecessors, and downwards to child nodes or successors. Continuing the family metaphor, two children of the same parent are called siblings. The highest-level node — that is, the one without a parent — is called the root.

The same terminology applies to all types of tree structure. What distinguishes binary trees is the rule that each node can have at most two successors. The left successor, usually abbreviated to LSUC, always contains a value lower than its predecessor or PRED. The right successor, RSUC, has a value higher than its PRED.

By translating this structure to a two-dimensional array it becomes possible to write programs to operate on binary trees. The array has one row per node and four columns. The first column holds the value stored in the node; the remaining three hold links, or pointers, to its LSUC, RSUC and PRED respectively. The pointers are represented as subscripts to other nodes within the array.

Figure 2 shows the same sample tree in this two-dimensional representation. Links to null nodes are shown as dashes in the table; in your program you can represent null links by any value that cannot be confused with an actual pointer. Zero is as good a value as any.

Searching for a specified value is simply a matter of starting at the root and comparing the value stored there with the one you are looking for. If the value is less than the search argument move along the link to the RSUC; if it is greater go to the LSUC. Continue in this way until you reach the searched-for value. If you come to a node whose LSUC or RSUC is null you know that the search is unsuccessful.

Inserting a new value into the tree is also a simple process. First place the value in the next free node at the end of the table. Then carry out a search for the new value,

(continued on next page)

```
5000    '       TREE-HANDLING ROUTINES
5010    ' The tree is held in the array TREE(MAX,4). This contains one "row"
          per node. Its four columns contain the value, LSUC, RSUC and PRED.
          The root node is at entry number one.
5020    ' Other variables used in the program are:
              MAX       max. no. of nodes       NXT     points to next free node
              CURRENT   current node            FLAG    general-purpose flag
5030    '     TRUE      constant of -1          PRED    constant of 4
              FALSE     constant of 0           LSUC    constant of 2
              CONTENTS  constant of 1           RSUC    constant of 3
5040    ' Note that all variables are defined as integers
5050    '
7500    ' Routine to search for a value (in TARGET) and to insert it in the
          tree if not already there. Exit with CURRRENT pointing to the node
          containing the existing or new value.
7510    ' Note that for this routine to work properly, the tree must already
          contain at least one entry.
7520    GOSUB 8000                                      'Try to find the entry
7530    IF FLAG=TRUE THEN
              RETURN                                    'Found ok. Exit
7540    TREE(NXT,CONTENTS)=TARGET                       'Otherwise, place new value in
                                                         next free node
7550    IF TARGET<TREE(CURRENT,CONTENTS) THEN
              TREE(CURRENT,LSUC)=NXT
        ELSE
              TREE(CURRENT,RSUC)=NXT
7560    TREE(NXT,PRED)=CURRENT: CURRENT=NXT             'Adjust pointers
7570    NXT =NXT +1
7590    RETURN
8000    ' Routine to search for a value (in TARGET). If found, CURRENT points
          to the node containing the value and FLAG is set true. Otherwise,
          CURRENT points to the last node examined and FLAG is set false.
8020    CURRENT=1: FLAG=FALSE                           'Make root the current node
8030    WHILE TARGET<>TREE(CURRENT,CONTENTS)
8040            IF TARGET<TREE(CURRENT,CONTENTS) THEN
                        IF TREE(CURRENT,LSUC)=0 THEN
                                RETURN
                        ELSE
                                CURRENT=TREE(CURRENT,LSUC)
                ELSE
                        IF TREE(CURRENT,RSUC)=0 THEN
                                RETURN
                        ELSE
                                CURRENT=TREE(CURRENT,RSUC)
8050                                                    'Exit if LSUC or RSUC (as
                                                         applicable) is emtpy; otherwise
                                                         make it the current node
8060    WEND                                            'and repeat the process
8080    FLAG=TRUE                                       'Target value has now been found
8090    RETURN
```

Listing 1. Tree search and insertion operations coded in Microsoft Basic.

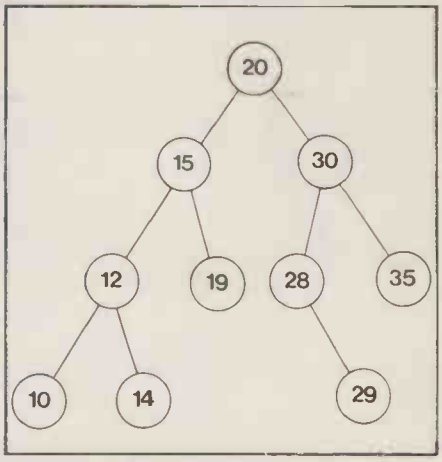

Figure 1. A diagrammatic representation of a binary tree. The integers in the circles at each node are the actual values to be stored in the tree; the tree is equally suitable for storing real numbers, character strings or any other type of data.

(continued from previous page)

ending, as already described, at a node with a null successor. Finally adjust the links so that the new value is a child of the one that terminated the search.

Listing 1 shows the searching and insertion operations coded in Microsoft Basic. Listing 2 shows an implementation of some slightly more complicated procedures: finding the first node in the tree, the one containing the lowest value; finding the next node at any point; and printing the tree in sequence.

To find the first node, you start at the root and follow the chain of LSUCs until you come to a null pointer. The last node examined is the one you are looking for.

To understand the procedure for finding the next node in sequence it helps to bear in mind the recursive nature of the tree. Every node can be thought of as the root of up to two sub-trees, one each at left and right. The node next in sequence to the current node is the first node of the current node's right sub-tree.

If there is no sub-tree, apply the following rule. If the current node is the LSUC of its PRED, then the PRED is the next node in sequence. Otherwise, make the PRED the current node and repeat the operation. If there is no PRED — that is, if you are at the root — then there is no next node.

These two procedures can be tied together to produce a routine for outputting the table in sequence. This is

Position	Value	LSUC	RSUC	PRED
1	22	2	3	–
2	15	5	6	1
3	30	7	4	1
4	35	–	–	3
5	12	8	9	2
6	19	–	–	2
7	28	–	10	3
8	10	–	–	5
9	14	–	–	5
10	29	–	–	7

Figure 2.

simply a matter of finding the first node, then finding the next node, and so on until the tree is fully printed. Of course, these operations are entirely symmetrical. By switching all references to LSUCs and RSUCs you can find the last and previous nodes, and output the tree in reverse sequence.

My reference to recursion might lead you to realise that standard Basic is not the ideal language for dealing with tree structures. If you read last month's Software Workshop, you will appreciate that languages that support recursion, such as Pascal and C, are much better suited for the job.

The routine for printing the tree in sequence provides a particularly elegant illustration of recursion. Consider a procedure called Treeprint, whose single argument is a pointer to the current node. To print the tree, the main program calls Treeprint for the root.

Treeprint itself consists of just four statements. First it performs a recursive call to Treeprint to print the current node's left sub-tree. Next it prints the current node. Then it calls Treeprint again to print the right sub-tree. Finally there is a test for completion. Thus, four lines of coding replace the entire routine shown in listing 2.

But even using recursion, binary trees suffer from one major defect: they are highly susceptible to the worst-case syndrome. If the values to be inserted into the tree happened to arrive in ascending or descending sequence, the tree would be completely unbalanced, consisting of one long chain of RSUCs or LSUCs. Its performance would be somewhat worse than that of a straightforward list, with the added overhead of handling all those pointers.

Several variations of binary trees have been designed, all aimed at overcoming this problem. The commonest is the height-balance or multi-way tree, which forms the basis of IBM's VSAM system and of Digital Research's Access Manager package. Here, each node may have several successors. The links are followed not by a simple greater-than or less-than test but by checking the target value against a range of values stored in the node. The structure is designed in such a way that the tree is more or less permanently balanced, thus ensuring the minimum number of accesses.

```
8500    ' Routine to print the tree in sequence
8520    CURRENT=1
8530    GOSUB 9500                                  'Get first node
8550    PRINT TREE(CURRENT,CONTENTS)                'Print it
8560    FLAG=TRUE
8570    WHILE FLAG=TRUE:
                GOSUB 9000:
                IF FLAG=TRUE THEN
                        PRINT TREE(CURRENT,CONTENTS)
8580    WEND                                        'Get next node; print it and
                                                     repeat
8590    RETURN
9000    ' Routine to find the next entry in sequence. On exit, required node
         is CURRRENT. If no next node, FLAG is set false.
9010    FLAG=TRUE
9020    IF TREE(CURRENT,RSUC)<>0 THEN
                CURRENT=TREE(CURRENT,RSUC): GOSUB 9500: RETURN
9030                                                'If current has a RSUC, use this
                                                     as the root of a sub-tree. Find
                                                     first node of this sub-tree
                                                     and exit.
9040    WHILE TREE(CURRENT,PRED)<>0
9050            IF CURRENT=TREE(TREE(CURRENT,PRED),LSUC) THEN
                        CURRENT=TREE(CURRENT,PRED): RETURN
9060                                                'If currrent is the LSUC of its
                                                     PRED, then PRED is the
                                                     required node
9070            CURRENT=TREE(CURRENT,PRED)          'Otherwise, make the PRED
                                                     the current
9080    WEND                                        'and repeat until we are back
                                                     at the root
9090    FLAG=FALSE: RETURN                          'at which point, exit with no
                                                     next node found
9500    ' Routine to find the first entry of a (sub-)tree. On entry, the
          CURRENT is the root of the sub-tree. On exit, it is the required node.
9520    WHILE TRUE
9530            IF TREE(CURRENT,LSUC)=0 THEN
                        RETURN
                ELSE
                        CURRENT=TREE(CURRENT,LSUC)
9540                                                'If current's LSUC is null, this
                                                     is the required node; otherwise
                                                     make it the CURRENT
9550    WEND                                        'and repeat indefinately
9590    RETURN
```

Listing 2. Routine to order nodes and print tree in sequence.

WARNING

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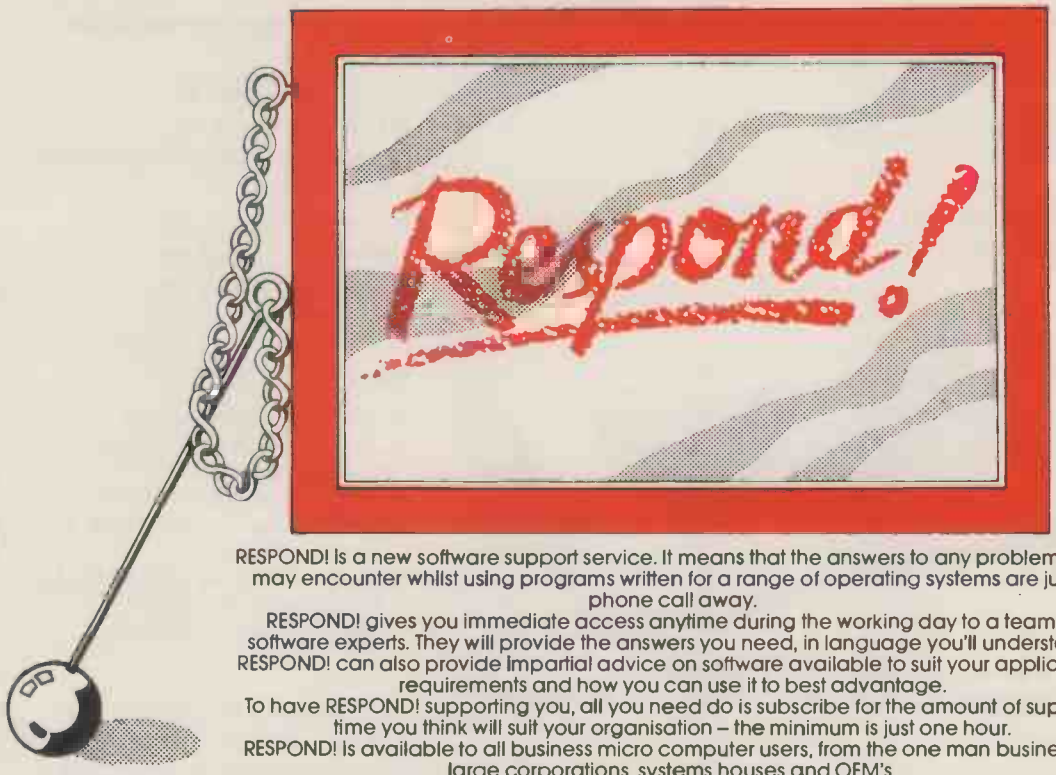

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by Ben Knox

Get on Board

Enthusiasts can get together on one of the growing number of systems linking micro to micro via the telephone network.

IF YOU have ever used a commercial network or information system and thought that, given the facilities, you might be able do better, perhaps you should consider starting a Bulletin Board System, or BBS.

BBSs started in the U.S. where there are now about 7,000 of them in operation. They are free messaging systems run by enthusiasts for enthusiasts — a forum where people can discuss different aspects of both computer and non-computer related subjects. In the U.K. the idea has only taken off in the last two years and the number of up-and-running systems stands at approximately 30, with this number increasing by about one every two to three weeks.

The operator of a BBS is usually called the Sysop, which stands for System Operator, and is the person to whom you should address messages if you encounter any difficulties.

Using BBSs you will hopefully make friends with many people from all over the country, but starting to use BBSs not only means increasing your circle of acquaintances, but also increasing your phone bill.

The table lists some of the most popular BBSs. All of them work at 300 baud and use word formats of seven bits, one stop bit and even parity, or eight bits, one stop bit and no parity.

When using BBSs it is worth following these guidelines:

- Do not use false names.
- Always go through the logging off procedure when you want to leave a BBS, do not just hang up.
- Check on operation times of a BBS before calling.
- If a voice answers, do not hang up. The BBS may be off-line for some reason, or you may have the wrong number.

If you have any information on new BBSs or anything else which would interest other readers, drop me a line, either on paper at *Practical Computing*, or electronically on Telecom Gold ID:84:TCC051, Prestel Mailbox: 919993567 or on TBBS London.

Literature

A new book on computer communication, *Talking To the World* has been published by Century Communications, price £5.95. Written by John Newgas, the Sysop of TBBS London, it covers most of the details you will need to know on how to start.

British Bulletin Boards

Name	Number	Times	Notes
BABBS	(0742) 667983	24hr.	British Apple System User Group
CABB	01-631 3076	24hr.	*Computer Answers* magazine, 300 baud and 1,200/75 baud
CBBS London	01-399 2136	Sun. 17.00-22.00	
CBBS Surrey	(04862) 25174	24hr.	
CBBS SW	(0626) 890014	24hr.	
City BBS	01-606 4194	24hr.	1,200/75 baud Weds.
Distel	01-679 1888	24hr.	Commercial free BBS run by Display Electronics
Estelle	(0279) 443511	Office hours	STC customer BBS
Forum-80 Hull	(0482) 859169	Mon.-Fri. 17.00-23.30; weekends 12.00-23.30	
Forum-80 London	01-902 2546	weekdays 19.00-22.00; weekends 12.00-22.00	
Hamnet	(0482) 497150	18.00-08.00	Radio Ham BBS
Liverpool Mailbox	051-428 8924	24hr.	
Mailbox-80 W Midlands	(0384) 635336	18.00-08.00	Ring Back*
Manchester BBS	061-427 3711	Sun.-Thu. 22.30-00.00; Fri. 23.30-02.00; Sat. 22.30-02.00.	
Maptel	(0702) 552941	24hr.	Maplin BBS; tele-ordering and stock levels
Micro Live	01-579 2288	24hr.	BBC *Micro Live*
Microweb	061-456 4157	24hr.	*Micro User* magazine
NBBBS	(0827) 288810	24hr.	Ring Back*
Southern BBS	(0243) 511077	20.00-02.00	Ring Back*
Stoke Itec	(0782) 265078	24hr.	Remote CP/M
TBBS Blanford	(0258) 54494	24hr.	
TBBS London	01-348 9400	24hr.	
TBBS Nottingham	(0602) 289783	24hr.	Multi-speed: 300/300 baud, 1,200/75 baud
TBBS Southampton	(0703) 437200	24hr.	

*On Ring Back Bulletin Boards use the following procedure: call the number and allow to ring twice, hang up, and call again. On the second call, the phone should be answered with a computer tone. Switch on your modem.

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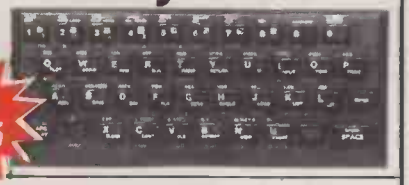

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Datafax Disk Interface

For ZX Spectrum
ZX Spectrum Plus

Disk Interface allows you to run 3"/3½" or 5¼" Disk Drives with your ZX Spectrum or ZX Spectrum Plus. Ask to see it at your local Spectrum Dealer NOW.

£99.95

Sinclair Expansion Pack

Increase the power of your Sinclair 16K Spectrum dramatically—with this neat expansion pack. Boosts the RAM capacity to a powerful 48K to run the top games software.

The very latest

ZX Spectrum+

Here's the brand new Spectrum micro. The 'Plus' boasts a new, professional typewriter-action keyboard, plus all the Spectrum's top selling features like powerful 48K RAM, 8 colours, 10-octave sound and full compatibility. AND you get a super 80-page User Guide PLUS SIX FREE SOFTWARE PACKAGES - unbeatable value-for-money!

SPECTRUM PRICE

£179.95

Rotronics Wafadrive

At last a versatile, flexible twin data drive for the ZX Spectrum! The Wafadarive features twin 128K drives that take the compact wafers (choose from 16K, 64 K or 128K sizes) - The dual drive means professional-style ease of use, with easy copying of files or whole wafers. There are no cables to connect - and there's RS232 PLUS Centronics ports to take a host of extra peripherals. For super reliability, the tape has been designed for extra long life and a top data intergrity. And it's incredible value-for-money!

Plus FREE Softeks Special Writer an excellent word processor program

SPECTRUM PRICE

£129.95

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

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Up to £1000 Instant Credit

- There's up to £1,000 worth of Instant Credit available on a Spectrum Chargecard. See your local SPECTRUM dealer for written details (UK mainland only) Typical APR -29.8%

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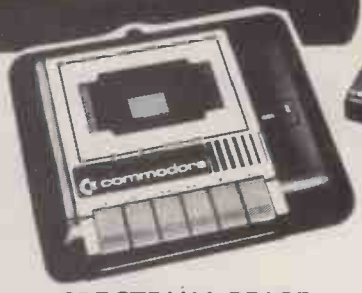
Commodore 16
Package offer

Including
Commodore 1531 Cassette Recorder



Introducing the new Commodore 16 - the advanced micro that's designed with the beginner in mind. This brand new micro features a powerful 16K RAM, a full professional keyboard, superb graphics with 121 colours, plus terrific built-in sounds. In its 32K ROM is a new BASIC 3.5 with over 75 commands including graphics plotting and editing. There's a unique HELP key that highlights errors when you're learning to program. It's a tremendous new micro and the Spectrum package includes a Commodore Model 1531 Cassette Data Recorder too. See it at your local Spectrum dealer now!

SPECTRUM PRICE

£139.99

Commodore Plus/4

Commodore's new, advanced Plus 4 bridges the gap between home and business micros in a way that's unique - and at a price that's unbelievable!

The Plus/4 features, beside its powerful 64K of RAM memory, has a host of features to make computing easier.

For starters there are four popular software packages built-in Word Processing, Spreadsheet, Database and a Business Graphics program. That's all small businesses needs - in a budget-priced micro!

Besides that, there's a HELP key that highlights errors in program lines, plus built-in graphics, advanced BASIC 3.5 with over 75 commands, separate cursor controls, a full 32K ROM and 4 programmable function keys.

SPECTRUM PRICE

£299.99

Commodore MPS801 Printer
Plus FREE!
Easy Script and Future Finance

SPECTRUM PRICE **£230**

Commodore 16/Plus 4 Joystick Converter

NOW you can use Britain's best-selling QUICKSHOT II JOYSTICK with your Commodore 16 or Plus 4!

SPECTRUM PRICE **£3.75**

Koala Touch Pad for CBM64

Lets you control your computer without using keyboard commands, by simply moving your finger across the touch-sensitive surface.

SPECTRUM PRICE **£79.95**

Commodore 64
Package offer

Including:
- Commodore 64
- A Joystick
- C2N Cassette Recorder
- 4 Cassette Games

SPECTRUM PRICE **£249.95**

£4.95

Plus 4 Data Recorder Adapter

Allows you to use the Shado Commodore compatible recorder with the plus 4

Computer Dealers

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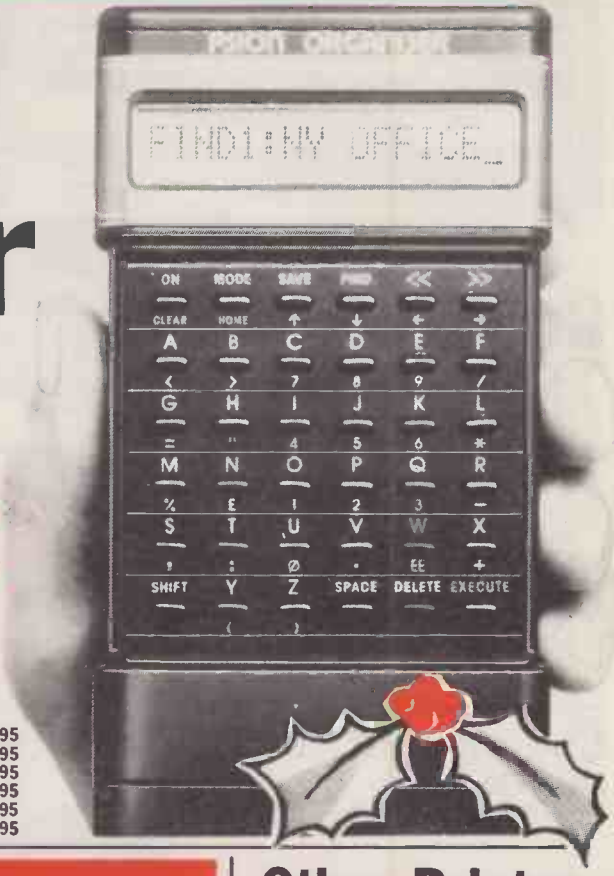
PSION Organiser

An easy to use personal computer that fits in the palm of you hand and slips in your pocket

Includes FREE 8K Datapak - Utility pack ● Built-in database stores information such as names & addresses, diary appointments, price lists and timetables ● Automatic cross referencing of records when using the 'Find' command ● Permanent slide storage of information in thumb sized datapaks which slot discreetly into unique 'Solid state drives' ● Range of comprehensive software packs solve finance, maths & science problems ● Create your own programs using P.O.P.L. -The easy to learn 'Psion Organiser programming language' ● Communication pack links the Psion Organiser to a wide range of printers and other computers.

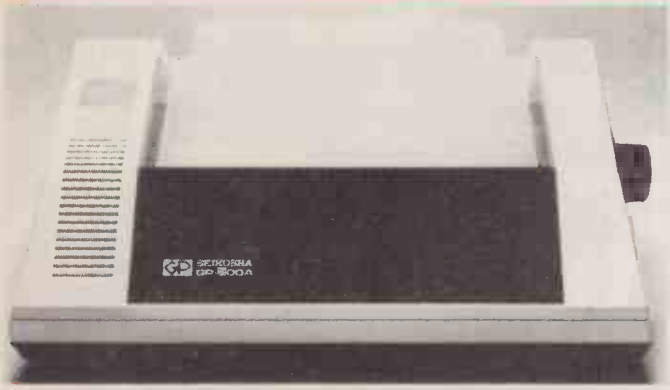
£99.95



PSION ACCESSORIES

16K Data Pack	£19.95
8K Data pack	£12.95
Finance Program	£29.95
Maths Program	£29.95
Science Program	£29.95
Formatter	£44.95

Spectrum Scoop Purchase



Seikosha GP500A Dot Matrix Printer INCLUDING FREE!

2000 sheets of Tractor Feed Paper

- Printing speed 20cps
- Full Graphics capability
- In the graphic mode, a column of graphic data can be repeated as many times as you want with a single command.
- Double width character output under software control.
- Print position addressable by character or dot. (positioning control).
- 8 European country character sets.
- Graphic, character, and double width character modes can be intermixed on a single line.
- Automatic Printing. When the text exceeds the maximum line length no data is lost due to overflow.
- Self-test printing is available.
- Centronics parallel interface.
- Paper width is adjustable up to 10 inches.

£159.95

Other Printer Bargains

Timex 2040	£77.50
Quendata	£289.95
Juki 6100	£399.00
SEIKOSHA	
Friction Feed GP100/250X	£28.75
GP50A	£99.95
GP50S Spectrum	£99.95
GP500A	£159.95
GP100A MkII	£199.95
GP100VC VIC 20/64	£199.95
GP550A	£299.00
EPSON	
RX80T	£286.35
RX80FT	£327.75
FX80	£503.70
BROTHER	
HR-5	£159.95
EP-44	£249.95
HR-15	£458.85
SMITH CORONA	
D100	£286.35

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Superb value and Service in Personal Computers from selected Spectrum Stores Nationwide

Apricot F1E/F1 System

These stylish new personal computers are among the best of the new generation of business micros. Powerful and versatile, the F-1 features a standard 256K OF RAM (expandable to 768K), with a 16-bit 8086 CPU running MS-DOS and Concurrent CP/M. That's backed up by a built-in 3½" floppy disk drive providing 720K on double-sided disks (you can add another floppy or Winchester drive later). The economical F1E has a 128K RAM and a single-sided 360K disk drive - with the same 92-key professional infra-red keyboard on the F1. And don't forget - when you buy from Spectrum you get the assurance of our trained, expert staff to help and advise you!

F1E SPECTRUM PRICE £955

F1 SPECTRUM PRICE £1095

Excluding VAT. Monitor extra.

Plus Free!

On-site service contract worth £175

Spectrum give you peace of mind with your new computer! There's a twelve month on-site service contract, worth £175, ABSOLUTELY FREE when you buy either a Sanyo 550/555 computer or an Apricot F1E/F1.

Plus Free Business Software.

Both the Sanyo and Apricot computers come complete with a superb pack of comprehensive business software worth hundreds of pounds. The packs contain virtually everything you're likely to need to get the very best from your computer -from Day one!

SEE YOUR NEAREST SPECTRUM PERSONAL COMPUTER STOCKIST FOR DETAILS OF BOTH OFFERS

Sanyo 550/555

Among the very best value in personal computers is the excellent Sanyo 550/555 Series. They feature high performance, 16-bit CPU that runs on MS/DOS, with a RAM that's expandable up to 256K bytes. The 550 has one 160K byte 5¼" floppy disk drive while the 555 has dual drives for professional flexibility. There's a choice of superb hi-resolution Colour or B&W Monitors too (not included). Both come with a comprehensive package of business software, and a very special free maintenance offer. - Take a look at these superb micros at Spectrum NOW!

Sanyo 550 Monitor extra SPECTRUM PRICE £749 Excluding VAT.

Sanyo 555 Monitor extra SPECTRUM PRICE £999 Excluding VAT.

Your local Spectrum Personal Computer Stockist

Aberystwyth **Aberdata Ltd**
Accrington **P.V.Tubes**
Alfreton **Gordon Harwood**
Bexhill-On Sea **Computerware**
Bognor Regis **Bits & Bytes**
Bolton **Wildings**
Bromley **Computers Today**
Canterbury **Jones Computers Ltd**
Chelmsford **Maxton Hayman**
Chesterfield **Computer Centre**
Chorley **Wildings**
Crawley **Gatwick Computer Services**
Darlington **McKenna & Brown**
Epsom **The Micro Workshop**
Exmouth **Open Channel**
Fakenham **Fastview**
Guernsey **Gruts**
Hull **Computer Centre**
Ipswich **Brainwave Micros Ltd**
Kidderminster & Dudley **Central Computers**
London NW11 **Computers Inc.**
London EC2 **Devron**
London SE1 **Vic Odden**
London SE9 **Square Deal**
London N14 **Logic Sales**
London W1 **Computers of Wigmore Street**
Lowestoft **John Wells Limited**
Liverpool **Hargreaves**
Luton **Terry-More Photo**
Morpeth **Telerents (Northern)**
Norwich **Norwich Camera Centre**
Norwich **Brainwave Micros Ltd**
Nuneaton **Micro City**
Peterborough **Logic Sales**
Plymouth **Syntax**
Potters Bar **Software Agents Ltd**
Preston **Wildings**
Rainham **Microway Computer**
Romford **Brainwave Micros Ltd**
Shrewsbury **Computerama**
Sittingbourne **Computers Plus**
Southampton **LT.C. Ltd**
Stafford **Computerama**
St Austell **A B & C Computers**
Stevenage **D.J Computers**
Seven Oaks **Ernest Fielder**
Thetford **Thetford C.B & Micro**
Warrington **Wildings**
Walsall **New Horizon Computer**
Waterlooville **GB Microland**
Watford **SRS Microsystems Ltd**
West Bromwich **Bell & Jones**
Whitehaven **P.D.Hendren**
Wigan **Wildings**
Woking **Harpers Computers**
York **York Computer Centre**

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Incredible value for money

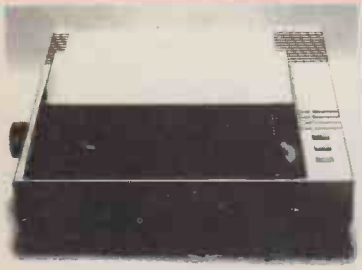
AVT Monitors

DM-216G or DM-216/0

- Available in Green or Orange
- Glare or Non-Glare screens
- For office micros, or Personal Computers

SPECTRUM PRICE £99.95

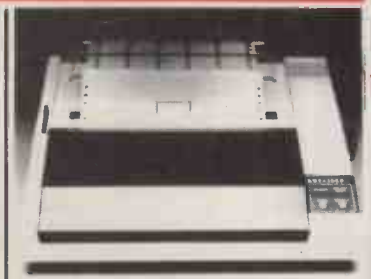
AVT Printer Bargains



80cps Printer

• 228 ASCII characters • 640 dots/line p/sec • Centronics Parallel • Opt. RS232C Serial • Sprocket & Friction feed • Semi-graphics • Normal & italic fonts

SPECTRUM PRICE £199.95



100cps Printer

• Letter Quality dot matrix • 80/132 cols • Serial & Parallel • Tractor & Friction feed • Graphics

SPECTRUM PRICE £249.95

Brother HR-5 Printer

A great printer at a top-value price from Spectrum. Here's what you get:

- Letter-quality daisy-wheel printing
- Between 13 and 18cps
- Bi-directional printing
- Tractor-fed paper or single sheets
- Super low price!

SPECTRUM PRICE £159.95

Brother EP-44

'Transforming Office Machines', runs Brother's slogan – with these super-compact battery powered typewriters, it's easy to see why!

- Top quality thermal head
- 4K of text memorise (3 A4 pages)
- Centering if required
- 15-digit LCD display for pre print corrections
- Line-by-line edit facility

SPECTRUM PRICE £249.95

NEW!

Music Maker

For Commodore 64

A superb new music system for the Commodore 64 micro, with everything that's needed for high qualiy music making. The package price includes Software (on either Disk or Cassette), a 24-key piano-style keyboard which fits over the computer keyboard, and a songbook containing 28 popular songs. Music Maker is versatile, but simple to use it suits both beginners and experienced musicians. There are 8 voices to simulate instruments (including piano, guitar and synthesiser); all the sound parameters can be varied, to create any sound within the 64's capabilities. Different menu-selected modes include one which creates rhythms, from waltzes to disco, and pre-programmed bass patterns that you can create around the tune. The Music Maker is an incredible addition to the Commodore 64 superb music for everyone!

£29.95

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MASSIVE SAVINGS
ON THESE TOP SELLING MICROS

BBC Model B
With Speech Synthesiser fitted

The BBC MODEL B probably the most flexible personal microcomputer available today. Using powerful BBC BASIC, the BBC B is widely accepted as providing the educational standard for computer learning.

The Model B features a variety interface ports allowing easy connection of both standard peripherals (like disk drives and printers) and second processors or other devices to give you access to Teletext or Prestel services.

SAVE £55

Total Normal Price £454

SENSATIONAL PRICE

£399

Atari 800XL

Plus!
Atari 1010
Data Recorder
Plus!
Basic Tutor

SAVE £50

This powerful and versatile home computer packs the punch of a full 64K of user RAM memory, to make the most of exciting games and educational software. Among its up-to-date features are a high quality full-stroke keyboard, three-and-a-half octaves of sound synthesis and a superb dscreen display capability that includes 11 Graphic Display modes and a palette of 256 colours—128 of which can be displayed together at any one time. Ask your local Spectrum dealer to show you the amazing Atari today!

Normally £249.99

SENSATIONAL PRICE

£199.95

Acorn Electron
Plus 5 Software Cassettes

The Electron gives high quality graphics output to either colour TV or monitor. Sound can be generated through the internal loudspeaker. The Electron comes complete with a free introductory cassette, containing 19 free programmes & two manuals—the User Guide and 'Start Programming With The Electron'.

£199

Computer Dealers

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Micro Dealers UK's Top 50
Britain's No.1 Software Chart

Program	Supplier	Machine	Price
Underwurlde	Ultimate	Spectrum	£9.95
Tir Na No	Gargoyle Games	Spectrum	£9.99
Eureka	Domark	CBM 64	£14.95
Eureka	Domark	Spectrum	£14.95
Fort Apocalypse	Synsoft/US Gold	CBM 64	£9.95
Daley Thompson's Decathlon	Ocean	Spectrum	£6.90
Raid Over Moscow	Access/US Gold	CBM 64	£9.99
Knight Lore	Ultimate	Spectrum	£9.95
Psi-Warrior	Beyond	CBM 64	£9.95
Backpackers Guide	Fantasy	Spectrum	£7.50
Travels with Trashman	New Generation	Spectrum	£9.95
Bruce Lee	Datasoft/US Gold	CBM 64	£9.95
Jasper	Micromega	Spectrum	£8.95
Eddie Kid Jump Challenge	Martech	Spectrum	£6.95
Combat Lynx	Durell	Spectrum	£8.95
Cyclone	Vortex	Spectrum	£6.95
Jinn Genie	Micromega	CBM 64	£8.95
Pyjamarama	Micro Gen	Spectrum	£6.95
Suicide Express	Gremlin	CBM 64	£7.95
Elite	Acornsoft	BBC	£14.95
Select 1	Computer Records	Spectrum	£12.49
Fighter Pilot	Digital	CBM 64	£9.95
Select 1	Computer Records	CBM 64	£12.49
Steve Davis Snooker	CDS	Spectrum	£6.95
Cliffhanger	New Generation	CBM 64	£7.95
Havoc	Dynavision	Spectrum	£7.95
Jet Set Willy	Software Projects	CBM 64	£7.95
Aztec (Hunt for the Sun God)	Hill MacGibbon	Spectrum	£7.95
King Arthur's Quest	Hill MacGibbon	Spectrum	£7.95
Skool Daze	Microsphere	Spectrum	£6.95
Sherlock	Melbourne House	CBM 64	£14.95
Valkyrie 17	Ram Jam	Spectrum	£9.95
Braxx Bluff	Micromega	Spectrum	£6.95
Zaxxon	Synsoft/US Gold	CBM 64	£9.95
Boulder Dash	State Soft	CBM 64	£8.95
D-Day	Games Workshop	Spectrum	£7.95
Avalon	Hewson	Spectrum	£7.95
Tower of Despair	Games Workshop	Spectrum	£7.95
Battlecars	Games Workshop	Spectrum	£7.95
Kosmic Kanga	Micromania	CBM 64	£6.95
Manic Miner	Software Projects	Amstrad	£8.95
Xavior	PSS	Spectrum	£7.95
Beachead	Access/US Gold	Spectrum	£7.95
Beam Rider	Activision	Spectrum	£7.99
Dues ex Machina	Automata	Spectrum	£15.00
Manic Miner	Software Projects	BBC	£7.95
3D Grand Prix	Software Invasion	BBC	£9.95
Kentilla	Micromega	Spectrum	£6.95
Dark Star	Design Design	Spectrum	£7.50
Summer Games	Quicksilva	CBM 64	£14.95

Omega Compucorder

- Battery/Mains Operation
- Built-in condensor microphone
- Automatic level control
- 3-digit Tape Counter
- DIN Socket

GREAT VALUE AT ONLY **£24.95**

BBC Emulator

NEW

This superb unit enables you to process your BBC projects on your Commodore 64 at home. All you do is type programs in BBC BASIC and the Emulator allows your Commodore 64 to 'imitate' the BBC.

Spectrum Price **£13.95**

Quickshot II Joystick

Helicopter-style grip with the Fire button on top. Features suction feet for stability and Auto Fire mode. Compatible with most micros.

£11.95

Super Value Shado Add-Ons

Shado BBC Compatible Data Recorder

Also suitable for other micros

This neat, stylish data cassette recorder is a terrific value-for-money way to save your program and data from your BBC Acorn or Electron micro. The Shado connects easily, offers reliable and consistent performance and features a Tape Position indicator for easier data access.

Spectrum Price **£32.50**

Commodore 64 Compatable Data Recorder

Directly compatible with the Commodore 64 and VIC-20 micros, this excellent data recorder eliminates the problems of using ordinary cassette recorders - at a top value price too!

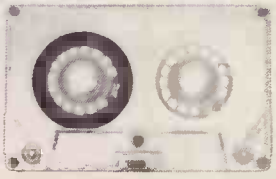
Spectrum Price **£34.97**

Shado Joysticks for the BBC

Designed as direct replacements for the Acorn originals, these superfast joysticks (connected to the Analogue port) feature much improved hand action with sprung response. left & right are identified by the colour of the fire buttons.

Spectrum Price Per Pair **£16.95** per pair

Blank Data Cassettes



C12 Standard Data Cassette..... 50p
C15 Standard Data Cassette..... 58p
C12 Reel to Reel.... 75p

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There's a Spectrum near you...

AVON

BATH Software Plus, 12 York St Tel: (0225) 61676
WESTON-S-MARE K & K Computers, 32 Alfred St Tel: (0934)419324

BEDFORDSHIRE

DUNSTABLE Dormans 7-11 Broad Walk Tel: (0582) 65515
LEIGHTON BUZZARD The Computer Ctr at Milton Keynes Music, 17 Bridge St. Tel: (0525)376622
LUTON Terry-More, 49 George St. Tel: (0582) 23391/2

BERKSHIRE

BRACKNELL Computer Centre, 44 The Broadway. Tel: (0344) 427317
NEW! WINDSOR Gadgets 30 Peascod Str., Tel: (07535) 67211
SLOUGH MU Games and Computers 245 High St. Tel: (0753) 21594

BUCKINGHAMSHIRE

BLETCHLEY Rams Computer Centre, 117 Queensway. Tel: (0908) 647744
CHESHAM Reed Photography & Computers, 113 High St. Tel: (0494) 783373

CAMBRIDGESHIRE

CAMBRIDGE K P Computers Ltd. 19/20 Market St. Tel: (0223) 312240 (Open 6 Days)
HUNTINGDON T.S.C. Electronics, 3 All Saints Passage, High St. Tel: (0480) 411579
PETERBOROUGH Logic Sales, 6 Midgate Tel: (0733) 49696
PETERBOROUGH Ptrbrgh Communications, 91 Midland Rd. Tel: (0733) 41007

CHANNEL ISLANDS

GUERNSEY Gruls, 3-5 The Pollett, St Peter Port. Tel: (0481) 24682
JERSEY Audio & Computer Centre, 7 Peter St, St Helier. Tel: (0534) 74000

CHESHIRE

ALTRINCHAM Mr Micro 28 High St. Tel: (061) 941 6213
NEW! CHESTER Computer Link 21 St Werburgh St Tel: (0244) 316516
CREWE Microman Unit 2, 128 Nantwich Rd. Tel: (0270) 216014
ELLESMERE PORT RFR Computers, 1 Pooltown Rd. Whitby. Tel: 051 356 4150
STOCKPORT Wilding Ltd. 1 Little Underbank Tel: (061) 480 3435
WARRINGTON Wildings, 111 Bridge St Tel: (0925) 38290
WIDNES Computer City, 78 Victoria Road. Tel: (051) 420 3333
WILMSLOW Swift of Wilmslow, 4-6 St. Annes Parade. Tel: (0625) 526213

CLEVELAND

MIDDLESBOROUGH McKenna & Brown, 206 Linthorpe Rd. Tel: (0642) 222368

CORNWALL

ST AUSTELL A B & C Computers, Duchy House, 6 Lower Aylmer Sq. Tel: (0726) 67337
TRURO Truro Micro Ltd, Unit 1, Bridge Ho., New Bridge St. Tel: (0872) 40043

CUMBRIA

BARROW-IN-FURNESS Barrow Computer Centre. 2/4 The Mall. Tel: (0229) 38353
CARLISLE The Computer Shop, 56-58 Lowther St. Tel: (0228) 27710
PENRITH Penrith Communications, 14 Castlegate. Tel: (0768) 67146 Open Mon-Fri till 8pm
WHITEHAVEN P D Hendren 15 King St Tel: (0946) 2063

DERBYSHIRE

ALFRETON Gordon Harwood 69-71 High St. Tel: (0773) 832078
CHESTERFIELD The Computer Centre, 14 Stephenson Place Tel: (0246) 208802
NEW! NEW MILLS New Mills Micro Centre 38B Market Street, Tel: (0663) 47332

DEVON

EXETER Seven Counties (Computers) Ltd., 7 Paris Street. Tel: (0392) 211211
EXMOUTH Open Channel, 30 The Strand. Tel: (0395) 264408
PLYMOUTH Syntax Ltd., 76 Cornwall St. Tel: (0752) 28705
TIVERTON Actron Micro Computers, 37 Bampton St. Tel: (0884) 252854

DORSET

BOURNEMOUTH Lansdowne Computer Ctr 1 Lansdowne Crescent. Tel: (0202) 20165
NEW! DORCHESTER Seven Counties Cptrs. 20 High Street East Tel: (0305) 66022
NEW! POOLE Lansdowne Cptr Centre 14 Arndale Centre Tel: (0202) 670901

DURHAM

DARLINGTON McKenna & Brown, 102 Bondgate. Tel: (0325) 459744

ESSEX

BASILDON Godfrey's 28-32 East Walk. Tel: (0268) 289379
BASILDON Godfrey's Computer Centre, 5 Laindon Main Centre Laindon. Tel: (0268) 416747
NEW! CANVEY ISLAND Tower Radio Ltd. 43 High Str., Tel: (0268) 682211
NEW! CHELMSFORD Way-In Cptrs. 7 Village Square Chelmer Village Tel: (0245) 467858
CHELMSFORD Maxton Hayman Ltd., 5 Broomfield Rd. Tel: (0245) 354595
COLCHESTER Brainwave 51 Head St. Tel: (0206) 561513
GRAYS H Reynolds. 79 Orsett Rd. Tel: (0375) 5948
ILFORD Woolfmans, 76 Ilford Lane. Tel: (01) 478 1307
NEW! ROMFORD 92 Market Place Tel: (0708) 41719
SOUTHEND Computer Centre 332 London Rd. Tel: (0702) 337161

HAMPSHIRE

BASINGSTOKE Fisher's, 2-3 Market Place. Tel: (0256) 22079
PORTSMOUTH (Waterlooville) G B Microland, London Rd., (Opp. Co-op) Tel: (0705) 259911
SOUTHAMPTON L.T.C. Ltd., 112 East St., Tel: (0703) 333958/24703
WINCHESTER Winchester Camera & Computer Centre, 75 Parchment St. Tel: (0962) 53982

HEREFORD

HEREFORD Melgray Hi-Tech Ltd., 53/54 Commercial Str., Tel: (0432) 275737

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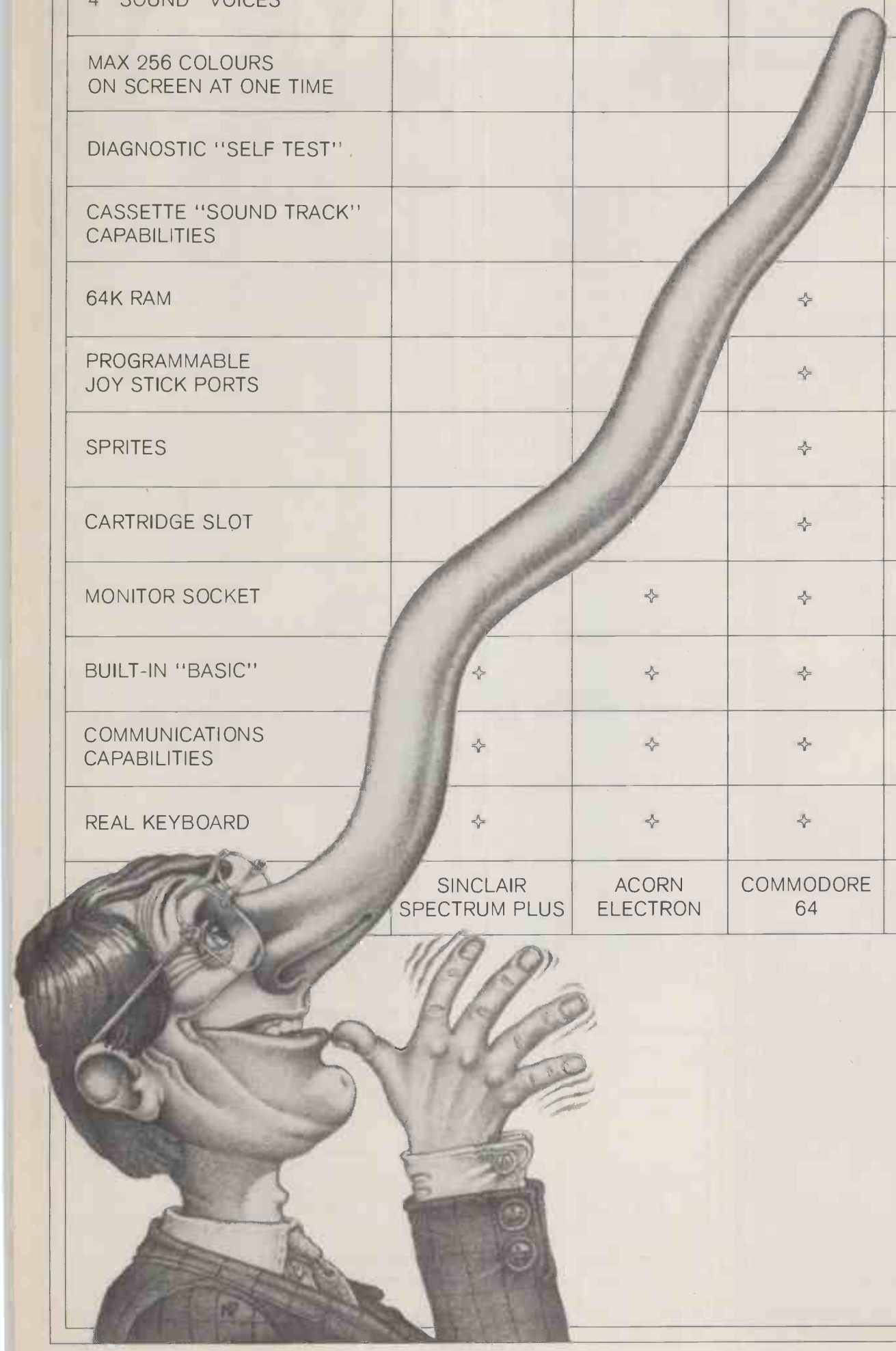

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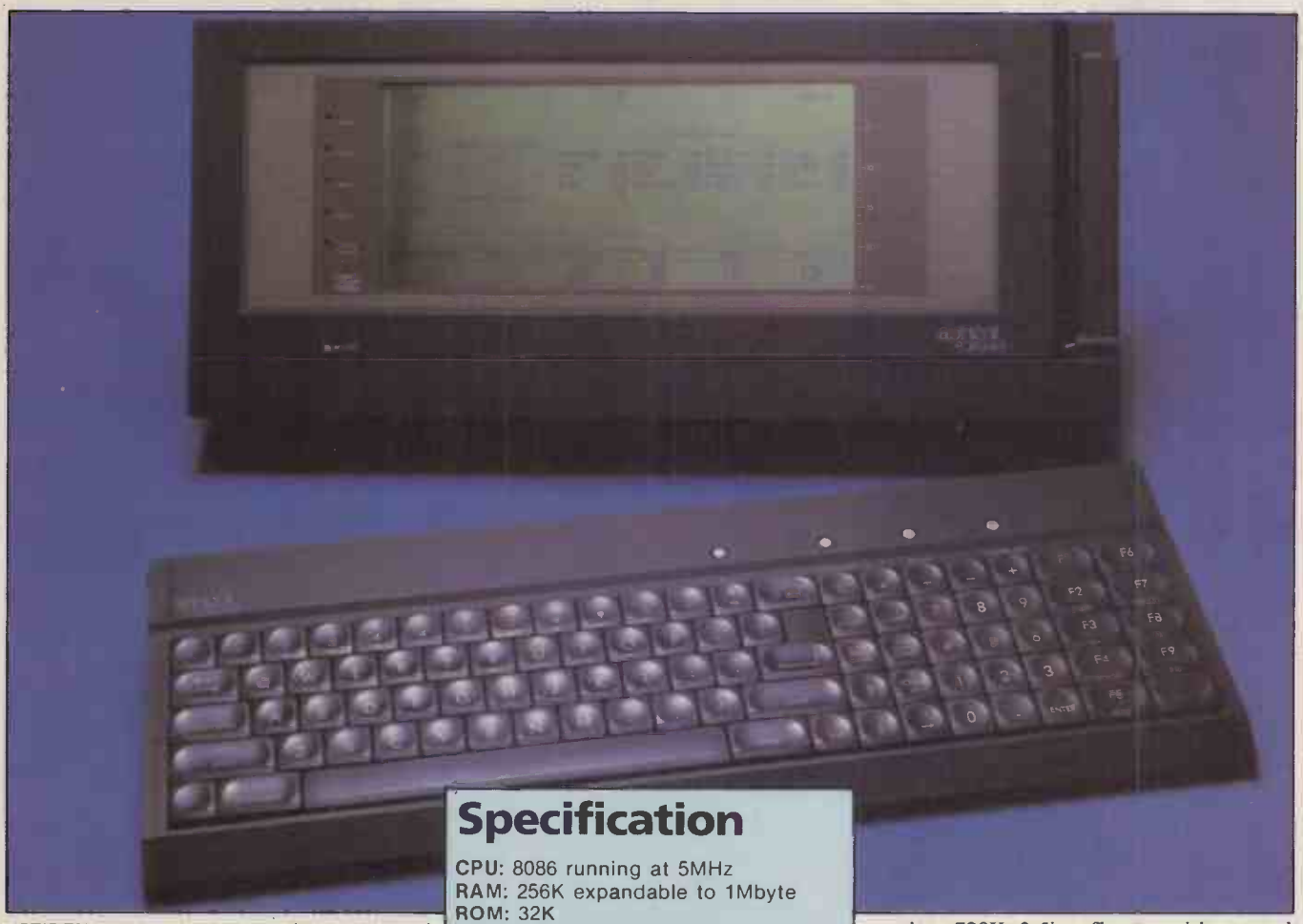
APRICOT PORTABLE

Glyn Moody is impressed by the capabilities and price of ACT's transportable micro — but who needs it?



ACT'S EVOLUTION as a computer company has been remarkable for its apparently unswerving logic. As the micro market has developed over the last 10 years, so the company has moved progressively from mainframe and mini bureau services to micro software and then hardware.

A keen awareness of where the market was going seemed to inform each successive launch of members of the Apricot family. With the arrival of the F1 machine and the Point 32 local area network, a very broad range of business needs is now catered for.

In this context of fairly standard machines aggressively priced and sensibly marketed, the launch of the Apricot Portable is all the more surprising. Within its unorthodox physical format it combines an 8086 processor, 256K RAM and a 720K 3.5in. floppy with several leading-edge technologies. These include an 80-column by 25-line LCD, a built-in microphone for voice-recognition software supplied as standard, and an infrared keyboard. Any one of these would be daring. Putting them all together in the one machine seems almost an act of defiance on ACT's part, intended to signal that it has really arrived.

Although called the Portable, the machine is in fact what is more normally termed transportable. That is, it is a mains-powered unit which can be moved fairly easily from site to site but is too heavy to be carried around all the time.

The careful design of the plastic carrying case is representative of the thought that has gone into this product. It is eminently carryable, and enables the

Specification

CPU: 8086 running at 5MHz
RAM: 256K expandable to 1Mbyte
ROM: 32K
Dimensions: main unit 450mm. (17.7in.) by 172mm. (6.8in.) by 200mm. (7.9in.)
Weight: 4.5kg. (10lb.)
Display: 80 columns by 25 lines; 640 by 256 pixels in graphics mode; colour option available
Keyboard: 92 keys, 10 function keys
Mass storage: 720K 3.5in. double-sided double-density; Winchester promised
Interfaces: RS-232 and Centronics parallel
Software in price: MS-DOS 2.1, Activity, ACT Sketch, ACT Diary, ACT Game, Supercalc, Superwriter, Superplanner, GSX
Software options: Concurrent DOS, CP/M-86, GW Personal Basic
Price: £1,695
Manufacturer: ACT plc, 111 Hagley Road, Birmingham B16 8LB. Telephone: 021-454 8585

main unit, keyboard and mains lead to be stowed neatly away inside. It is also symptomatic that the case is rather hard to open, and it is equally hard to remove the keyboard from under the elastic strap that secures it. Other such small problems are encountered elsewhere in the design.

The main unit itself is one of the most innovative designs seen in a computer for years. At first sight it looks like a large grey Toblerone bar, with an olive-green LCD on the slanting face. To the right of the screen is a small microphone which swivels on a small plastic peg that fits into the machine.

In use, the microphone can either be tilted forward or pulled out on about 35cm. of wire. This must then be stuffed back into the hole whence it came — hardly the most sophisticated solution. Similarly, the plastic peg that secures the microphone is just asking to broken off by an incautious movement, or when the micro is being packed away in the carrying case. It is small details of execution like this that spoil the conceptually brilliant ideas.

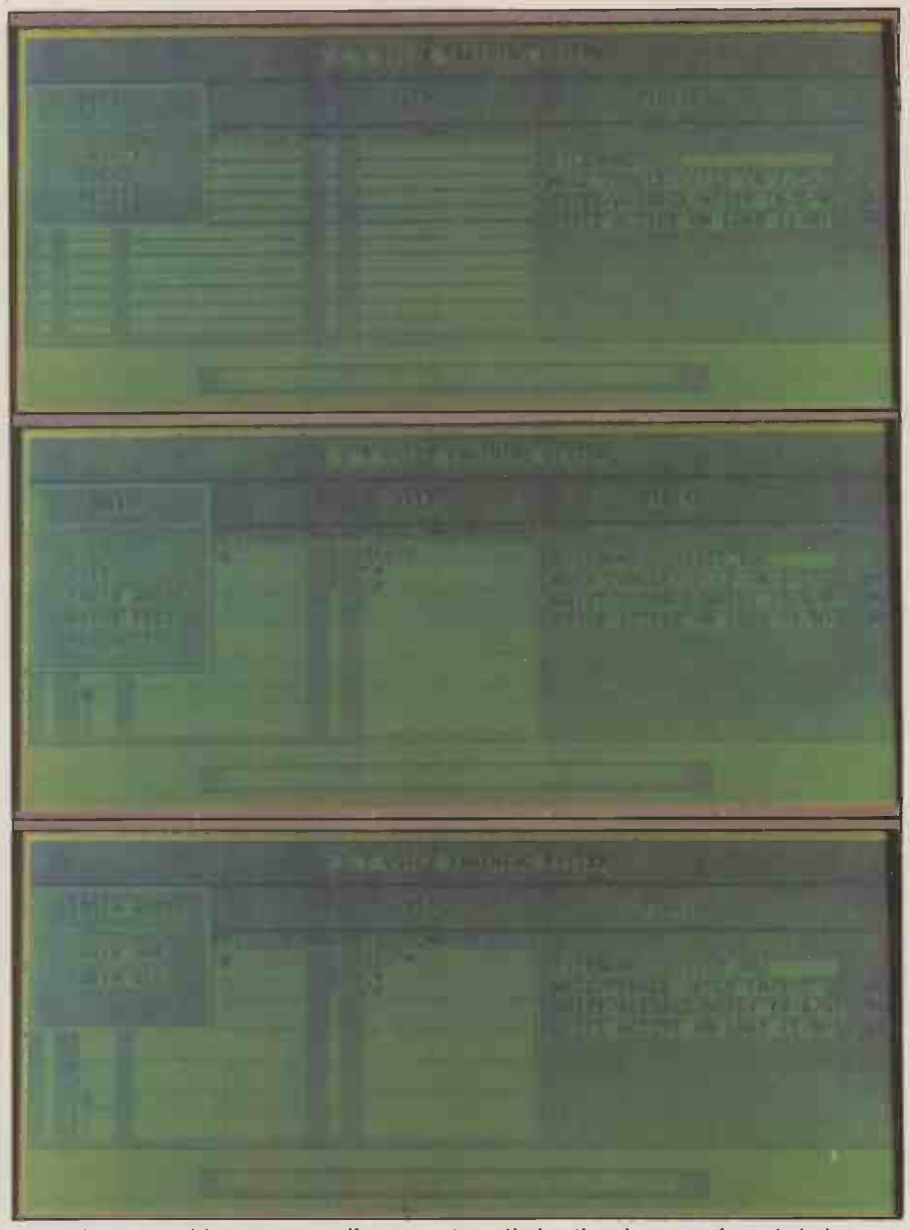
Gentle whirr

Also on the right of the machine, at the side, is the double-sided 3.5in. floppy. At the back, a small plastic cowling can be removed to reveal RS-232 and Centronics interfaces, and a video output socket. On the extreme right of the back of the machine is the power On/Off switch and kettle-type plug socket. Next to this is a large metal heat sink. There is no fan, so the Portable is almost silent in operation apart from the gentle whirr of the disc drive.

At the front of the machine, on the right-hand side just under the microphone, is the infrared receiver and transmitter. The keyboard and optional mouse both use infrared signals to communicate with the main unit. Alternatively, glass-fibre light pipes can be used to channel the information more directly. They are slightly unwieldy in practice, since they are springy and do not lend themselves to being tucked away easily.

The keyboard is light and slim, and possesses a full complement of keys. They are square, with moulded depressions for the fingers. Although fully sprung, they feel clattery and the close spacing means that double strikes are relatively easy. As with all keyboards the overall impression is bound to be subjective, so the best solution is to try it for yourself.

It is certainly true that the standard of construction is lower than on the original Apricots. The whole keyboard as well as the machine itself has a much more plasticky feel about it, and the keys all rock too much. There are two legs at the back which can be released to tilt the whole unit. However, on the review machine things were slightly out of true, so that one of the legs was slightly in the air.



The voice-recognition program allows you to optimise the chances of words being recognised by allowing for different speakers and background noise levels.

Such carping should, however, be placed in context by the price of the Portable: for £1,695 you cannot expect cast-iron solidity. Clearly ACT has gone for functionality on this machine. If you want something more up-market you will buy the standard Apricot version.

Along the top the keyboard are four recessed buttons. One is the Reset, which sensibly requires some seconds' depression before it operates. There are also buttons to alter the repeat rate on the keyboard and to adjust the real-time clock. The keyboard contains a small battery unit, but there is no battery back-up in the main computer so the clock has to be set each time you power-up. The final button enables you to lock the keyboard.

Functions like Shift and Caps are shown by small indicators alongside the LCD. There is also a light indicating disc activity and power-on. The Stop light refers to the Stop key on the keyboard, which halts screen scrolls. Other keys are fairly standard, except that the 10 function keys and numeric pad perform auxiliary roles in certain applications, notably voice training.

On power-up a logo appears, together with an indication of the system's RAM and floppy-disc capacities. Inserting one of the main discs supplied with the Portable loads MS-DOS, followed by a graphics program and finally the main front-end system called Activity. This replaces the various menus found in earlier Apricots. As befits a machine that has everything, great use is made of icons. The cursor can be moved using either the outer numeric keys or an optional infrared mouse which doubles as a trackball when lying on its back.

(continued on next page)

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The cursor is in fact semi-intelligent. Once pointed in a general direction it will move until it hits an icon. This has its advantages and disadvantages: if you are going in the right direction it is fine, but all too often the cursor wanders off and embeds itself somewhere obscure, and then has to be found again.

For those allergic to newfangled devices like icons, the main Activity screen also provides a list of files executable under MS-DOS, that is those ending in .Com, .Exe or .Bat. A command entry line even lets you avoid the cursor by typing in MS-DOS commands directly.

Two main classes of icons are displayed on the opening screen. First there are the installed applications, appearing on the left-hand side. They can be any standard programs that have been set up with their own icon, allowing them to be called up using the cursor. Then along the bottom are the standard Activity icons that appear all the time you are using Activity or any of its sub-systems.

These system icons were described in the preview of the Apricot F1 machine which appeared in October's *Practical Computing*. The Portable shares with it not only this graphics-based front end, but also other bundled software. In many ways, the Portable represents a repackaging of the very straight F1 along with additional features.

The LCD is one of these, and it is certainly impressive. Whether it is usable is another matter. The 80 columns by 25 lines provides sufficient space for sensible screen designs. The conversions from the full-colour F1 versions work well, and there is never any sense of dealing with an inferior display medium.

Fuzzy views

The main problem is that of legibility. Although the screen is physically angled to improve the visibility of its display, it is still difficult to read. This is made worse by the fact that ACT seems to have set the screen at slightly too shallow an angle. The best image is obtained by stooping down and viewing it from almost desk level. It is also quite crucial to view it head-on; side views are fuzzy and unclear.

Perhaps the main attraction of the Portable is its voice-recognition facility. Its inclusion in any micro would be remarkable at this stage, but in one costing little more than the add-on voice unit for TI's Professional micro — the Portable's only real rival in this sphere — it is little short of miraculous.

The system is very similar to that used by Texas Instruments. A vocabulary is set up, containing a set of words, their spoken equivalents as recorded by the computer, and the corresponding commands that are to be initiated when the words are recognised.

Sensibly enough, the Portable's voice-recognition program lets you set up certain parameters so as to optimise the chances of words being recognised. For example, you can specify whether the speaker will be male, female or a child. It is also possible to allow for different levels of background noise. Once these have been set, you create a file holding the vocabulary. Words are entered, followed by Y for yes or N for no. This refers to whether the corresponding command will be the same as the vocabulary word.

The optional mouse has an infrared link to the main unit.

Normally the command is terminated by a Carriage Return. If, however, you wish to concatenate command words, an alternative is available. For example, if you wish to set up a vocabulary for MS-DOS containing the word "Type", which would normally be followed by a file name, you would need to ensure that there was no Carriage Return after the word "Type". So the sequence

TYPE_^M

is used. This will insert a space between Type and the word that follows, and not send a Carriage Return after Type. The Carriage Return that follows the file name will then initiate the command string.

In this way whole command sequences can be built up from simple vocabulary words. Once the vocabulary has been set up, it is necessary to train it. As with the TI system, this is done by speaking the relevant word several times, and allowing the software to take a kind of audio average.

Unfortunately, the software shipped with the review machine was pre-production, and seemed to have a number of bugs still in it. Although it proved possible to set up and train a vocabulary, the subsequent performance was erratic. ACT assures us that production versions are untroubled by these problems. There is no reason to doubt that the ACT system in it final version can match any other voice-recognition system around on micros.

The question is, do we really need it? Although great claims are made for the ease of using voice-driven systems, it is still true that keyboard input is and will remain the norm. Even if the microphone lets you cut out certain stages, there comes a point where you have to put it down and start typing. In this respect the TI system scores by letting you use a headset instead of a hand-held microphone.

That said, there can be little doubt that ACT is right to pursue this avenue of development. Even if totally voice-driven systems take a few years to come through, it seems certain that they will play a major role.

As if all this were not enough, the Portable has a couple of other bundled packages also provided on the F1. The ACT Diary is just what it says, except that like much of the voice-training software it goes in for modish windows and neat graphics. For all this superficial sophistication, the command structure is surprisingly old-fashioned. To get the diary entry for December 23, you have to key in turn

```
open_at
Return dec Return
2
Return
3
Return
OK
Return
```

which is hardly concise. Also the LCD is really ill-suited to the type of graphics attempted here; a full-colour monitor is essential.

The other software is ACT Sketch, a drawing program. Again this seems to be here merely for the sake of it. After all, why should your go-ahead executive need this sort of thing? The standard applications of Superwriter and Supercalc are more staid and much more useful.

The documentation supplied is very well produced, with excellent screen shots. It is rather limited though: there is little in the Starter Pack for the experienced micro user, and no information is provided on system layout, specification, configuration and so on.

Conclusions

- **The ACT Portable is an innovative machine with an astonishing spec at a very reasonable price.**
- **If you want to experiment with the latest in voice-recognition software, use an infrared keyboard or just impress people, the Portable is probably for you.**
- **Many may find the LCD difficult to use. A second monitor is almost obligatory for serious work.**
- **The Activity front end is well designed, provided you accept its initial assumptions.**
- **The overall quality of construction leaves something to be desired, and there are various infelicities which are annoying. But these pale beside the price tag.**
- **Already the database Retrieve from Derwent Data Systems is available as a voice-driven system, which augurs well for the development of software making full use of the new machine.**
- **No Basic was supplied with the review machine, so Benchmarks were not possible. However, it seems likely that the Portable will be roughly comparable with the F1 for speed.**

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TDI PINNACLE

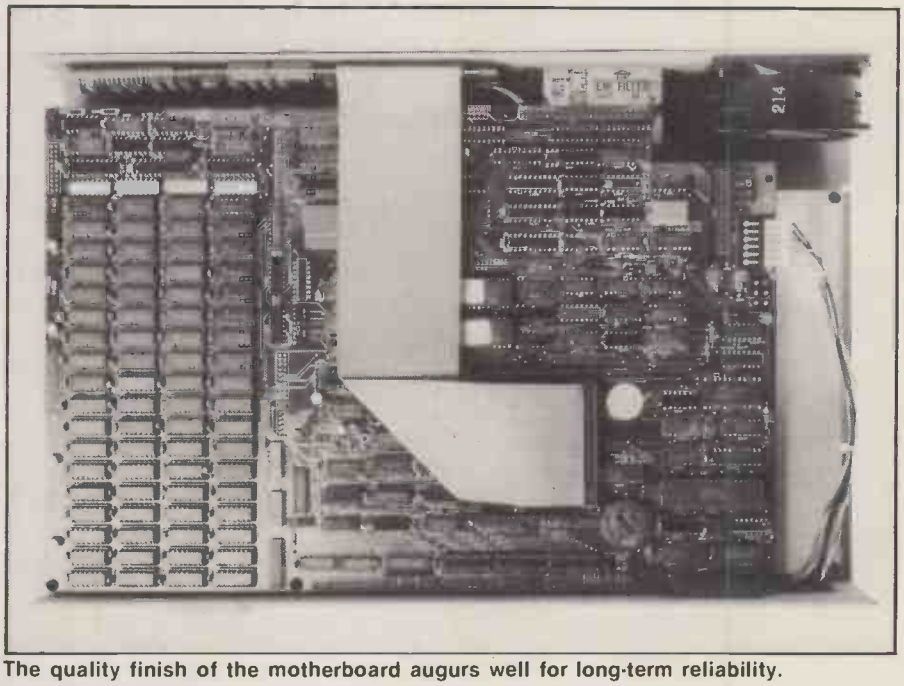
With its 68000 processor running the p-system this multi-user micro is hard to beat on raw computing power — but Glyn Moody suggests that programming the beast is best left to the experts.

THE PINNACLE is a 68000-based multi-user micro produced jointly by the Bristol firm TDI and the U.S. firm Lamtek Industries. Hitherto Lamtek has specialised in designing printed circuit boards. TDI is probably best known for the Sage series of multi-user micros which it distributes in the U.K. and for being the principal U.K. distributor of the UCSD p-system.

The Pinnacle is mainly designed as a p-system engine, though it can run such operating systems as CP/M-68K, Tripos and BOS. The entry-level system has 256K RAM, one 800K floppy, a 10Mbyte Winchester and costs £4,995. Upgrades include a 32Mbyte Winchester, 1.5Mbyte RAM and a further six terminals.

Externally the machine is surprisingly unassuming for a system sporting a 12MHz 68000. The main processor unit is in battleship grey, and the separate terminals are off-white. Both are slim, and styled without frills. At the back, from left to right, are the fan vent, power socket and power switch, seven serial ports used to hook up terminals, a printer port and a microscopic Reset button.

Elegant and quick — the Pinnacle produced the fastest Benchmarks we have seen.



The quality finish of the motherboard augurs well for long-term reliability.

Penetrating noise

The Pinnacle notches up a black mark on account of the cooling fan, which the publicity hype has the temerity to describe as "whisper quiet". I can only think they had something like a whispering elephant in mind, since in *Practical Computing's* office, where this review was carried out, everyone remarked how loud and penetrating it was. This may seem trivial, but for a system designed to function in professional environments, the noise-level is unacceptable, and mars an otherwise well thought-out system.

Opening up the micro is easy. Removing four screws on the bottom the case reveals a very neat and densely packed layout. Particularly noticeable are the serried ranks of memory chips. With such a high-quality finish it is no surprise to learn that Lamtek supplied high-reliability products to the American military, which augurs very well for the Pinnacle's long-term performance.

The terminal units are surprisingly compact, but offer a full 14in. screen with tilt and swivel. In addition to an On/Off switch, there is a brightness control plus ports at the back for power, connection to the main system box, an auxiliary port and the keyboard.

Non-typewriter keys are moulded in a darker grey for convenient identification. There are 16 function keys as well as a numeric keypad. The touch of the keys is positive, though a fraction on the light side. A bar at the back allows the whole unit to be angled for easier use.

On powering-up the terminals, a short self-test is initiated. Switching on the main unit produces the ROM version number — 2.2 on the review system — and a hardware checkout begins. The hard disc is initialised and operating system routines are copied across to a RAM disc for faster access times. You can also boot from a floppy, and DIL switches at the back allow various options to be configured.

The Pinnacle is designed very much with the turnkey market in mind and consequently you can set up various menus to appear at this point to aid the inexperienced user. They are called up as part of the boot routines, but if there are no such front ends the micro enters the p-system.

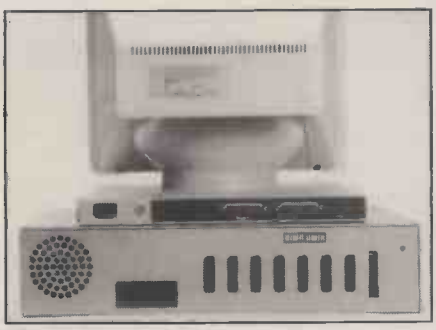
The p-system grew out of attempts to put Pascal on micros. Workers at the University of California at San Diego first developed the idea of p-code on an LSI-11 mini, and then moved it over to Z-80 machines and the Apple II. The basic idea is that programs are compiled to a pseudo machine code. This does not correspond to any real processor's machine code, but is based on a fictitious chip whose particular characteristics would optimise the running of a Pascal program.

To run the p-code, it is fed into an interpreter which converts the fictitious machine code into the real thing for the machine's processor. The big advantage of this approach is that only the interpreter contains machine-dependent code, so the same compiler can be used for different machines. The only other machine-dependent parts are the I/O drivers. All the p-system software is written in the language it was created for, Pascal.

Portable software

Similarly, if a program runs directly under the p-system, in theory it can be ported from machine to machine without modification. This is perhaps the greatest strength of the p-system concept and one reason why it has outlived its initial purpose.

The p-system was produced originally by academics for academics. But once the commercial possibilities were realised its development was handed over to Softech Microsystems. It is now available on over 100 machines worldwide, and on 32 in the U.K., including low-end machines like the BBC Micro and Commodore 64. A version for the QL is currently under development.



The Pinnacle supports up to seven terminals connected via the serial ports.

Specification

CPU: 68000 running at 12MHz, no wait states
RAM: 256K up to 1.5Mbyte
ROM: 16K containing bootstrap loader and hardware test
Weight: 8.6kg. (19lb.) main system box
Dimensions: 102mm. (4in.) × 279mm. (11in.) × 432mm. (17in.)
VDU: 14in. green phosphor, 80/132 columns, optional colour graphics gives 640 by 576 pixels in eight colours
Keyboard: full QWERTY with numeric keypad and 16 function keys
Mass storage: 5.25in. 800K floppy, 10Mbyte Winchester
Hardware options: floating-point second processor, graphics card, mouse, tape streamer, 32Mbyte Winchester
Interfaces: Centronics parallel port, seven serial ports, internal network, SASI and graphics interfaces
Software in price: UCSD p-system
Software options: Fortran, Basic, Pascal, Cobol, APL, C, Lisp, Modula 2, assembler
Price: £4,995 for 256K RAM, 10Mbyte Winchester; £9,345 for 1,536K RAM 32Mbyte Winchester; extra terminals £695; second-processor unit £715; colour-graphics board £2,250; all prices exclude VAT
Manufacturer: TDI Pinnacle Ltd, 29 Alma Vale Road, Bristol BS8 2HL. Telephone: (0272) 742796

Those used to CP/M will find the p-system unorthodox. Command options appear as a horizontal menu along the top of the screen. Words are of the form E(dit, R(un, F(ile, and commands are executed by initial letters. Commands may lead to further nested sub-menus displayed in a similar fashion.

You can set up the Pinnacle via one of the sub-menus to partition the hard disc into users, allocate memory to RAM discs, and determine how many terminals will be active. The Pinnacle will support up to seven users, and the manufacturers claim that there is no significant degradation of response. Unfortunately, on the two-terminal system reviewed here, one screen malfunctioned, so we were unable to put this claim to the test.

As the Benchmarks show, the single-user system is extremely fast. Adding the National Semiconductor 16081 second processor as a floating-point arithmetic unit produces even more impressive numbers. However, it is difficult to make sensible comparisons between ordinary interpreted Basic running on standard micros and Basic running under p-system. Benchmarks normally measure the time taken for a Basic program to be interpreted to machine code, but under p-system, a Basic program is first compiled to p-code. The Benchmarks then measure the time taken for this code to be compiled to native code; no account is taken of the p-code compilation time. Nevertheless, the Pinnacle is a very fast machine, and one of the first to push the 68000 near its limits.

However, the p-system may limit the applicability of the Pinnacle and seems likely to thrive best in two situations. First, in the turnkey world, where a complete hardware and software package is offered, and users can be shielded totally from the idiosyncracies of the p-system. The other area where it should come into its own is for software development, where the full power of the p-system can be unleashed by those best able to take advantage of its strengths.

Already, a wide range of languages is available, including Fortran, Basic, Pascal, Cobol, APL, Lisp and Modula 2. There are also various multi-user application packages covering most of the standard areas like word processing, spreadsheets and accounts. Various hardware add-ons are available including a colour-graphics processor, offering an 8088, 192K on-board RAM and 640 by 576 pixels in eight colours.

The manuals supplied reinforce the image that the Pinnacle is not a beginners' machine. They are from the same TDI stable and mostly detail the glories of the p-system. The one devoted exclusively to the Pinnacle is thin and technical.

Benchmarks

The figures below show the time in seconds taken to execute eight standard Benchmarks written in Basic. The Pinnacle emerges as the fastest machine yet tested by us. The two sets of figures are for tests with and without the floating-point unit.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Pinnacle — 68000 and 16081	0.2	0.2	0.4	0.4	0.5	1.5	2.1	3.4	1.1
Pinnacle — 68000	0.3	0.4	0.8	1.2	1.3	3.2	4.1	11.8	2.9
HP Series 200 Model 16 — 68000	0.2	0.6	1.4	1.6	1.7	2.8	4.3	15.0	3.5
Seiko 8600 — 8086	1.2	4.0	8.7	8.6	10.3	19.1	29.7	23.7	13.2

Conclusions

- **The Pinnacle is a sleek thoroughbred 68000 machine. Running under the p-system, it produces the fastest Benchmarks we have seen.**
- **Because it has been principally designed to run the slightly uncommon p-system, it will be most useful as a powerful engine at the heart of a turnkey business system, or as a raw processor in development work.**
- **The machine is generally well designed and built to high standards. The exception is the noisy cooling fan.**
- **The basic power of the machine should mean that it will lend itself to multi-user applications, though you should try out typical tasks before buying to check for degradation of response.**
- **The manuals leave a lot to be desired: only experienced computer users will find the information they contain accessible.**

FUJITSU 16S

Not all 8086-based business micros are hanging on IBM's coat tails. Robert Piper looks at one machine from Japan which strikes out on its own.

EVEN THE MOST ARDENT of computer enthusiasts could be excused a yawn or two at the prospect of yet another new 16-bit business micro. The Fujitsu 16S is based on the ubiquitous Intel 8086 processor, comes with 128K of RAM and is designed to run CP/M-86 and MS-DOS — so far, so boring. It is only when you look inside the system box that it becomes apparent that the 16S could provide a much better long-term investment than any IBMulator.

Though launched a year ago the Fujitsu machine has taken a while to reach the U.K. in quantity. It is now available in two forms. At £2,300 for a 128K twin 320K drive system, including WordStar and Supercalc 2, the colour version looks reasonable value for money. The green-screen version at £2,080 without software is a less attractive proposition. Both systems use the same well-styled but bulky processor unit, which at 19in. by 15in. by 6in. does not leave a lot of room on the desk for the keyboard.

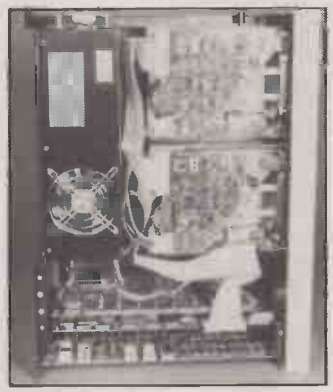
Full height

The front of the box houses two full-height 320K 5.25in. Fujitsu disc drives. A rather disconcerting feature of these drives is that when the doors are open there is a 2.5in. by 1.25in. hole through which dust and prying fingers can enter unhindered. A recessed On/Off switch and Reset button are found on the left-hand side of the unit, where they are ideally placed for convenient use without the risk of inadvertent operation.

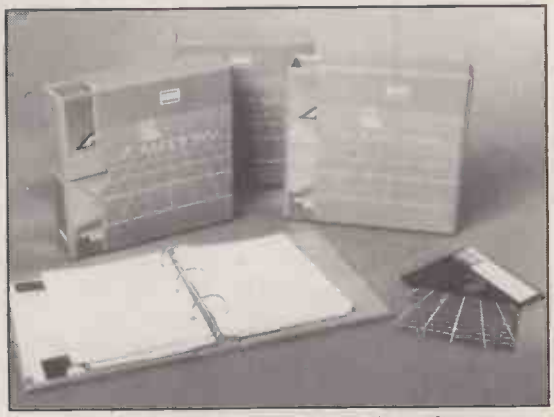
The rear of the system box is beautifully engineered on the 16S. There are DIN connectors for the keyboard, light-pen, analogue/digital converter, and for monochrome and colour monitors. Next to them are a standard Centronics-style parallel printer connector and an RS-232C port.

The inside of the 16S looks cramped, as the disc drives and shielded power supply occupy much of the space, but there is still room for four expansion cards on the left-hand side. Its really unusual feature is that the main processor, an 8MHz 8086-2, does not reside on the motherboard. To allow the 16S to take advantage of future developments in CPU technology its designers placed the 8086 on a plug-in board. There are plans for a Motorola 68000 board in the future which should allow it to run Unix. The machine comes with a 4MHz Z-80 processor on a board plugged into slot 2, which lets you run configured CP/M-80 software. The machine defaults to the 8086 when switched on.

The 16S has a conventional three-box layout with a colour or monochrome monitor.

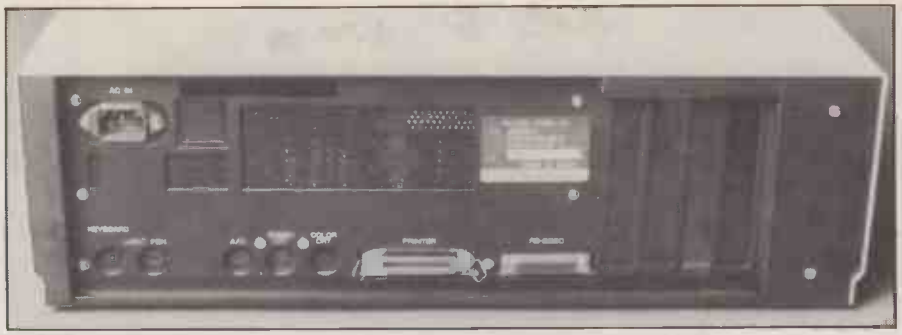


The 8086 CPU is on a 130-pin slot-in card.



The three manuals concentrate on the software.

With the two processor boards in place, another two slots remain free for more worthwhile activities. Fujitsu has used its own 130-pin bus for these slots so it will not be possible to use boards from other manufacturers unless they are specifically designed for the 16S. However, it boasts a full 16-bit data path, so future developments should not find themselves



Light-pen, A/D, Centronics and RS-232 ports are provided.

strangled by the limitations of the eight-bit variety found on the IBM PC.

The standard machine is delivered with 128K parity-checking RAM, which is expandable under Concurrent CP/M-86 to 1Mbyte. In addition, 48K of video RAM, 4K of character video RAM and 10K of monitor ROM are also provided.

The keyboard is a fairly compact unit fitted with an adequately long cable; there is a storage clip to retain unused cable. The keys are split into four groups. The main QWERTY keypad is based on the IBM Selectric II layout, with a usefully large Return key, Shift Lock and a separate Caps Lock facility, each with status LEDs. The Caps Lock set the QWERTY keypad's numeric row into Shift mode, which proved infuriating, especially when programming in Basic.

Dedicated keys

The next pad along has the cursor-control and dedicated editing keys, once again with a useful LED to indicate the status of the Insert key. Finally, on the far left is a conventional numeric keypad with a separate Return or Enter key. Along the top of the QWERTY keypad are a Break key and 10 function keys labelled PF1 to PF10. Key action is excellent, with good tactile feedback and an optional electronically generated click.

The colour monitor is both compact and attractive, with a full tilt/swivel base and front-mounted On/Off switch and brightness control. It requires a separate mains supply. The 11.5in. screen has a mirror-like surface similar to IBM's colour display, and is susceptible to stray background reflections.

The 16S can display up to eight colours on its 640- by 200-pixel display. The overall effect is really vivid, and the coarse characters displayed in an eight- by eight-dot matrix make text tiring on the eyes after a while. The display comes into its own when displaying graphics. Both DR Graph and DR Draw produced outstandingly crisp displays with minimal ghosting.

The 16S is very straightforward to set up. Switching on the machine initiates a brief auto-diagnostics procedure, and the machine then looks for a disc in drive A. Strangely it does not seem to matter how quickly you can find one and insert it; the machine invariably displays a Time Out error code, and you have to press the Reset button to reboot.

The fan and the drives are quite noisy. The fan is thermostatically controlled, and it takes a while to get used to it periodically cutting out. It sounds just like a mains power failure, and your heart sinks in proportion to the amount of data being worked on at the time.

The 16S is undoubtedly a fast machine as measured by the Basic Benchmarks, but in office use disc read/write times become more crucial. The 16S seems rather slow in this respect.

Users of 16S have the choice of CP/M-80, CP/M-86 or Concurrent CP/M operating systems. Having decided not to go for IBM compatibility, Fujitsu has hedged its bets somewhat by offering an implementation of MS-DOS. The beta-test version supplied with the review machine seemed to offer all the standard facilities.

CP/M-86 is supplied in a very competent implementation which generates colour displays and configures the function keys to produce the most widely used command strings like Dir and Stat. Function keys PF9 and PF10 are configured to call up WordStar and Supercalc. Utilities to change the display colour defaults are included. The Digital Research GSX-86 graphics kernel is also provided.

The owner of a Fujitsu 16S is never likely to have the wide choice of software available to IBM PC users. Fujitsu has prepared a list of packages to run under CP/M-86 and MS-DOS which should be available shortly through W H Softeam and Xitan. The list seems to be far from comprehensive, though it does include such notables as dBase II, the entire Micropro suite and Sorcim's Superwriter. Fujitsu says that other packages, including Vector's Everyman and DR Graph and Draw, are currently being ported over.

To document the 16S Fujitsu has used the literature supplied by the software houses, repackaged in three volumes. The operator's guide contained in volume 1 is only 40 pages long. The remainder of this volume is taken up with the Digital Research CP/M-86 manual, while volume 2 covers DR Personal Basic and volume 3 documents WordStar and Supercalc.

Specification

CPU: 8086-2 8MHz and Z-80 4MHz
Memory: 128K expandable to 1Mbyte
Bus: Fujitsu 130-way
Standard interfaces: Centronics, RS-232C, light-pen, A/D
Operating systems: CP/M-86; Concurrent CP/M-86 and MS-DOS options
Drives: two 5.25in. 320K drives
Dimensions: 489mm. (19.25in.) wide, 368mm. (14.5In.) deep, 146mm. (5.75in.) high
Monitor: 11.5in. colour CRT
Display: eight colours; 80- or 40-column by 25-row text; 640- × 200-pixel graphics
Keyboard: 93-key, including 10 function keys; detachable with coiled cable
Price: £2,300 with WordStar 3.3 and Supercalc 2; £2,080 with monochrome monitor and no software
Supplier: Fujitsu Mikroelektronik, 1 Curfew Yard, Thames Street, Windsor, Berkshire SL4 1SN

Benchmarks

The standard Benchmarks were run on Digital Research's Personal Basic under CP/M-86 on the Fujitsu, and on Microsoft Basic under PC-DOS or MS-DOS for the others.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Fujitsu 16S — 8086	0.7	2.0	4.8	4.9	5.6	10.2	14.9	16.7	7.5
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8
Olivetti M·24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2
IBM PC — 8088	1.3	4.8	11.8	12.2	13.4	23.6	37.6	36.6	17.7

Conclusions

- **The 16S has an innovative internal architecture which may give it a longer life than many of its current competitors, provided that Fujitsu produces the promised processor board upgrades.**
- **The 16S is not IBM compatible. Fujitsu is promising Concurrent CP/M, which may enable the machine to run a limited amount of IBM software, but until it arrives owners of the 16S may find their software options severely restricted.**
- **The hardware is beautifully engineered and obviously built to last.**
- **At £2,300 for a 128K dual-disc full-colour machine, including WordStar and Supercalc 2, the colour version is good value for money.**

SYCERO

Chris Bidmead tests out a program generator designed to create database-management systems for the IBM PC.

SYCERO is a program that writes programs. If you tell it what you want to do in the way of managing a database it will produce the Basic to do it.

Sycero comes from System-C, a small British company with roots in Olivetti and mainframe program generators. The package comprises five discs and two black and yellow dwarf-format manuals, one for reference and one containing examples to be worked through. Sycero is serious stuff, so the reference manual does not begin by explaining where to find the cursor. But it does not assume you are a seasoned systems analyst either, so the documentation begins by offering a succinct course in systems design.

The ideas are good and put across in a way that is easy to grasp: "Only when you have established what you want out of the system should you decide what information you need to hold on it". For some reason though, this excellent advice is not followed in the first example, a simple name and address system. "First of all, we have to decide what information we want to keep on the file. . . . Next, we have to decide what information we are going to get out of the system".

Automated

Installing Sycero on a dual-floppy computer requires writing system information to all five discs. Configuration is automated for the IBM PC and the Olivetti M-24 by running the Install.Bat file supplied on the Sycero master disc. This prompts you to place the discs one by one in the drive, which takes about five minutes.

When I repeated the installation procedure on the hard-disc version of the same machine I found that it took a lot longer, as all the files have to be copied across to the hard disc. Also you need to reboot once the configuration has been done, so that the ANSI graphics module is loaded — a point not mentioned in the manual. Omit this step and the screen positioning and highlighting information appear as strings of garbage.

Sycero is driven through a hierarchy of menus, and entered by typing SY from the MS-DOS command line. Instead of taking you to the main menu, SY leads you directly to item 1 of that menu. This is where you set the date and time, inform the system about the size of paper used in your printer, and establish a number of details about the date format and the use of the keyboard.

This is also the point at which you choose the name of the program suite you intend to generate. The Sycero documentation calls these generated program suites systems. They will generally consist of a main menu program that calls a number of option programs: one to append or amend records, one to search the database, one to generate written reports, and so on.

The system configuration also asks which drives you are going to use to keep the Sycero system files and to store the developed source code. Unfortunately, Sycero does not understand the MS-DOS treed directory. So on the hard-disc Olivetti M-24, to take advantage of the speed of the Winchester the development drive could only be specified as C:, rather than something like C:/sycdev, which would have saved jumbling up the generated code with the numerous Sycero generator files. The archipelago of files needed to run the system is a disadvantage on a hard-disc machine, where periodic ruthless purging is necessary.

The main Sycero menu reflects the stages you need to go through to create an application. The process falls into eight basic sections: file definitions, screen definitions, screen variable processing, report definitions, program definitions, program generation, file creation and program running.

File definition is a similar process in all the various database management systems, a matter of describing field by field what each record should consist of in each of the data files your suite of programs will use. But Sycero adds a dimension absent from many other data-handling methods: it understands more than one type of file.

Sycero's norm is the ISAM file. The acronymn stands for Indexed Sequential Access Method, a technique that allows a file to be indexed on up to 14 separate key fields. A field that has been designated a key can be used like a handle to pull out a particular record, but a key may also be made from a combination of fields. Basic is capable of handling ISAM files, but to speed things up System-C has delegated the task to code of its own, originally written in C, which is called from Basic as an external module. ISAM files are fast at data retrieval, but carry an overhead in disc space, as a separate index file has to be

The documentation begins by offering a course in system design.

Sycero normally handles sequential files, but can cope with other types too (left). It is equally flexible in its treatment of data (right).

created for each key. So a file indexed on all 14 keys will need need 15 files in all to carry the data.

Sycero's second file type is the Extension file. ISAM files with large records tend to be inefficient, so the Extension file idea allows the creation of a virtual flat file that is made up of a number of files, each carrying part of each record. The linking between the main file and its extensions which ensures the records stay in sync with each other is taken care of automatically.

Transaction files can be regarded as a development of the Extension file. But instead of attaching a single extension record to each record of the main file, the transaction file allows a number of additional secondary records to be attached. Thus in a flat file of suppliers, say, each record can be supplemented by a diary of transactions. The physical equivalent would be to turn each card in the suppliers-file card index into a loose-leaf folder.

Random files are the fastest and most efficient method of storing data because they use no additional index files, but access is only by means of the physical record number. Sycero requires the first field of a random file to be numeric, and automatically ensures that the physical record number is stored there.

The simplest file type known to Sycero is the sequential file, which can only be read by starting at the beginning and working your way through. Sequential files have no logical record structure, and are useful for keeping a log of transactions or text.

Data types

Sycero's sophisticated understanding of files is matched by its handling of the file contents. You are not restricted to the data types provided by Basic. Rather than integer, single precision, double precision and string types, Sycero thinks in terms of six data types, identified by two-letter mnemonics.

NU indicates a numeric variable, the precision being assigned automatically, depending on the length you allow for it. AN is a standard alphanumeric string variable. NA is a subset of AN, a Numeric Alpha field that comprises only digits since code is generated to shut out non-numeric input. AO, Alpha Only, is the complement to NA. CA is a field that only allows capital leters. The fifth type, DA, or Date, displays and accepts dates in the form ddmmyy, or mmddyy if the American date option is set, but stores them as a four-byte quasi-Julian number.

Once the files are defined, the layout of each record on the screen needs to be established. Screen definition, option 4 of the main menu, takes you into a screen editor which lets you set up a mixture of inert textual constants and live field variables.

Most database management systems offer a variation of this technique, but Sycero's is the most elegant, simple and powerful I can remember seeing. Textual constants are set up as though using a simple screen editor, and to insert a field into the screen all you do is put the cursor where you want the field to begin and hit Control-F.

This opens up a window at the bottom of the screen. Enter the name of a field into the window, and its length and data type jump into view, drawn in from the system's data dictionary. You can then decide whether the field will be used to collect input or is for display only, and the additional qualities of the field are entered into the data dictionary. Fields not already defined are assumed to belong to a notional field called Temp.Fle and are treated like free-floating temporary variables.

Screen creation

There are some rough edges to screen creation. For example, if you have been amending a screen and make a series of errors, you might want to abandon your editing and start afresh; but in screen creation the Quit command only works in certain circumstances. If you have made any alterations to the definition or location of fields, Sycero cannot restore the status quo, so it issues the message that quitting will result in field corruption, and the quit is denied.

Provision is made for drawing boxes using the line and corner graphics characters that from part of the IBM extended fount. According to the manual this is done by going into graphics mode, establishing a start and finish at diagonally opposite points of the rectangle using f9 and f10, and then commanding the box to be drawn with Shift-f1. The software has been improved since the manual was written, and the redundant graphics mode is no longer necessary. But the process is still more complicated than it need be and it would be simpler to allocate one key to mark the beginning of the box and a second key to signify "draw the box between the marker and the cursor position".

Sycero's screen design program is supplemented by an option in the main Sycero menu that allows you to build in the processing that is to be done on the data. All these activities are organised on a tabulated screen, and the choice of processing type is made by entering a three-character code: Val for validation, Hel for help, Err for error handling and so on.

You can define help lines to provide text to supplement the static prompt when the cursor arrives at the field. Also you can validate data as it is entered, including error messages if necessary, and you can establish calculations that are to be carried out on input data and/or other variables.

This is one of the best features of Sycero. For example in validating an entry to make sure it is not an empty string or a string of spaces, Basic has to apply the wordy validation test 5

```
IF ENTRY$ < >"" AND ENTRY$ < >
  SPACE$(LEN(ENTRY$)) . . .
```

Sycero keeps a library of such tests. Simply tell the screen-variable processing routine that you want to use V5, and the library line will be slotted into place. As you construct the program the Basic expansion of V5 is spelled out for you on the screen.

Validating the contents of a field against a check file are not completely automated in Sycero, but can be included as extra lines of Basic. Sycero simplifies this process by providing a collection of complete routines stored in the library and accessed through the Sycero command language. Opening a check file and reading the record associated with a particular input field to see whether that particular input is a valid entry is all accomplished with the Sycero command

@READ RECORD<file name> USING KEY(x)

Sycero commands all begin with @, and encapsulate several lines of Basic into one or two words. For example, the Sycero command

@OPEN <ISAM.file name>

takes care of all the code necessary to open an ISAM file together with all its associated key files. @Goto and @Gosub are structured versions of the similar Basic statements that allow targetting on labels rather than inflexible line numbers. As you get to know Sycero better you can push this freedom further by personalising the library.

Line numbers

The sections of hand coding developed like this have their own line numbers for internal reference, but the lines are renumbered when the program is pulled together, so the modules behave very like the relocatable code familiar to assembler and Fortran programmers. Thus Sycero becomes a highly sophisticated hand-coding environment, providing powerful editing and library tools, as well as patching over many of the shortcomings of the Basic language.

A similar series of menus and prompts guides you through the creation of the report section of your program, the function of which is to write the code that will generate the hard-copy output. Report layout copes with the fact that the printed sheet may be larger than the screen, allowing pages of up to 100 lines of 254 columns each. Both headers and footers can be repeated at the top and bottom of each page with the inclusion of page number and date variables.

You can also set up criteria against which the file will be filtered at run time.

(continued on next page)

(continued from previous page)

Again there are three character codes: Rng lets you specify ranges; Mat is a numeric match or a string match, with or without the wild cards ? and *, standing for any letter or sequence of letters respectively; Min and Max are self-explanatory, and Qtn stands for question and is used to check for blank fields.

Sycero's main menu invites you to define the programs that are going to use the data files, screens and report formats. Most of the hard work of coding has already been done in the screen-definition cycle, and the primary job now is to tell Sycero which of the following types of program you want to generate.

File Maintenance — enter, edit, delete records
Enquiry — search the file for matches
Posting — update the file
Report — produce written output
Menu — create a menu or sub-menu
Batch — virtually everything else, as long as the data files are sequential

Like Sycero itself, Sycero-generated programs are linked together by menus. You can create up to 21 options per menu, and if your generated program suite needs more you can cluster programs together under sub-menus. There can be up to nine sub-menus in each menu, but they have to be specially defined; you cannot treat them simply as other programs to be run.

Menu generator

The menu generator takes the form of a table you have to fill in with the name of each program to be run from that menu, the drive that the program is on, and a description that will appear on the menu screen to act as a reminder of each program's function. As each file has already been described to Sycero for the purposes of documentation, it is a pity that this description is not offered as a default.

But surprisingly in a system with an automatically maintained data dictionary you can insert the names of non-existent programs, or programs from another system, and Sycero will not complain. This leaves a certain flexibility, but a "File not on the system" warning would be useful.

One nice touch is that you can supplement each descriptive prompt line in the menu with a second line that will appear immediately before the program is run. So the user has a chance to duck out if the wrong program has been brought on-line by mistake.

Program generation is the simplest part of it all, and your only decision is whether you want the Rem statements integrated into the code, put in a separate file, or omitted altogether. The program generation routine lets you know the various phases — Files, Channel Allocation, Logic and so on — that it is going through, and reports on the final size of the program. It crunches down the generated ASCII text file into tokenised binary format, a phase that takes longer than program generation itself.

Once a program has been generated, making alterations is conceptually easy but by no means quick. You will have to go back over each option in the main Sycero menu, changing where necessary your screen definition, screen processing, program definition and report definition changes. Any of the other programs in the suite affected by these changes must then be regenerated.

Programs created in this way can be run from Sycero or given an independent existence. Basica — or in the case of the Olivetti, GWBasic — will be needed, and so will System-C's Csam routine, which is locked into the operating system by running the program Csam2.Com.

Obviously this file will have to be provided with every program suite, and System-C is happy to allow copies to be made for this purpose, as the intention is that all Basic programs generated under Sycero can run free of System-C copyright. Sycero purchasers are also free to use Csam outside Sycero as a file handler in its own right. Later versions of the package will take the screen handling out of Basic too and make it another external module, available for distribution in the same way as Csam2.Com.

Some impressive features are built into the generated software. As in dBase II the cursor keys move the cursor around the input screen, and insertion, deletion and overwriting were available for editing entered fields. Error reporting was fulsome: when I tried to send a report to a non-existent printer an inverted-video error message gave the option of retrying or abandoning the report. Hitting Escape in most cases worked as predictably as in Sycero itself, allowing a retreat to the next highest level of the menus.

To take advantage of the built-in automation you have to accept certain awkward methods of working: options referred to numerically rather than more memorably by letters; error messages appearing on the bottom line of the screen; empty fields delineated by angled brackets and marked out in underlines, only visible when the cursor moves into them; and so forth. If these features do not suit you they can, in theory, be changed by dabbling with the Basic source code, but such modifications are likely to be time-consuming.

My first assessment of Sycero consisted of getting it to do something simple: the telephone number and address system that forms the first exercise in the *Example Manual*. At this elementary level the hoops Sycero puts you through are out of proportion to the modest result. Following the example took four hours, and the code generated to update and search a flat file was vast — some 100K in all. The same thing could have been knocked up in dBase II in about 30 minutes.

Progress through the telephone number and address example was bogged down by a series of trivial disparities between the *Example Manual* and the way the software behaved. Most of these turned out to be covered by an errata page, which itself contained errors. But some features still left me puzzling. During screen configuration, for example, Control-H was supposed to bring up a Help screen, but it behaved as a destructive backspace. And the wodge of code at the end of the process made it obvious that flat-file handling was not Sycero's main strength.

Thoroughly documenting a system can be almost as time-consuming as writing the code, but here Sycero really triumphs. It keeps track of everything you do, allowing you to print out a thorough, well-commented audit trail of every stage of the development.

It might just be my general allergy to Basic, but I didn't enjoy reading through the source code itself. Microsoft Basic has always allowed long physical lines to be formatted into paragraphs by the insertion of Linefeeds, but Sycero doesn't take the trouble to do this. Instead, logical program lines are gathered into long lines that sprawl across the screen and sometimes wrap around the terminal.

Subsequent fine-tuning will probably be by way of Sycero, although in theory the advantage of a program generator is that the code can be maintained by Basic programmers. The courteous comments embedded in the code or hived off to a separate file, and the way the code is structured into handy-sized, easily maintainable modules, seem designed to allow this sort of low-level maintenance.

Conclusions

● Sycero is a beautifully designed and thoroughly versatile system for generating Basic programs to run on the IBM PC and its near relatives.

● At £600, for simple flat-file handling there are better and cheaper ways of doing the job. Sycero's strength lies in business-like real-world database management.

● Progress is slowed down by the slippage between the documentation and the way Sycero really works.

● Basic has inherent disadvantages. For example, every time you enter Basic to run a generated system you have to tell the interpreter the number of files you intend to open and the maximum record size, to make sure these are not larger than the default allows. Sycero ought to create a .Bat file that sizes Basic appropriately before running the system.

● Basic programming is also less productive than programming in a dedicated database language like dBase. Sycero goes a long way to make up for this by providing its own compact and structured command language.

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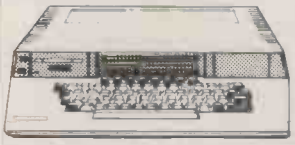

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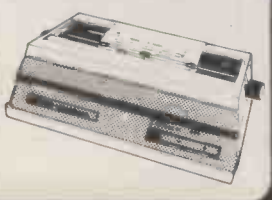

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Well, not a computer exactly. If you fit the profile above, you will probably not be involved in repetitive routine operations, and the chances are you have so far found personal computers disappointing or irrelevant in your job. What ICL wants to sell you is the One Per Desk — essentially a telephone with ideas above its work station.

To date 400,000 IBM PCs and 300,000 other-brand desk-top computers have been installed in British industry. Another 250,000 screens are expected to be installed in the U.K. in the next 12 months, and ICL wants that business, if only to regain ground lost during the less than modest success of the ICL PC, the badge-engineered version of Rair's Black Box. So a team of about 50 inside ICL has spent £10 million over the past 18 months researching, designing and tooling up for a low-cost machine aimed specially at the fragmented task hopping of the professional general manager.

The research, undertaken in conjunction with Warwick University, showed that managers' time is mostly spent in spoken and written communication: telephoning, meeting and report-writing. The rest of the time they are searching for information, often wandering down the corridor to interrupt somebody else's work to find it. As interrupters and interruptees there are few opportunities for managers to settle down to long periods of concentration. What is needed is a device that is fast on its feet and can switch from job to job as quickly as the human brain. It should be easy to learn to use and offer desk-to-desk and worldwide communication without expensive special networks.

Sinclair elements

Early rumours suggested that the OPD was to be a badge-engineered QL, but it turns out not to be. ICL says that apart from a slightly modified SuperBasic only three Sinclair elements have been carried across from the home machine: the Microdrives and a pair of uncommitted logic arrays; the other two ULAs in the machine are ICL's own design.

Like the QL, the OPD also draws on the talents of the software house Psion for its spreadsheeting, word processing, file handling and graphics facilities. On the OPD the Psion suite is more than the Archive/Quill/Abacus/Easel bundle offered with the QL, and very nearly amounts to the high-powered and unified Xchange version available on the IBM PC.

The advantage over both is that the OPD carries the application packages in ROM so that they can be pulled in almost instantaneously, making the exporting and importing of data between the four elements very fast and painless. The applications packages can be interrupted at any point to switch over to the telephone facilities, resuming in the same place when the communication is over.

One Per Desk — a glorified telephone?

The OPD looks like a computer with a telephone grafted on to the keyboard. You can autodial from a phone list held in RAM and send voice or electronic messages internally over the PBX or to the outside world via the telephone line, quickly scanning and recalling any of the last six phone numbers dialled. The machine copes with the three most common baud rates, and understands Prestel graphics. When you knock off for lunch an electronic voice with a vocabulary of 152 words can be programmed to let called know when you will be back.

ICL says its operating system allows multi-tasking, but this opportunity is not seized by the Psion software. Print spooling allows printing while using Xchange — although this was not fully implemented at the demonstration — but you cannot run the spreadsheet while searching the database.

Because the OPD is not a general-purpose micro it will not run the old favourites like WordStar and Lotus 1-2-3. Nevertheless ICL conceives it as an open system, and will provide full documentation for independent software vendors to create their own packages for the OPD, and will be offering a development add-on ROM for the purpose.

In the U.K. ICL expects to sell to 600,000 general managers in the near future. At around £1,200 for the monochrome version or £1,800 for colour, that represents the largest single business market it has ever attacked. The company is also looking for foreign distribution via major distributors, with badge engineering, redesign and possible local manufacture. But if they hope to sell to France a nom-de-plume will be necessary — to the Gallic ear OPD sounds like a slur on the customer's masculinity.

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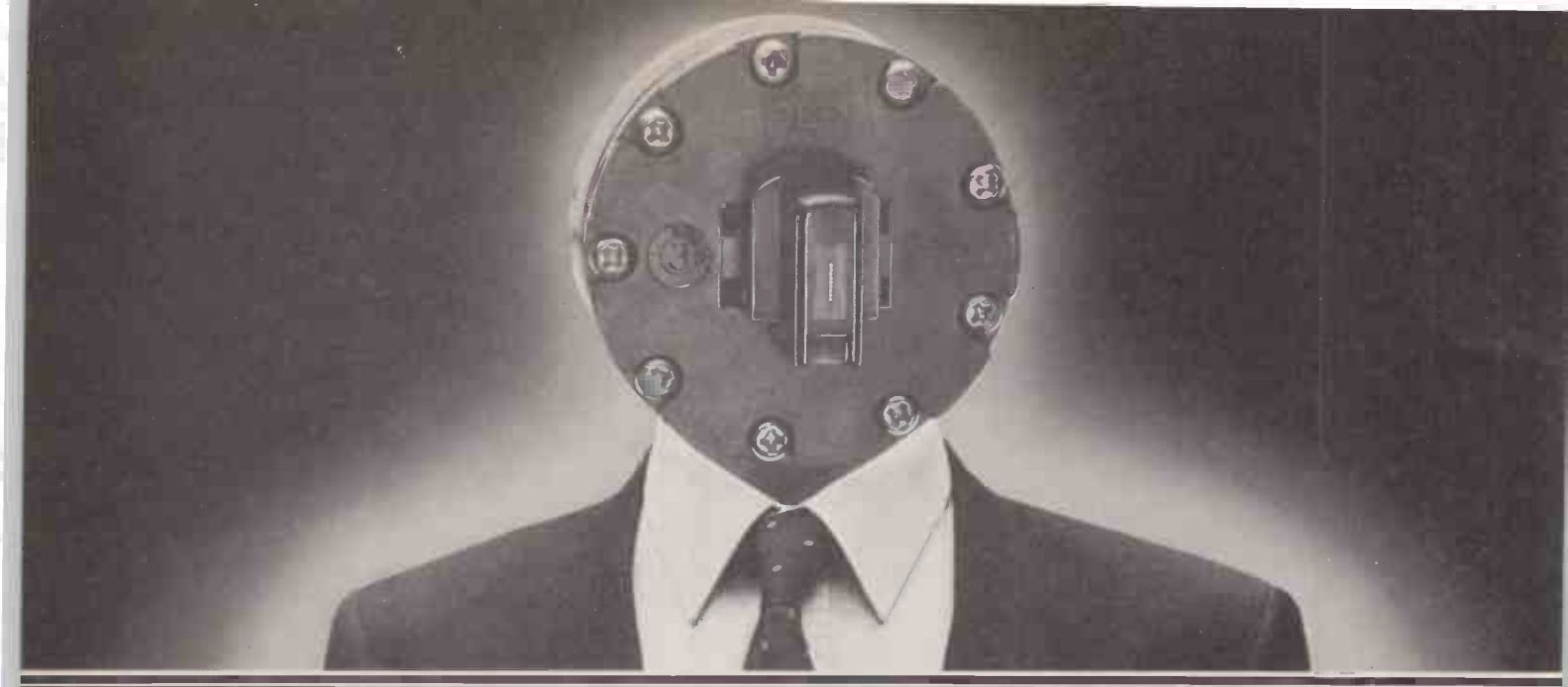

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Gazing into the crystal VDU

John Dallman speculates on what computer games of the future may have to offer.

THE FUTURE of games is not an easy subject for prediction. In an area where the most important asset is ideas, and a new company can make millions in its first years, great effort will go into trying to be unpredictable. However, out of these fashions and the more predictable path of advance in computer technology, it is possible to make some forecasts of future trends in games.

The first field of computer games to come to wide attention were the arcade games, so much copied in home-computer software. The first of these established some general themes that are with us today: attempts by the player to predict the movements of blobs of light on a screen so that they can either be batted, as in Pong and Breakout, zapped as in Space Invaders, or dodged as in Dodgems and Pacman.

Such games were used for very practical reasons, in that they could be presented on low-resolution screens using little memory and simple programs. An amazing amount of ingenuity has been used on elaborating these ideas, and on promoting the products resulting from them. The range of enemies capable of zapping, eating or simply smashing themselves into the player's representative beggars the imagination, as does the number of areas of outer space populated entirely by assorted hostile races.

Cheaper memory

The price of computer memory has halved every year until recently, allowing high-resolution colour displays. This, together with advanced display-generation techniques, such as the vector-graphics techniques of Tempest and its descendants, has meant that the technical elaboration of games has continued. Now there are games such as Defender, and amplification of the Asteroids theme, and Mr Do!, a more complex version of Pacman.

The quest for greater visual appeal has brought the video-disc game into the arcades, but without any advance in theme. Currently the best around is a Star Wars/Death Star game, with solid-looking backgrounds, enemy ships and film of real explosions to signal a hit. Video discs have considerable potential, and when techniques for putting games — including computer-generated images — on to them have become more established this potential will be realised.

The other main group of primarily visual computer games are the simulation games, typified by Atari's Pole Position. They tend to be less fun in the arcades, because a game has to end as quickly as the violent games to be commercially viable, and having a game just come to a halt is far less satisfying then being shot out of the sky/water/ground. Such games need good graphics to work at all, and will use video disc more widely very soon.

Simulation games are doing much better on home computers, where simulations of long processes such as aeroplane flights are practical. Flight simulators are becoming very popular, and will be able to develop on current hardware for some time. This type of game is the most obvious target for very powerful personal computer, based on CPUs like the National Semiconductor 32016, the Motorola 68000 and their descendants.

Such machines, with the power of the super-minicomputers like as the DEC Vax, now used to control professional simulators, should become available in a few years, and reach the home market soon after that. They will provide simulations of a quality now used for training aircraft crews, one IBM PC flight simulator is already recognised by the U.S. Federal Aviation Authority as capable of contribution to pilot training. Doubtless more will follow.

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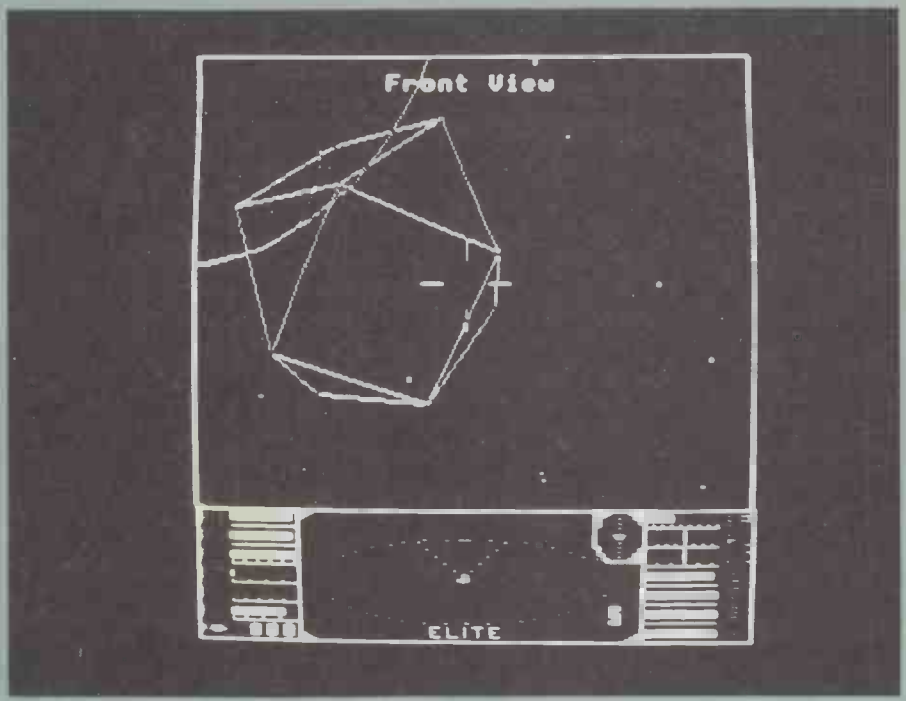


Elite: a new game for the BBC Micro; and one likely to last.

(continued from previous page)

The games most popular for home computers are, of course, adventure games. They were invented on mainframe and minicomputers, beginning with the orginal Fortran Adventure on IBM mainframes, where the processing power available to an individual player was usually about the same as on an eight-bit micro. The disadvantage of the micro is in its limited memory, and the lack of fast disc access that would allow descriptions to be stored in text files, instead of within memory.

In general, adventure games are the target for advances in application of software techniques, mostly in natural-language input and artificial intelligence. Natural-language programming enables the player to give commands without having to follow a rigid command format. AI is used both in comprehending this input, and to create other characters within the game, each capable of taking independent action.

The use of graphics to illustrate scenes from the adventure has also been very successful, most notably in games like Lords of Midnight with thousands of scenes. The first games to combine a significant degree of AI with graphics were The Hobbit and Valhalla. Both set very high standards but were limited by shortages of memory and graphics resolution.

Limited RAM

In selecting a machine for sophisticated adventure games, memory capacity is the most important feature, and may prove more important than sophisticated design. For example, the BBC Micro version of *The Hobbit,* despite being a very fine adventure game, had very little success because it had no graphics due to the BBC's memory limitations. The Sinclair Spectrum and Commodore 64 are less sophisticated machines, but they have more memory and consequently better adventures.

Memory limits are being overcome by the greater use of floppy-disc based games, with the U.S. market leading this trend. The trailblazing company in this field, Infocom, produces adventures far larger than those possible in a cassette-based system, and it is to be hoped that this trend will spread. The advent of 16-bit home computers, of which the Sinclair QL is only the advance guard, will speed up this process with larger memories and better disc or tape storage.

The influence of role-playing games like Dungeons and Dragons has been noticeable for some time in a few isolated games, such as Wizardry for the Apple II. These differ from the normal adventure games in being at least partially random, with a wide range of possible creatures and treasures to encounter. The encounters are not fixed, but are generated by the program and are different each time.

Other than complexity, the main reason the games have not caught on is that they do not simulate the thought processes of a human refereee very well. They tend to show their random origins rather than the deviousness of a good games-master.

A reappearance of the theme may be about to occur with Rogue, the most popular game for the Unix operating system, which was recently translated for the IBM PC. However, this style of game will not succeed in impersonating a human referee until some very large advances are made in AI, although some of the failures remain quite fun to play.

A species of war-gaming has already become available on micros, of which the best example is Eastern Front for Atari machines. The processes involved in playing such battlefield simulations are simpler than those of a role-playing game, and these games are accordingly successful. Again advances in AI are the main line for improvement, although the effort put into this field by software houses will be limited by the small market.

The search for themes for adventure-related games has spread into one of the largest sources of ideas around: written science fiction and fantasy. The Hobbit may well have been the first piece of "bookware" to reach a mass market, but it will not be the last.

Mosaic Publishing is producing adventure games based on stories by Colin Kapp, Ian Watson and Harry Harrison. Also Baen Software, which is headed by Jim Baen, a notable SF editor in the U.S., seems set to bring out games based on most of the books published by Baen Books, an SF and Fantasy publishing house.

Acornsoft has recently produced Elite, a graphics adventure game of interstellar trading, for which a novel has been specially written. Also a series of computer programs is being produced, based on the best-selling *Fighting Fantasy* series of games books. The first of these, The Warlock of Firetop Mountain,' was not very well received, but Eureka, from one of the same authors, looks highly promising.

In spin-off games not based on books, there are adventure games based on *Monty Python and the Holy Grail* and a *Star Wars* arcade machine. A game based on the SF television series *The Prisoner* is attracting very favourable comment in the U.S., and must be expected here soon.

A trend appears to be starting to base games on popular strip cartoons, with the appearance of games based on *The Hulk,* from Scott Adams, and the *B.C.* series by Johnny Hart. No announcements have been made at the time of writing on the subject of a *Peanuts* game, but it can only be a matter of time.

Computer games have a vast, if as yet unrealised role in education. Most of the educational games presently on sale have the same problem: they try to do the teacher's job. Teachers generally prefer to do things their own way, but some designers are finding ways to satisfy them. Coventry schools are using adventure games in French lessons to give practice in the use of written language in a field that children are interested in. These games are being written by teachers at present, and form a promising and untapped market for software houses.

Education

Games could also be helpful in the education of remedial children, who might find the responsible, obedient micro easier to learn from than a teacher beset by demanding pupils. Atari has done valuable research in this field, and it must be hoped that it has not been discarded in Jack Tramiel's reorganisations.

A new field is opening in computer games with the increasing popularity of

The search for new themes has led writers to books, as in The Hobbit.

computer communications by modem. Gaming by post is a widespread and long-established hobby. It is run by organisations ranging from pure amateurs, where the range of games extends from chess and Diplomacy to snowball fighting, to the computer-moderated war and trading games run by such companies as KJC Games with Crasimoff's World and ICBM with Feudal Lords.

Bulletin boards

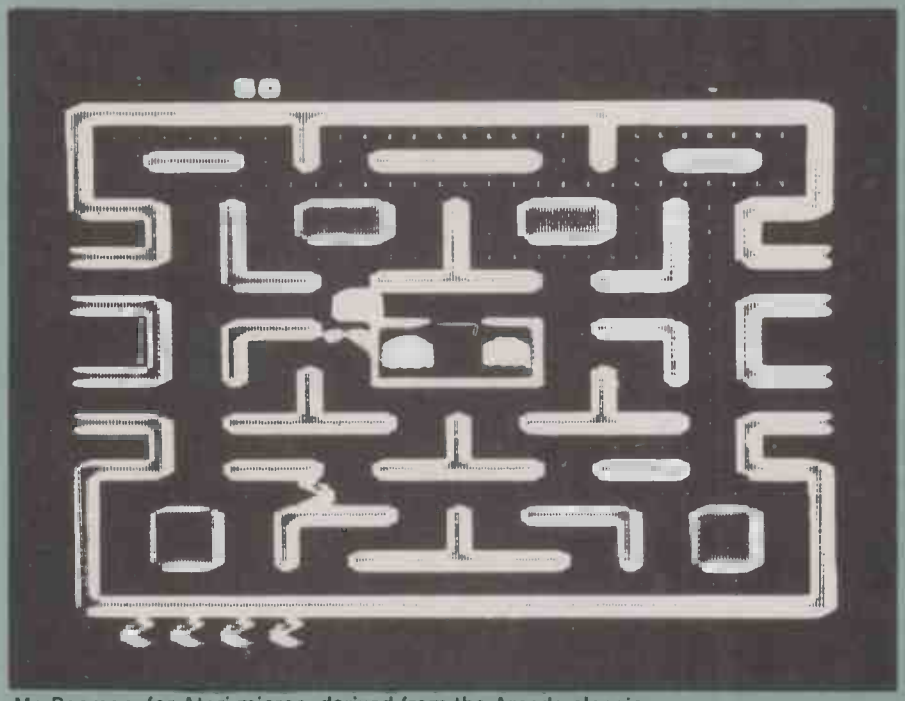
A simple bulletin board system can reduce the turnaround time for such games from days to hours, even without links into the computer invigilator. A step up from this is already available in the U.S., where it is possible to log on to a timesharing service, so that your micro behaves as a terminal on the mainframe being used, and play against other users in real time. The main disadvantage of such a scheme for the private user is its cost, since you have to pay for phone time in addition to a share of the cost of the central computer.

One example of such a system has existed for some years in this country in the Essex University Multi-user Dungeon, Mud, see page 92. This system provides independent characters within an adventure-game setting at a stroke, by allowing many players to participate in the same game being played on the university computer.

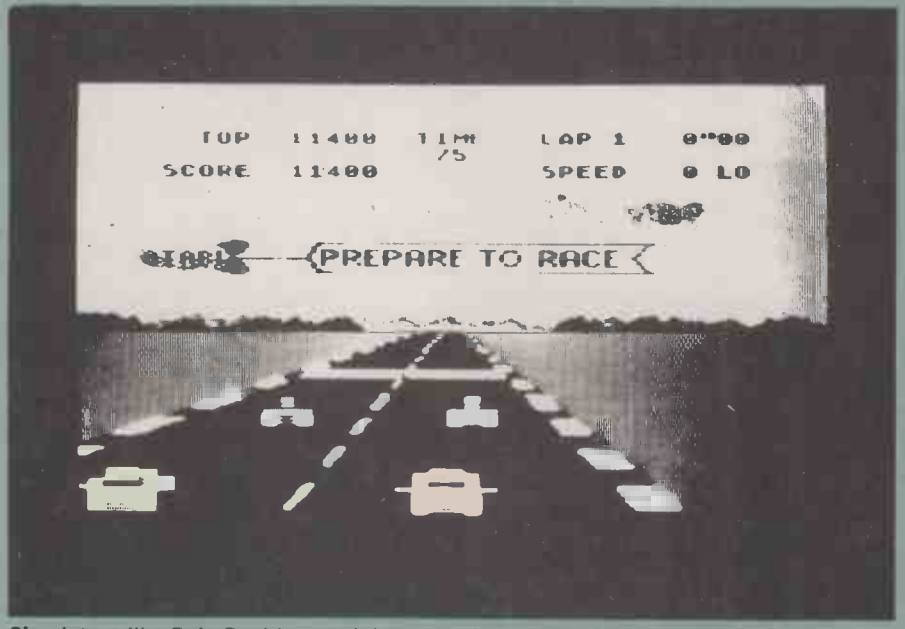
The game is also available outside the university, through the British Telecom Packet Switched Service and, for Commodore users, through Compunet. The same idea could be applied on a local area network, and has been implemented for the Spectrum. Sadly, this does not use the Sinclair network, but relies on the players saving their games on cassette after each turn, and passing them to a referee for adjudication of their actions, which leaves plenty of opportunity to cheat.

Cable television also has great promise, offering very fast data channels over which software can be downloaded, similar to the system already available through Prestel and teletext. Thorn EMI plans to offer a software channel in its cable TV service, which will transmit 5,000 standard teletext pages every second, with dozens of programs available.

This is accomplished using full-field teletext, where the whole of a television channel, rather than small gaps between TV frames, is used for teletext transmission. The system does not offer two-way communication, and hence does not allow competitive game playing, but this could be achieved with users sending data back by modem.



Ms Pacman, for Atari micros, derived from the Arcade classic.



Simulators like Pole Position work better on home micros than in the arcades.

Novel inputs

The least predictable line of change is in new forms of player input. Techniques to make input more powerful are developing rapidly: joysticks have elaborated from simple switches to track-balls and gravity-switch systems, and the first cordless infrared device has appeared in the form of the Rat from Cheetah Marketing. The next significant development could be a system for sensing hand gestures.

Software techniques for input are almost limitless, with an example of a new form being The Great Space Race, from Legend. This is a mixture of adventure and arcade ideas, where the player's actions can be suggested by other computer-generated characters in the game. AI can do a great deal to extend this technique, although the lateral thinking required for puzzle-solving adventures may well give problems.

The future of computer games appears to lie in new ideas for games and techniques as much as on more powerful computers. Nobody can predict the new ideas, but quite a bit can be forecast regarding the technology and the way it will be used. Of the areas in question, AI, communications and interactive graphics are some of the topics addressed by the current fifth-generation projects such as the E.E.C's Esprit and the U.K. Alvey Project. These schemes supply grants to projects intended to advance techniques in software and in VLSI. Most such funds are going to large companies, such as GEC, Logica and British Telecom.

But programmers are a breed very fond of working for themselves rather than in large companies. The new face of computing that these projects aim to create might well be seen in the arcade and the home before the office or factory.

Making the right move

Tony Harrington recommends some computer chess programs.

THE LAST YEAR has been a vintage one, at least as far as computer chess programs are concerned. The best packages of previous years are still available, new programs have appeared, and others which are just about to are significantly stronger than the previous generation.

We are a society raised on the belief that every consumer has the right to expect a massive range of alternatives in every product line. Unfortunately, how much choice you have in the selection of a chess program depends very largely on which machine you own. But fortunately, choice is not as important as simply having something reasonable available.

Price advantage

One of the perennial questions asked about chess programs is: How do they compare against the dedicated chess-playing machines, provided by firms like Fidelity, Hegener and Glazer, Scisys, Novag and Conchess? Good chess programs have several advantages over the specialised machines, the most important being the price. Chess programs tend to cost between £5 and £50. Dedicated machines have become a lot cheaper over the last two years, but the good ones start somewhere around the £150 mark.

Aside from price, the major advantage any computer chess program has over a dedicated chess machine is the instant-reply facilities made possible by the screen-based graphics display. Nearly all chess programs allow you to replay the entire game up to the last move entered and give you the ability to set the speed of the replay by specifying how many seconds should elapse between each move.

The benefits of this feature cannot be exaggerated. It provides an overall picture of the game so that you can see where you or the computer went wrong. So much of chess is memory work, and the replay facility makes it easy to memorise opening lines. You can replay the line as much as you like. With most programs you can step back to any position, so it is also a great way of exploring and memorising variations.

Of course, you can replay games with the chess machines too, but it is much more tedious. You have to pick up each piece manually and make each move of the replay on the board under the guidance of flashing display lights. In this respect, the animated graphics of computer programs are hard to beat.

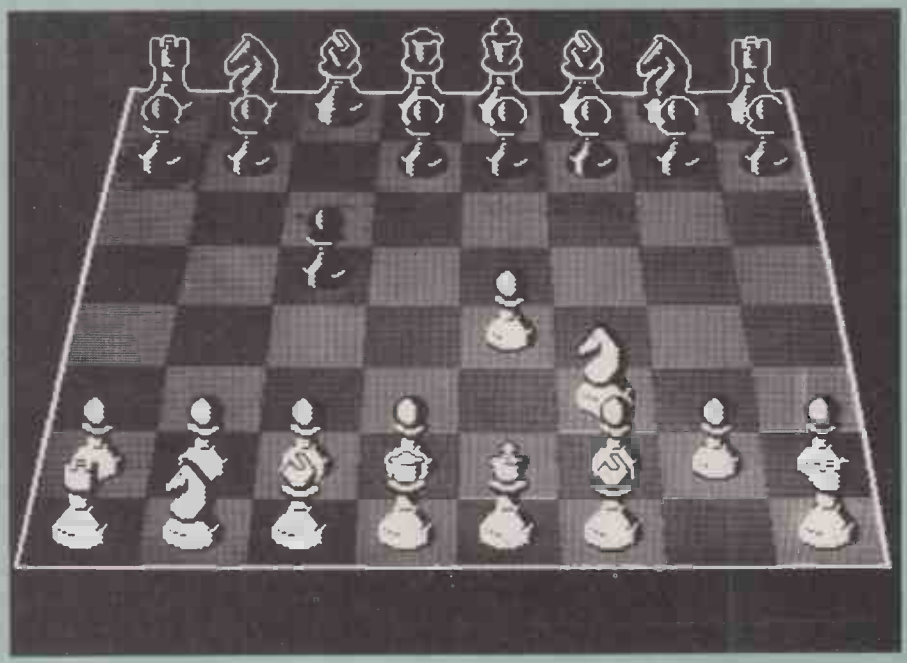
In the past, the real disadvantage of the computer programs has been that they played weaker chess than the dedicated machines. This is still largely true, but the level of chess played by the leading designs has improved so much that for most chess players the computer chess program will be strong enough to meet their requirements.

For example, Psion entered a program called Psion Chess, designed for the QL but actually running on a Sage, in the 1984 World Microcomputer Chess Championships. The program had one or two lucky breaks but it achieved joint first position with three dedicated machines, an unheard-of achievement.

The story behind Psion Chess's success reflects the change that is taking place in chess software. In the past, nearly all the commercially available software for micros has been written by amateur programmers working on their own with limited resources. The amateurs were very hard put to compete against the resources behind dedicated machines like those from Fidelity or Novag. But Psion Chess, instead of being developed in someone's back room on a ZX-81, drew on the full resources of a large software house.

Throughout its development the programmer, Richard Lang, had his QL interfaced to a Vax with the full power of the Vax's programming environment at his disposal. Lang was able to get on with honing the algorithms and tuning up the program's playing strength while a separate team designed the screen graphics. The result is the excellent three-dimensional graphics on the QL version of the program, which come as close as anything can to providing a screen display that actually presents an over-the-board view of the game.

Chess programming is such a specialised art that one of the best ways of selecting a package is to find out who the programmer is. Two programmers who have received a certain amount of publicity and who have improved with each published program are Richard Lang and Martin Bryant. Bryant has two commercially



Psion's powerful program for the Sinclair QL also sports outstanding graphics.

available programs, one for the Commodore 64 and one for the BBC model B.

In the U.S., with their Sargon chess programs for a range of micros, Dan and Kathy Spracklen are worth following. The Californian distributor of their programs, Hayden Inc., entered IBM and Macintosh version of the latest Spracklen programs for micros, called Sargon 4.0 in the Fourth World Microcomputer Tournament. The programs were slightly weaker than the dedicated machines opposing them, but they achieved creditable scores.

Bryant's first commercial program was White Knight Mk 11 for the BBC model B, Bryant sold White Knight to the BBC Software Publications for the BBC model B shortly before the 1983 PCW European Microcomputer Chess Tournament. The BBC entered White Knight for the competition and it won the home-computer section comfortably. It is still on sale and a good buy, though BBC Micro owners should note that a substantially stronger White Knight Mk 12 should be released in January or February 1985.

Shortly after the Third European Tournament, Bryant sold another chess program, Colossus 2.0 for the Commodore 64, to CDS Micro Systems. According to Bryant, Colossus wins an average of two out of three games against White Knight Mk11. Moreover, as well as being stronger, it also has better features. The manual consists of 14 clearly laid-out pages. It covers all the features clearly and concisely. The board graphics are neat, and the colours of the squares and the background border can be set by the user. As well as the graphics display, there is an excellent status screen. The user toggles between the display and status screens by pressing the space bar on the keyboard.

One important function of the status screen is to show the elapsed time on the program's built-in chess clocks. Since chess clock costs £15 or more, the fact that they come as part of the program is worth remembering. These clocks perform like the real thing and you can see the elapsed time for yourself and the computer displayed at any time during the game.

Colossus's status screen displays the number of positions currently examined by Colossus when it is its turn to move. The two left-most figures on this counter revolve at an amazing rate. More usefully, this screen also shows the best line found so far by the program, up to its current look-ahead level, which is also displayed.

Like all chess programs and machines, the program has a number of different playing modes, based around the amount of time taken to respond to your move. Colossus has six playing modes, ranging from instant response, through tournament level to problem mode. In practice, since mode 3 allows you to set any clock setting, there is an endless set of playing levels. Most important, the program clock can be set independently so weak players can give the computer a time handicap. Strong players can try handicapping themselves by giving the computer more time.

One of the good things about the design of this program is that all numeric input, even the clock setting, is done by pressing the Up-arrow key to increase the default number and the Down-arrow key to decrease it. It is also extremely easy to clear the board of all pieces and then set up whatever position you want.

The more sophisticated chess programs now have a good problem-solving mode. Colossus will solve problems up to mate-in-seven. This limit cannot be exceeded because the program has a maximum look ahead of 14-ply. Also the program recognises self-mate problems as well as the more standard variety. As the name implies, self-mate is where White has the first move and tries to mate itself in the shortest possible sequence. Bryant claims that this is a first for Colossus, and I am not aware of any other program that recognises self-mates, or help-mates as they are sometimes called. Also to its credit, Colossus, unlike almost all other home-computer chess programs, recognises and can use underpromotions.

Commodore owners have an alternative in Audiogenic's Grand Master program, written by the West German firm Kingsoft. There are versions for the Vic-20 as well as for the Commodore 64. But my pick would be Colossus 2.0.

The hardest machine to make a clear recommendation for is the Spectrum. There are several programs available; two worth considering are Cyrus IS Chess by Intelligent Software and Spectrum Chess II by Artic Software. Both are slightly aged programs, having been released in early 1983, but they have reasonable tournament records since they both participated in the 1983 PCW European Microcomputer Championships.

Tournament win

Cyrus IS is the better packaged of the two, with something resembling a user manual instead of the traditional method of printing the instructions on the cassette cover. It also has the advantage of having been written by Lang. It was based on an earlier program of his which won the 1981 European tournament.

Atari owners have the choice of five programs, of which Atari's own cartridge is the weakest. The Parker cartridge is actually Cyrus, from Intelligent Software. The three disc-based programs are Sargon II, the old faithful, Mychess II from Datamost, which has three-dimensional graphics, and Larry Atkin's Odesta's Chess. Atkin has a solid reputation as a U.S. chess programmer, having been responsible for the design of Chess 4.7, the North-Western University program which won the World Computer Chess Championships several times in the early seventies. The same program is also available for the IBM PC.

IBM PC and Apple Macintosh users will be delighted to know that there is a Sargon 3.0 program available for these machines, and that Sargon 4.0, the version that played in the Fourth World Micro Championships, should be out shortly.

In addition to chess programs, several computer-based chess tutors have been released. They start with the basics — for example, how to tell a pawn from a rook — and work up to complex middle-game tactical concepts like discovered checks, pins and skewer attacks. Easily the best of these is Chess Master for the Sinclair Spectrum, by Serin Software, prepared in collaboration with U.K. Grandmaster Tony Miles. Two commentary tapes give you move by move instructions as you work through the program.

The latest Sargon program emerged creditably from the Fourth World Micro Tournament.

Glorious Mud

Richard Bartle believes there's nothing quite like Multi-user Dungeon.

IN THE December 1983 issue of *Practical Computing* I introduced the world to a new kind of adventure game, called Mud. The essence of the game is that rather than wandering around the environment all by yourself, killing evil damsels and rescuing dragons in distress or whatever, you find yourself in a land where there are real people with the same aims and objectives that you have, and with whom you can communicate and interact in any way that is reasonable for that particular world. Mud stands for Multi-user Dungeon, because more than one person plays in it at once. The normal sort of adventure you buy in the shops is an example of a single-user Dungeon, or Sud.

Whereas at the moment Suds dominate the intellectual end of the home-computer games market, the probability is that within the next few years they will be superseded by Muds. Although Muds are as yet in their infant form, unless British software producers wake up to the fact that such programs are where the future lies in the games world, they will lose the market lead they currently enjoy in the area. Moreover, if they leave it too late they could well find that they have been overtaken permanently.

Expansion

Since the December article was written, Mud has continued to evolve, expanding in both the size and complexity of the world in which it allows players to roam, and in the power of the interpreter which runs and manages this world. It has continued to give greater insight into how the adventure games of the future will look, and provide new software technology to help pave the way to creating such games.

Since autumn 1983, Mud has been opened up to players external to Essex University where it is sited. Anyone can play the game for as long as they like, provided that they satisfy the criteria of being nocturnal and immensely rich.

The nocturnal requirement is because Mud runs on the University's DEC System 10 mainframe, which not unnaturally the University tends to want to use rather heavily itself during the day. Outside users are allowed on free of charge from midnight to 7a.m. Players have to be quite well off because British Telecom does not provide a free service to use its phone lines. There are two ways to get to a remote computer from your home: dialling it direct or using a network.

The vast majority of Mud's external users use PSS, the Packet Switching Service run by BT. This is mainly because it is cheaper — only the cost of a local phone call in most cases. Of course you need to have an account on PSS, which is around £25. Also you do have to pay a charge on each packet of data sent, which can add up, but it is still far less than the cost of a long-distance phone call. Other reasons for using PSS are because of its faster baud rate, 1,200/75 versus 110/110, and the ability to contact other systems, such as Prestel.

Despite the hours being inconvenient and the expense involved, people are coming in droves to play. Almost as many people off-site have achieved the ultimate objective of becoming wizard/witch as have people on-site — and it has been available internally for about eight times as long. Not that it is unplayed by the students, but they are only allowed to spend about four hours a week maximum on the DEC 10, and since academic work is supposed to take up all that, it takes them longer to reach wizard. On the other hand, external users start playing at midnight, and do not stop until the machine is taken away for house-keeping the next morning.

Now Mud has been exported to other sites. It has been adapted to work on a DEC 20, which is also probably a bit expensive to find as a free gift in a packet of cornflakes, but not so bad as a DEC 10. There are a few minor changes which need to be made, including one to the DEC 20's DEC 10 emulator — but they are not too devastating.

Being as out of this world as it is, if Mud could be let loose on an unwary public in the same manner as ordinary computer games it would kill the rest of the industry stone dead. There would still be those who would stay with their flash graphics games for a while, and others who would prefer the fast-moving action of the player versus random-number generator sort of game you get in amusement arcades, but everyone else would be out there having a whale of a time hacking away in Mud.

However, if it was that easy people would have done something already. Mud cannot be marketed in the same way as normal games because of the very property that sets it head and shoulders above them: its multi-userness.

To run a multi-user game you need some way for all the players to contact your computer. You also need a computer. DEC 10s and DEC 20s are not as expensive as a Cray, but they are hardly ZX-80s. Any viable system is likely to need the equivalent of quite a powerful minicomputer, say a Vax, which would not be cheap. Even the best micros could not hope to cope with the number of players you would get in even a modestly populated area, although something like a Sage might be able to handle one game by itself. So anyone who wanted to run a Mud would have to make quite an investment in hardware before they started.

Starting up

This is not the real sticking point, however. You can at least cut your losses and sell back any equipment you may have bought were your implementation to be a flop for any reason. The real problem is getting people in contact with your system in the first place. At the moment all the ways are very expensive, and little profit could be made in selling access to your

Richard Bartle is a Lecturer in Computer Science at Essex University. He is a co-author of Mud and currently maintains the program.

Play Mud on a Commodore 64

Mud has become available to a wider audience through being implemented on Compunet, the new network for Commodore 64 owners. This is possible since the Compunet also runs on a DEC 10.

To access Mud you need a Commodore 64 with the special Compunet 1,200/75 baud modem. The Compunet modem has an identity number which is checked by the system, so an ordinary modem will not do. It costs £99.99, which includes free membership for the first year. After that it costs £30 per annum. When joining, you sign a direct debit form, though you are invoiced well in advance in case any charges are in dispute.

It is planned to extend the Compunet system — and so Mud — to users of non-Commodore machines.

game if people could barely afford the phone charges.

There are two ways out of this, assuming you did want to set up something along the lines of a Mud. Either you own a network and let people play free, making your money out of charging for the time they spend hooked into it, or you find a network belonging to someone else which is realistically inexpensive or free, and you charge what you like and give the network owners a cut.

What is likely to happen is that because there are more games software firms than there are networks, the companies which own the networks are likely to make users pay some small standing charge to discourage people from having a line then never using it. They will then make their real profits by letting the software producers hook up their own systems on to the net, in return for some fixed percentage of the profits these games make. This is fair on the games people, because they are attracting people into using the network, and fair on the network people because they need to be paid for their trouble. The user would be billed by the network owners, and after they had deducted their cut the remainder would be distributed among the software people depending on how much their product had been used.

The situation now is that several cable TV franchises have already been taken up in the U.K. Recognising that although people with home computers may originally intend to use their machines for doing the home accounts and educating their children they eventually end up playing games on them, some of the cable owners have decided that games are a good idea and have decided to put them on their network. Unfortunately, their approach is not particularly far-sighted, relying on a standard machine like the Spectrum at the user end, and only using the cable lines to download software on to them. The users do not say anything back to the system at the other end. There is nothing in the technology which says they could not do, it it just the cable firms do not see any point at present.

It is obvious that such companies could make a killing if they put up a Mud on their end and let users play it from theirs. But frankly they will make a killing anyway, at least until someone else puts up a Mud and people see what they have been missing. Vested interests play their part too. Some of the cable owners are the same people who make millions selling ordinary games over the counter, and knocking a hole in these profits by making the games obsolete overnight will not go down well with the management, even if the money lost is merely being redistributed to the cable part of the organisation. Fortunately, a side-effect of multi-userness is that it can plug two large holes which already exist in the setup, namely software piracy and network hacking.

For every single game sold, it is estimated that up to 10 illegal copies are made. Some of the people making copies are doing it for backup purposes, and others would not have bought the game anyway. However, there are increasing numbers of criminals doing large-scale copying and selling them to *bona fide* retail outfits as if they were genuine. Regardless of how much of a problem you think either casual copying or organised counterfeiting is, the problem disappears with Muds. For a start, the thieves need a whopping big computer to even consider running such a game. Then they need a network, and you cannot set one up without someone noticing. Finally, you have to get other people to play to make you money, so you cannot just take it and disappear off to South America. It would be simple for the company you had ripped off to see what you had done and take the appropriate action.

Network hacking is what plagues the network owners. Although every PSS user would swear on a stack of bibles that they were using their own account, not all of them do. Quite a lot use illegal ones. What happens is some poor sod's password is leaked and they are landed with a phenomenal bill, which in order to run up on their own they would have to have been logged in four times at once continually for three months.

Cable accounts

If people were given accounts on a cable system to play Muds, there would be none of this. The point of a Mud is that you are in the thick of things, and if you let someone else use your account then when they do anything stupid, it is your character record, or persona, it happens to.

The biggest stumbling block for any company wishing to try its hand at a Mud is that they cannot be sure whether it will work out. It might turn out that the computer user in the street just does not want to know. But you do not have to spend a lot to get started, so long as you can convince someone with a network to give your product a trial.

Neither do you need a big computer. You can use one of the better micros. It may only run one game, but that is all you need to show that the product is going to be successful. Buy some more micros from the money you make from the first, and you're away. You can cut costs by linking them into a local area network so they can share the same hard disc since they are all running the same program, and any other features you may wish to make available.

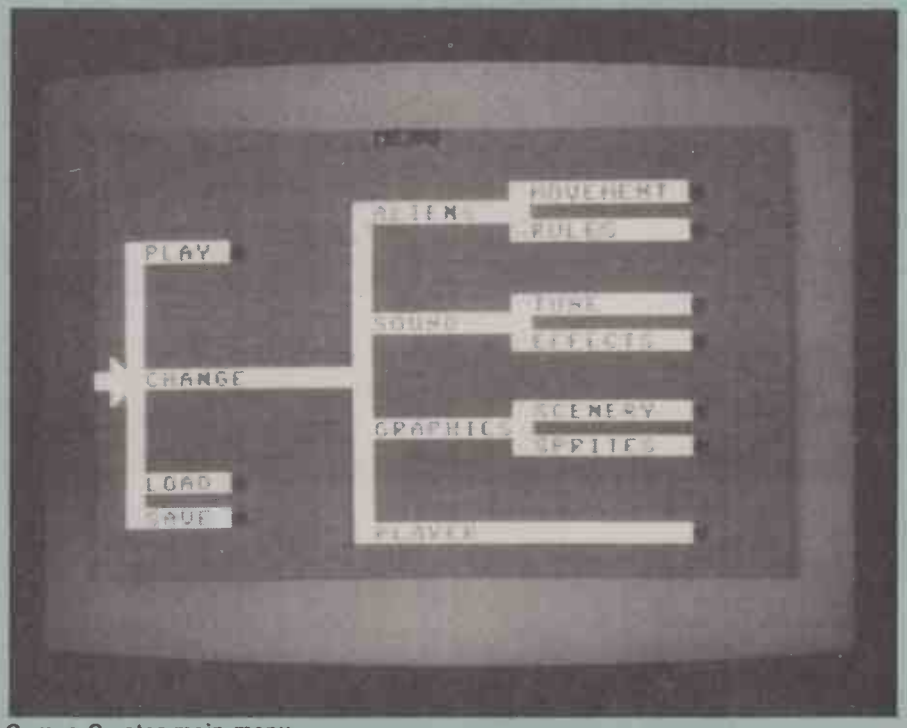
Games generators

Creating games can be a problem if you have to program in Basic. Fin Fahey checks out three of the packages which aim to make it easier.

WHEN they discover Basic, new owners often wish to use it to create arcade games immediately. But disappointment soon sets in when they discover the leisurely pace of an interpreted language. The problem is not so acute for devotees of the adventure game genre, but even then using Basic is a time-consuming affair.

So it is reasonable that software manufacturers try to develop ways around Basic. One is to write in a different language: Forth, assembler, Pascal or even an arbitrary assembler-like construction like Scope II. However, these are all general-purpose software methods and the problem is to write certain types of games. So the second solution is to use a specific games-generation package.

There are not a huge number of such packages on the market, but those that do exist may well point the way forward. In the arcade-game field, the only one which can really be taken seriously is Mirrorsoft's Games Creator, whereas adventures are relatively well served, with Dream's Dungeon Builder, and Gilsoft's Quill which are both capable of producing a marketable product.



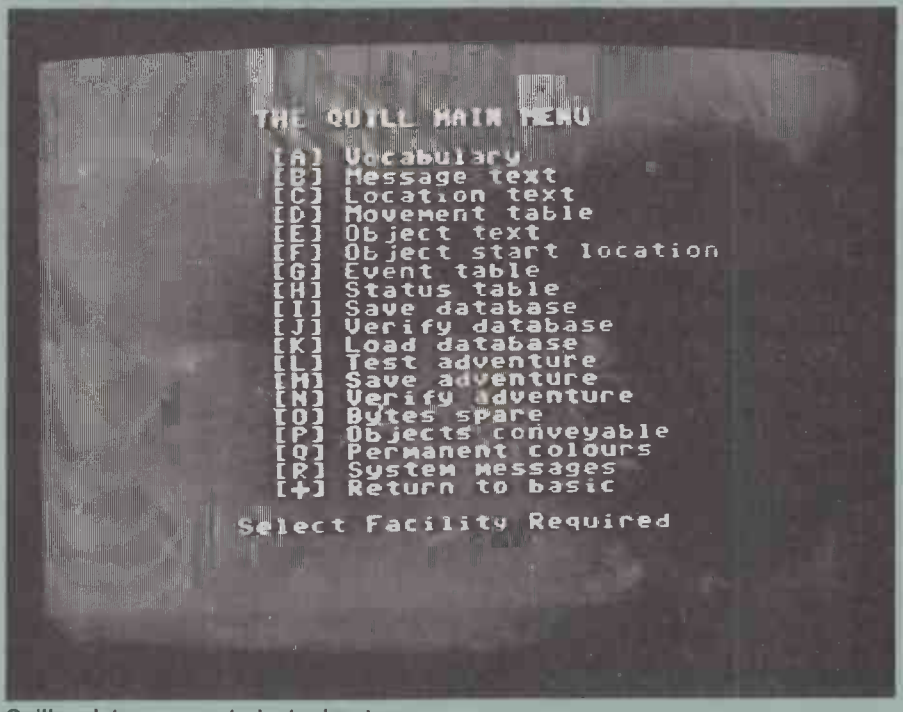
Games Creator main menu.

Arcade games

Games Creator runs on the Commodore 64 and makes full use of the sprites which are a powerful feature of this micro, but which are almost impossible to use from Basic. The package boils down arcade games to a small number of elements which can be designed separately and reassembled: sound effects and music, background scenery, and the moving elements.

The different components are selected by means of a tree-like menu screen. The tune-editing screen is excellent, and better than a number of dedicated synthesiser programs I have seen for the Commodore 64. The sound effects are linked to inevitable events such as player death, shooting, jumping and so on.

Background scenery is equally straightforward. First, a character designer allows you to design the basic elements, and then a screen designer lets you dump them where you want using the joystick. Picture elements come in three types. Some do not



Quill — lets you create test adventures.

affect the player's progress in any way, for example the background of stars you see in many Defender-type games. Others block the player's progress, such as girders and ledges, and some cause instant death if touched. This is a very acute summary of the role of scenery in the average game.

You use a sprite creator to design the animation. The 32 Commodore sprites are conceived as being arranged on a circular strip of film. Each type of entity is defined using four sprites, except for the player, who can have eight. When the entity, alien or player is displayed, all its main sprites are rippled through in order to give an animated effect.

If you do not want them to move, the sprites must all be the same. Different sprites must be linked with movement. For example, the player has two sprites for each direction, left and right, which are flipped back and forth when it moves. Further sprites give animated death sequences.

Finally, the created alien sprites must be placed on the screen. Rules of movement are then established for them so that they bounce about randomly in one small corner, or sweep across right/left or up/down.

Games Creator is well designed, and I enjoyed using it. I think a lot of people will have fun with it as a means of producing customised games full of their friends and acquaintances. There is no chance, however, of producing a Jet Set Willy or a Sabre Wulf with it. You can only design one screen, and what makes a lot of arcade games score is their size. However, there is an awful lot of dross on the games market, which could just as well have been produced using this package. Games produced by Games Creator will not run independently of it, so would-be millionaires will have to look elsewhere.

This is not so with the adventure generators, Dungeon Builder and The Quill. Apart from the designer package, both have a run-time program which allows the adventures to be run independently. The makers welcome this and there have been a lot of Quill-generated products on the market for a while.

The Quill was designed for the Spectrum, but is now available for the Commodore 64. Its maker, Gilsoft, is ambitious, and it is also being converted for the BBC Micro, Oric and Atari 800. A selection of foreign languages will also be available.

Like most games creators, the Quill is menu-driven. The great stylisation of adventure games makes it easier to see what the design elements are. First, the map of the adventure must be defined and objects must be placed in the rooms. Then verbs or actions must be defined to set up the game vocabulary.

Also, any adventure game must take account of any action, no matter how absurd, that the player may take, and Quill adventures are no exception. The actions are dealt with by setting up a codified list of contingencies which can be linked to game status flags such as "has the dragon been slain?" and to elements like an in-built game timer. This part of the process resembles a sort of interpreted database language, and is not immediately easy to use, although it is still a lot simpler than writing in Basic.

The Quill is not as user-friendly as Dungeon Builder, which is a more graphics-orientated package. The neat thing here is that you can design the game map graphically, which makes the game a lot easier to visualise. The screen displays a honeycomb of squares, and you can break down walls to link them up, or you can insert locked doors, traps, and so on.

Suppliers and prices

GAMES CREATOR
Mirrorsoft, Mirror Group Newspapers, Holborn Circus, London EC1P 1DQ.
Telephone: 01-822 3947.
For Commodore 64 only: fast-loading cassette, £12.95; disc, £15.95.

DUNGEON BUILDER
Dream Software, 18 Cromwell Road, Basingstoke, Hampshire RG21 2NR.
Telephone: (0256) 25107.
For the Sinclair Spectrum only: cassette, £9.95.

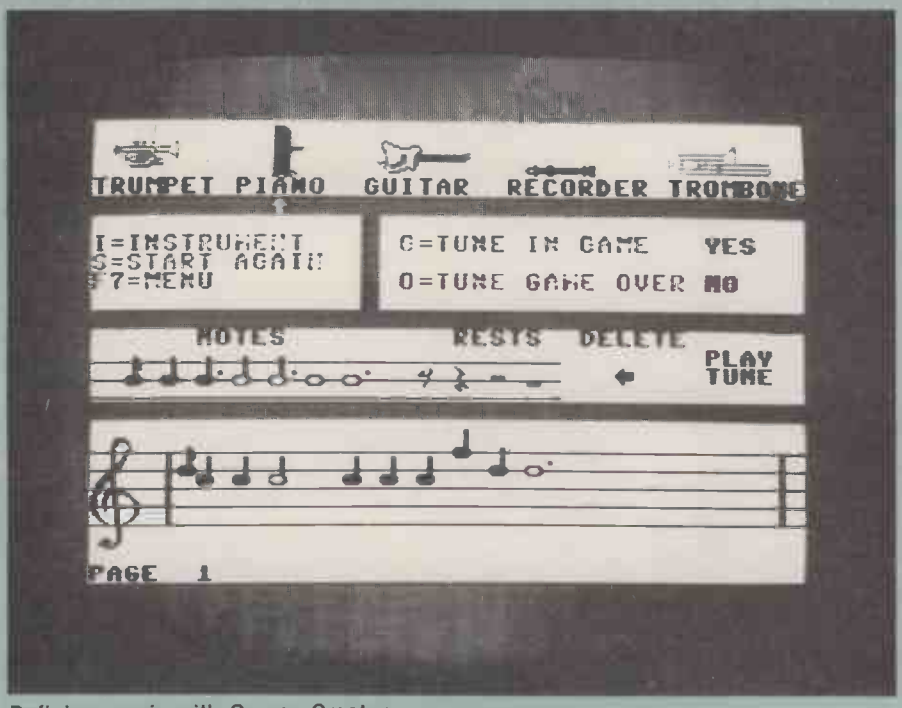
QUILL
Gilsoft, 30 Hawthorn Road, Barry, South Glamorgan CF6 8LE. Telephone: (0446) 732765.
Cassette varsions for Commodore 64 and Sinclair Spectrum, £14.95. Disc version for Commodore 64, £19.95.
The Illustrator program for the Spectrum lets you add graphics to Quill-generated adventures: available on cassette, £14.95.

The rest is, again, a matter of setting up a vocabulary and contingencies, but it is a lot more interactive than Quill, and conceptually simpler.

In addition, in line with this year's vogue for wasting memory in adventures, you can add graphic displays to the locations. These are of necessity very simple, and are built up mostly of square and triangular elements which are then filled with colour. Dungeon Builder is really a very pleasant package to use.

The adventure packages display how stylised the standard adventure game has become. With consummate ease they reduce the genre down to a small number of discrete elements. Most of the games on the market today could just as well have been produced on Dungeon Builder. The exceptions will continue to be the genuinely innovative products like The Hobbit, which involves character interaction and the use of a more natural English.

Arcade games prove less easy to systematise, and Games Creator shows up as a less serious product as a result. The industry is still innovating in this field, and it is hard to see a package keeping up with all the best-selling trends here.



Defining music with Games Creator . . .

. . . and building a background.

All-time winners

From adventures and arcade classics to realistic simulations, the most playable games around are highlighted by Jack Schofield.

1984 HAS SEEN the arrival of more games charts than good games. Like the pop-record charts from which they are ultimately derived, they all substitute quantity — that is, sales figures — for any judgement of quality. Like the pop charts they are susceptible to hype and inaccuracy, and mostly they are just plain misleading.

For a start, British charts are hopelessly biased towards Spectrum games, simply because there are more Spectrum games players than for any other brand of computer. Yet programming games on the Spectrum is rather like rolling spaghetti by hand. It can be done, with great difficulty, but the process is tedious and the results tend to be decidedly uneven. Most Spectrum games can, in fact, be classified as "pretty good for the Spectrum", which is to imply that on decent hardware they'd be rubbish.

However, most Spectrum games players are protected by a happy ignorance of all that has gone before. They missed out on the five years of continuous and intense development of games that preceded the launch of their machine. Hence they are able to greet each improved game as a breakthrough, mindless of the fact that it has nearly all been done before. Dr Johnson summed it up in his definition of wonder as "the effect of novelty upon ignorance".

Old games

To choose just one example, consider this description — from the *Addison-Wesley Book of Atari Software* — of an old Atari game from Synapse. It was written while the Spectrum was being invented. "Shamus is a real-time adventure game that combines the shoot-'em-up aspects of an arcade game with the puzzle map qualities of an adventure. . . . There are four levels, each containing 32 rooms. The rooms (which are mappable) contain dangerous whirling drones, robo-droids and snap-jumpers. These creatures must be defeated with your ion-shiv (vaporizer) before you can proceed to the next room. Some of these rooms also harbour mysterious and extra-life bonuses; and in a few, a coloured key will open more passages into the lair — if you find the corresponding lock." Remind you of anything?

For those who are interested in a more historical perspective, Scott Adams has contributed a list of notable firsts over the last eight years. Scott started writing games on mainframes in 1969 when he was 17. He was probably the first, and certainly the most successful, adventure game writer for micros when he started with a 16K TRS-80 in 1978.

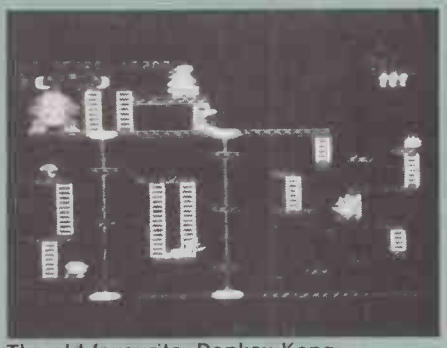
The purpose of all this preamble is not to knock the Spectrum, which hardly needs it. It is, rather, to prepare the ground for this selection of what, with due modesty, we suggest are The Top 50 Games of All Time. It is not simply a list of the latest hot-selling Spectrum games, but includes many titles that have stood the test of time. In addition, no allowance has been made for the fact that some micros are, actually, better than others, and therefore support better games.

The list was prepared in consultation with a number of leading games writers — who for obvious reasons prefer to remain anonymous — and with reference to reviews published in *Practical Computing*. In addition we consulted all the books we could find of the "Good Software Guide" variety, to see if anything had been missed.

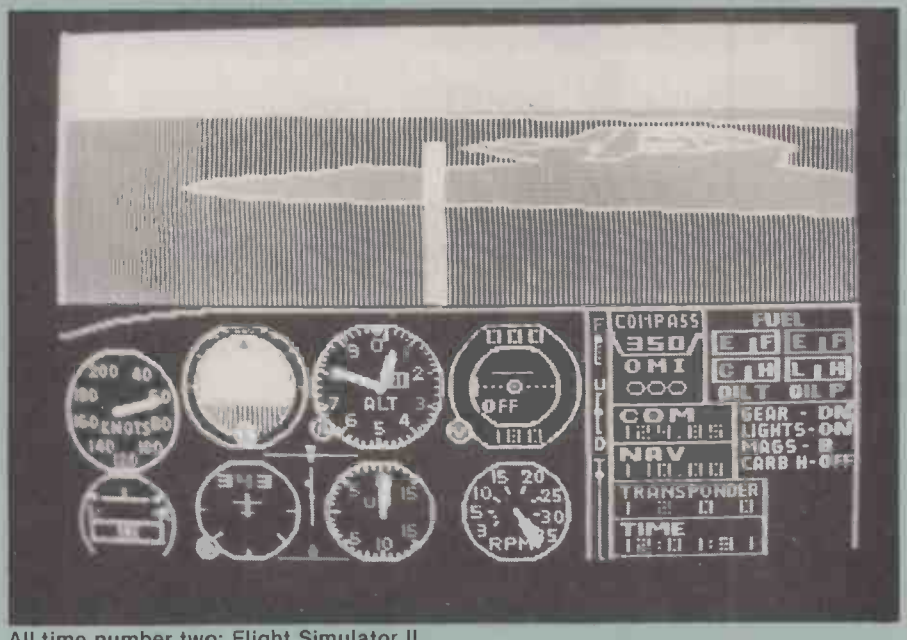
Famous firsts

Scott Adams, the founder of Adventure International, describes himself at 32 as "one of the grandfathers" of the computer games business. His own games include Adventureland, Pirate Adventure, Secret Mission, Voodoo Castle, Strang Odyssey, The Count, Mystery Fun House, Pyramid of Doom, Ghost Town, Savage Island, Hulk, Spiderman and Sorceror of Claymorgue Castle. This is his list of the top games that have also been notable for being firsts on a microcomputer in some way or other.

	Micro	First for . . .
Android Nim	TRS-80	Animation
Adventureland	TRS-80	Adventure genre
Zork	TRS-80	Full-sentence text entry
Wizardry	Apple	Multi-character role playing
Berserk	TRS-80	Arcade game
Preppie	Atari	Professional music score
The Wizard & the Princess	Apple	Graphics adventure



The old favourite, Donkey Kong.



All-time number two: Flight Simulator II.

All-time top 20 . . .

		Publisher	Type	Machines
1.	Star Raiders	Atari	Star Trek	At
2.	Flight Simulator II	Sublogic	Simulation	Ap,At,C64,IBM
3.	Defender	Atari	Arcade classic	At,C64,TI,Vic
4.	Atic Atac	Ultimate	Action/adventure	Sp
5.	Manic Miner	Software Projects	Platform	C64,Sp
6.	Zaxxon	Datasoft	Arcade classic	Ap,At,CoCo,C64
7.	Eastern Front, 1941	Atari	War	At
8.	Elite	Acornsoft	Action/trader	BBC
9.	International Football	Commodore	Simulation	C64
10.	Scrabble	Leisure Genius	Board game	BBC,C64,Sp
11.	Jumpman	Epyx	Platform	Ap,At,C64
12.	Choplifter	Broderbund	Action	Ap,At,C64,Vic
13.	Donkey Kong	Atari	Platform/arcade	At,C64,TI,Vic
14.	Pole Position	Atari	Simulation/arcade	Ap,At,BBC,C64,IBM,Sp
15.	Way Out	Sirius	3D maze	Ap,At
16.	Gridrunner	Llamasoft	Shoot-'em-up	At,C64,Sp,Vic
17.	Football Manager	Addictive	Management	BBC,C64,Sp
18.	3D Ant Attack	Quicksilva	Action	C64,Sp
19.	Millionaire	Blue Chip	Stock market	Ap,At,C64,IBM
20.	Lode Runner	Broderbund	Action	Ap,At,C64,IBM,Vic

. . . the next 30

Archon	Electronic Arts	Action/board game	Ap,At,C64
Asteroids	Atari	Arcade classic	At
Attack of the Mutant Camels	Llamasoft	Shoot-'em-up	At,C64
Aviator	Acornsoft	Simulation	BBC
Boulder Dash	First Star	Action	At,C64
Bruce Lee	Datasoft	Action	Ap,At,C64,IBM
Centipede	Atari	Arcade classic	At,C64,TI,Vic
Dimension X	Synapse	Action	At,C64
Encounter	Novagen/Synapse	Battlezone type	At,C64
Fighter Pilot	Digital Integration	Simulation	C64,Sp
Frogger	Parker/Sega	Arcade classic	At,C64
Hesgames	HES	Simulation	C64
Jet Pac	Ultimate	Action	Sp
Jet Set Willy	Software Projects	Action/adventure	Sp
Missile Command	Atari	Arcade classic	At
Mule	Electronic Arts	Educational game	Ap,At
One on One	Electronic Arts	Basketball game	Ap,At,C64,IBM
Pacman	Atari	Arcade classic	At,BBC,Sp
Penetrator	Melbourne House	Scramble type	Sp
Pengo	Atari	Arcade classic	At
Pinball Construction Set	Electronic Arts	DIY pinball game	Ap,At
Pssst!	Ultimate	Action/novelty	Sp
Psytron	Beyond	Action/strategy	C64,Sp
Robotron 2084	Atari	Arcade classic	At,BBC,C64,Vic
Sabre Wulf	Ultimate	Action/adventure	Sp
Scuba Dive	Durrell	Simulation	C64,Oric,Sp
Shamus	Synapse	Action/adventure	Ap,At,C64
Splat	Incentive	Maze/action	C64,Sp
Tennis/Match Point	Atari/Psion	Simulation	At,Sp
The Snowman	Quicksilva	Platform game	Sp

10 adventures

Colossal Adventure	Level 9	At,BBC,C64,Oric,Sp
Deadline	Infocom	Ap,At,C64,IBM,TRS
The Hobbit	Melbourne House	BBC,C64,Oric,Sp
Lords of Midnight	Beyond	Sp
Lords of Time	Level 9	At,BBC,C64,Oric,Sp
Mystery Fun House	Adventure International	Ap,At,BBC,C64,TRS
Savage Island	Adventure International	Ap,At,C64,TRS
Suspended	Infocom	Ap,At,C64,IBM,TRS
Valhalla	Legend	C64,Sp
Wizardry	Sir-Tech	Ap,IBM
Zork	Infocom	Ap,At,C64,IBM,TRS

KEY
Ap — Apple
At — Atari
BBC — Acorn BBC
C64 — Commodore 64
CoCo — Tandy Color Computer
IBM — IBM PC
Sp — Spectrum
TI — Texas Instruments 99/4a
TRS — Tandy TRS-80
Vic — Commodore Vic-20

The obvious answer is, yes, lots of things have been missed, but it is impossible to include every game that someone, somewhere has a passion for. More seriously, the whole genre of adventure games has been left out of account. Only someone who has played a lot of them all the way through could be relied on to sort the wheat from the chaff, and such expertise is rare.

In addition, while it is hard to compare, say, Donkey Kong with Pole Position — because so much of the difference is a matter of taste — it is ridiculous to compare Donkey Kong with The Hobbit. They are not the same kind of thing at all. Chess programs have been excluded for similar reasons. We would recommend everyone to buy a chess program, but it is pointless to mix specific examples with a collection of mainly arcade games.

No chess

Chess has been dealt with in a separate feature in this issue, while for any would-be adventurers we have included an alphabetical list of recommended programs. As a matter of fact, we recommend everything written by Scott Adams, or published by Level 9 or Infocom!

The rest of the Top 50 is presented as a list of the Top 20 in approximate order of merit, with the next 30 in alphabetical order. Trying to rank them all would take forever.

Of the Top 20 only a few are available on only one micro; these are the games that it is almost worth buying the machine to run. Star Raiders, Atic Atac and Commodore International Football are in this class. Elite has not been around long enough to judge. But while it is a strong candidate, it seems likely to appear on other micros before this becomes a problem.

Still top

Star Raiders needs little justification for its continued position at the top of the chart, though it is rather odd it should still be there: it is an 8K game written in 1979. Numerous attempts have been made to duplicate its effects, such as Time Gate and Code Name Mat on the 48K Spectrum, but with little success. Elite itself is, in the words of Jeff Minter, a sort of "thinking man's Star Raiders".

While Star Raiders is one of the best-selling games of all time, relatively few people have reached the higher levels — in spite of a famous five-page article in *Byte* magazine on how to improve your technique. In Star Raiders, the Commander game is to the Novice level what chess is to noughts and crosses.

All the games in the Top 20 are first class. If there are any you haven't tried or even heard of, perhaps you should. That, after all, is the purpose of this feature.

Amstrad WP

Ian Stobie finds it's a case of great software, shame about the printer, for the first serious application of the Amstrad micro.

AMSTRAD'S CPC-464 COMPUTER seems ideally suited for home word processing. It has an 80-column display, a good-quality keyboard and a reliable built-in cassette storage system. All it needs to become a low-cost cassette-based word-processing system is appropriate software and a suitable printer.

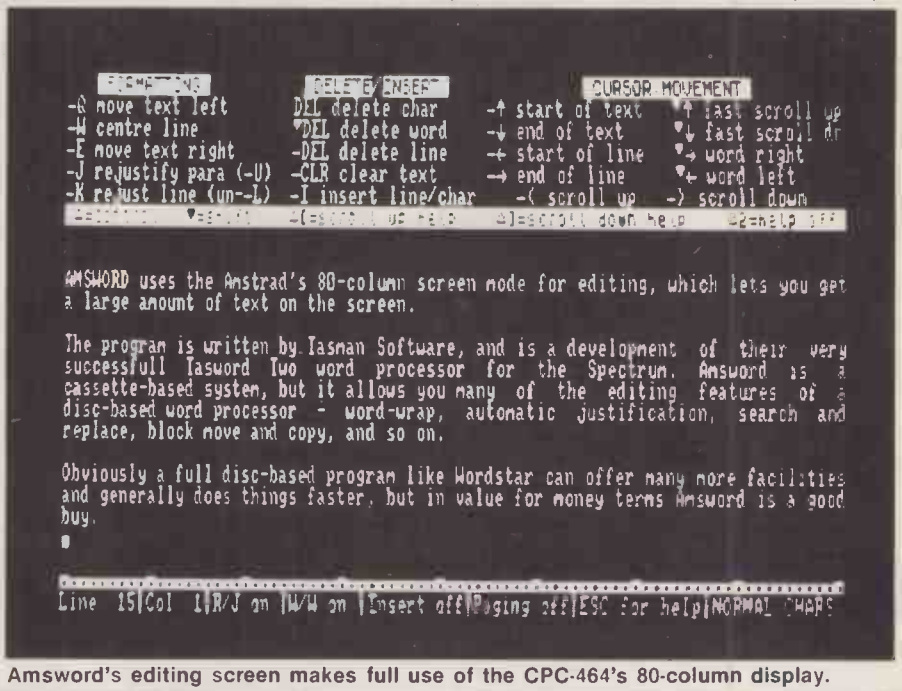
Amsoft's cassette-based WP program, Amsword, turns out to be excellent and Amstrad's DMP-1 printer turns out to be the opposite. The CPC-464 computer itself still seems to justify the rave review we gave it in our October issue, but the printer rather spoils Amstrad's record as the home-computer company that has managed to get everything right.

It took us some time to get the DMP-1's unconventional ribbon cartridge working properly. It consists of a short, fabric loop which picks up ink from a saturated felt pad. At its best the system gave us printed output that was smudgy and unclear; at its worst the output was too faint to see.

But even with a more effective ribbon system the DMP-1's output would still be unpleasant to read. The machine's print-head mechanism is not up to producing characters like j, g and p with true descenders, as it forms it characters from a matrix of just five dots by seven, which is very limited by modern standards. At £199.95, the DMP-1 is poor value for money.

Since the Amstrad computer looks a very attractive system for low-cost home word-processing we tried it out with an alternative printer, the new Shinwa CPA-80. Although this is slightly more expensive than the dreadful DMP-1 it is much better value. We found it gave much better performance in every respect except when it came to printing graphics.

At least three word-processing packages



Amsword's editing screen makes full use of the CPC-464's 80-column display.

The Shinwa CPA-80 (foreground) beats Amstrad's model.

Printers

Amstrad's DMP-1 is basically a Seikosha 500 modified to print CPC-464 graphics and boxed up in matching black plastic with an Amstrad label on the front. The Seikosha was a good printer in its day but it is hardly state of the art now.

The CPA-80 is the latest, quicker version of Shinwa's CP-80 printer, one of the best-selling low-cost matrix printers. It leaves the DMP-1 standing. It is at least twice as fast, and the characters-per-second figures underestimate the difference as the old Seikosha print mechanism only prints in one direction. The Shinwa also seems the quieter machine

Text printed with the Shinwa has much better definition. Characters are formed on a seven-by-eight matrix, the eight vertical dots being enough to allow critical lower-case letters like j, g and p to print partially below the line, which is much more readable. The CPA-80 also has a much better ribbon system — at least as far as print quality is concerned — a large cartridge containing carbon film.

However, it is a one-shot cartridge and you throw it away when each part of the ribbon has been past the print-head once. So running costs of the Shinwa printer may be slightly higher than on the re-inkable Amstrad system. A new carbon ribbon costs about £5 and at the moment fabric ribbons do not seem to be available for the CPA-80. On the other hand, the Shinwa has a very

are available for the Amstrad, or soon will be. Easy Amsword is a very simple cassette-based package which costs £9.95. It is not up to much more than demonstrating to a beginner what word processing is generally about. Amsword is the serious program for use with cassettes, price £19.95. It is written by Tasman software and is a development of Tasword Two, which is probably the best word processor running on the Sinclair Spectrum. It comes with a 45-page manual which describes clearly everything the package can do.

Disc options

For Amstrad users with the CP/M disc system, which is just beginning to come on to the market, Amsoft will also be offering a disc-based word processor written by Intelligence (Ireland) Ltd. This will cost around £50 including VAT and will integrate with matching Calc and database packages. WordStar, the best known CP/M word-processing package, does not look like being available for the Amstrad disc system in the very near future, as no deal with Micropro has been struck.

According to Amsoft, Amsword will be upgradable to work with the Amstrad disc system. Amsoft will offer the upgrade for a nominal fee, and data files now stored on cassette should still be usable. Even so, Amsword is inevitably a more limited program than one written from the outset for disc. Discs not only allow faster and more convenient filing, but allow a word processor to have many more features, as the program itself can be many times longer than the available memory, with the system swapping chunks in as required.

The word-processing setup we eventually arrived at would cost around £619 including VAT. This breaks down to roughly £359 for the computer itself with colour monitor, £240 for the Shinwa CPA-80 printer and cable, and £20 for the Amsword software. Using the cheaper £249 Amstrad with monochrome monitor, which might be a better choice if word processing is the only thing you want to do, the overall price works out at £509.

Loading Amsword from cassette takes about three minutes. Amsword then brings up a clear editing screen. At this point you can load in text from an existing file held on cassette or start typing in new text. Amsword allows you to create documents about 2,000 words long.

Most of the editing screen is taken up by a 16-line by 80-column area into which you type text or perform manipulations on text already there. You can scroll around the document you are editing using the ordinary Amstrad arrow keys in various combinations with the Shift and Control keys.

Most Amsoft commands take the form of a single-key combination with the Control key. The most common commands are shown in a seven-line Help display at the top of the screen. You can suppress this display to give a larger 23-line editing area. At the foot of the editing screen is a horizontal bar showing current tab and margin positions, and beneath it is a status line showing the current settings of various functions.

Amsword uses the full 80-column width of the CPC-464's screen. It is possible to prepare wider documents up to 128 columns across by scrolling horizontally. This is a bit tedious in practice but still a feature worth having.

Hitting the Escape key brings up a single Help screen, which shows most of Amsword's facilities. Compared to a disc-based word processor like WordStar, Amsword does not have many functions, but the ones it does have are well chosen.

Straightforward editing is carried out using combinations of the Delete, Shift

(continued on next page)

Printer specifications

AMSTRAD DMP-1

50cps, uni-directional impact dot-matrix printer forming characters on five-by-seven dot matrix. Prints 80 characters across standard 8.5in. wide paper. Normal and enlarged founts. Dot-addressable graphics giving Amstrad screen-dump capability. Tractor paper feed.

Price: £199.95 including VAT and printer lead

Supplier: Amstrad Consumer Electronics plc. Telephone: (0277) 230222

SHINWA CPA-80

100cps, bi-directional, logic-seeking impact dot-matrix printer forming characters on seven-by-eight dot matrix. Prints 80, 96 or 142 characters across standard 8.5in. wide paper; normal, condensed, enlarged and Elite founts, Epson-compatible control codes. Dot-addressable graphics but not pre-programmed for Amstrad. Both tractor and friction paper feed.

Price: £239.78 including VAT and printer lead

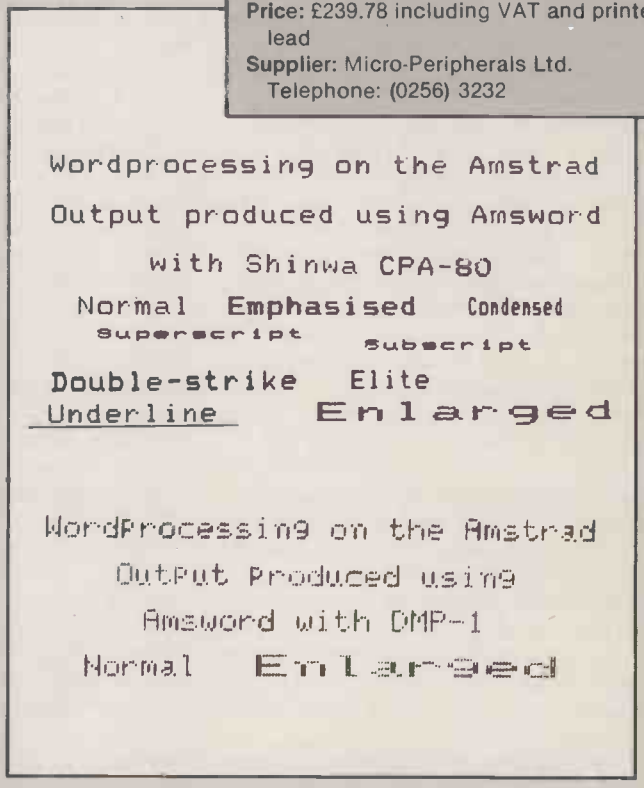
Supplier: Micro-Peripherals Ltd. Telephone: (0256) 3232

well-designed Perspex lid which lets you tear off paper neatly without having to wastefully throw away an extra page.

The superiority of the DMP-1 when it comes to printing graphics is a result of a peculiarity of the Amstrad computer's built-in parallel interface. Most computers using the standard Centronics parallel interface can send a full eight bits at a time, which is what the Shinwa expects. The CPC-464 interface only sends seven data bits at a time. This is fine for sending normal ASCII text, as the ASCII code only uses the bottom seven bits of each byte. So for word processing with Amsword we could send control codes to get underlined and emphasised characters and other special printer effects.

If you ever need to address individual needles in graphics mode the Shinwa expects data to control all eight needles: everything we did in the way of fancy graphics from Basic had a horizontal white stripe all the way across the paper at every eighth vertical dot position.

On the other hand, the Amstrad DMP-1 has been specially adapted to work with the Amstrad's seven-bit interface, and graphics printing presents no special problem. There may be some hardware fix available to people using non-Amstrad printers, but although the Shinwa manual is very good on graphics, in the time available we could not find a software solution for the printer we were using.



Amstrad WP

(continued from previous page)

and Control keys, and is very easy. You normally are in Overtype mode, if you want to insert you need to create space by hitting Control-I. To insert several characters you insert a new line and later reformat the paragraph with another command.

Text is automatically justified as you type it in, but you can opt for unjustified text, giving lines of uneven length. Reformatting a paragraph to fit changed margins is slow, but it works. A new command has to be issued for each paragraph; there is no global Reformat command. Individual lines can be automatically centred or moved right or left on the screen.

Amsoft's block operations are slow compared to a disc-based word processor. You mark a block with a visible control character at the beginning and end; the selected text is not highlighted in any other way, so the block is not too easily seen. Block operations work on complete lines, not on part lines, which is a fairly major limitation.

Limitation

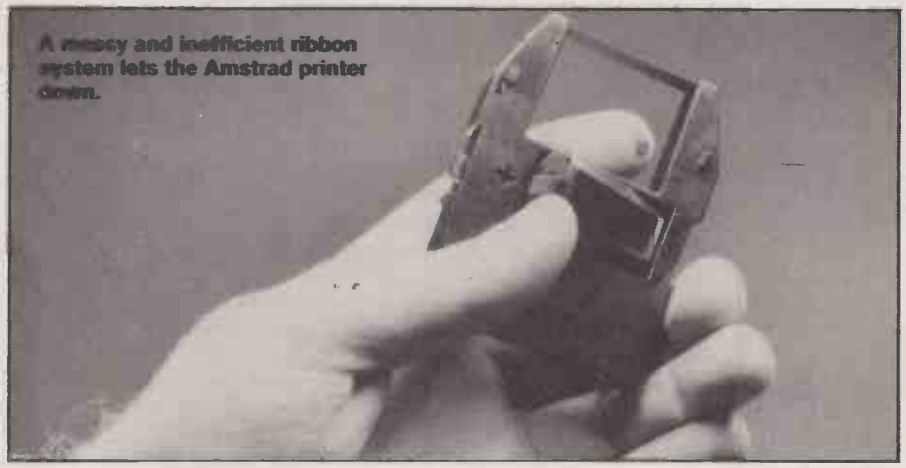
Limitations are also apparent in Amsword's Search and Replace function. You cannot search for phrases, just single words, and you cannot replace with null strings or spaces, so you cannot use the command to selectively delete. You have a stark choice between replacing once or globally; there is no equivalent of WordStar's useful Find/Replace Again command.

Despite its limitations, Amsword is really a very good package and only appears limited compared to disc-based products; few cassette-based word processors even reach a standard where it is worth making the comparison. For instance, Amsword lets you load text from tape into a document you are already editing. This merge facility is really an append, as the loaded text has to go on the end of the document in memory, but once there you can use the Block Move command to move it where you like.

In fact, Amsword possesses some useful functions that are missing from many disc-based word processors. It is possible to convert upper case to lower case and vice versa. So if you accidentally type a few lines with the Caps-Lock key on you do not have to retype them. Amsword gives you a word count as well as a character count, and has the ability to use a second character set which includes many foreign-language characters.

You can print an Amsword document without first saving the file. The word processor has a good range of print-time options, letting you print page numbers and text messages at the head and foot of every page, print multiple copies, and alter the line spacing and left-hand edge of the text on the paper.

All the main Amsword options appear on a single Help screen.



A messy and inefficient ribbon system lets the Amstrad printer down.

What is more, Amsword allows you up to 40 different printer control codes, which can be up to five bytes long each. The program comes with these printer control codes pre-defined for the Epson FX-80, which is something of a standard in printers. We were able to get a good range of effects very simply from the Shinwa printer using these, included underlined, emphasised, enlarged and superscript print, and from the DMP-1 I was able to get expanded print. This feature is well documented in the Amsword manual, and the default printer control codes can be shown on-screen.

Amsword is a very well thought-out program. An unexpected but welcome touch is the Save Amsword option found on the main menu. This allows you to copy customised versions of Amsword to tape, incorporating your own printer control characters and other default settings of alterable features. The only feature regrettably missing is the facility to change the editing scren display to 40 columns, which is much more readable than the 80-column mode on the colour version of the Amstrad.

Conclusions

● Amsword is one of the best cassette-based word processors we have seen. It is quite adequate for writing letters and short articles, and extremely good value for £19.95.

● There is no point in getting Amstrad's matching DMP-1 printer because it is not very good. The slightly more expensive Shinwa CPA-80 is superior on virtually all counts and is much better value.

● The Amstrad CPC-464 computer itself is very suited for home word processing because it has an 80-column display, good-quality keyboard and reliable built-in cassette drive. For heavy word-processing the cheaper system with monochrome monitor is probably the better buy as it displays text better than the colour version.

● For a total cost including software and printer of between £500 and £600, depending on the type of monitor chosen, both Amstrad-based home word-processing systems are worth looking into.

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FILEVISION

Ian Stobie looks at a database package for the Apple Macintosh where you use pictures rather than words to classify information.

FILEVISION is an innovative database package for the Macintosh, which allows you to link pictures to your data. This visual approach is particularly effective for browsing through a database once you have created it. It is no accident that Filevision runs on the Mac, as this machine, with its good graphics, mouse pointing device and pre-programmed user interface software in ROM, seems to encourage software developers to try more visual ways of doing things. However, the Macintosh is not without its problems.

We were reviewing Filevision on the minimum configuration it is supposed to run on, the standard 128K Mac with single built-in Sony drive. It turns out that this setup is virtually unusable, as you are constantly having to change discs. It is not possible to get Filevision, which is 159K long, the Mac system files it uses and your data all on one disc. Even simple housekeeping tasks are unbelievably tedious: it took us 17 disc changes to make a working copy of the Filevision disc. You really require either a second disc drive or more memory to get the best from it.

Filevision itself is a good product. It comes with a well-written and clear 150-page manual. The first section links to a guided tour which comes on disc along with the Filevision program.

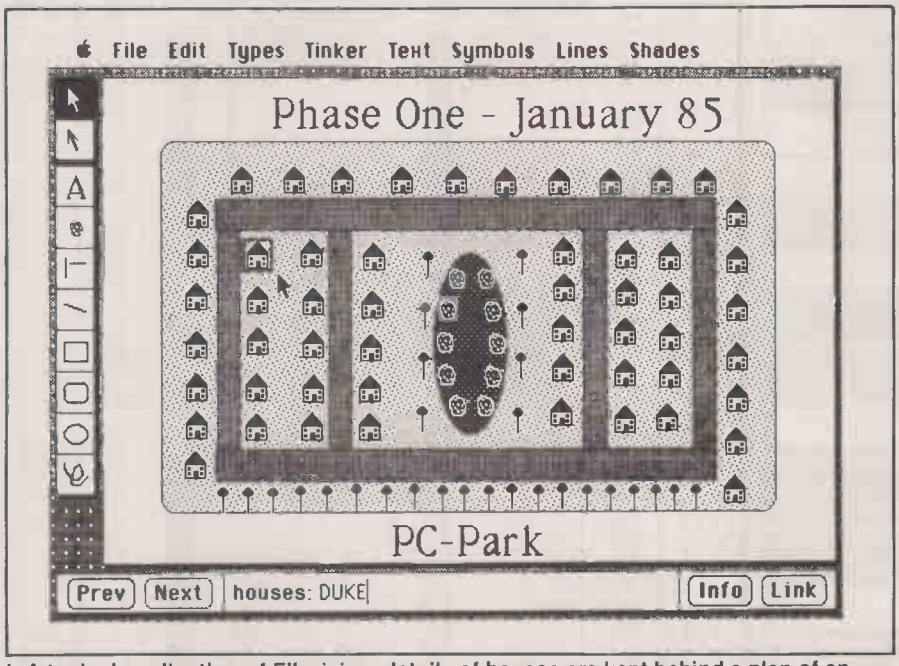
Filevision uses pictures at the record level as a way to get at data which is then presented in the normal way. It is really quite a simple package, more like a visual cardbox than a visual dBase II. It is particularly appropriate for applications where you are dealing with data that relates to location, such as data relating to maps or floor plans.

After loading, Filevision comes up with a blank screen with a set of Mac drawing tools down the left-hand side. To create a database — called a Drawing File in Filevision parlance — you just start drawing on the screen. For instance, you might want to hold information on a new housing development, so you could start setting up your keys by drawing a house.

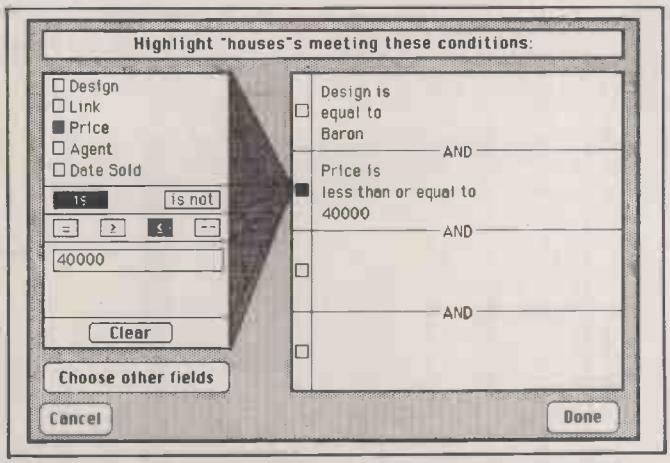
Filevision then asks you to specify the information you want to hold on each house by creating a record layout, which you do on screen. Records can be up to 2K long and can contain up to 30 fields. You can then begin to create a plan of the development by copying houses all over the screen.

Each time you create a new type of object you are invited to define a record associated with it. So you could define different record layouts for the trees and streets. You are allowed up to 16 different types of object on any screen, some of which may be designated background.

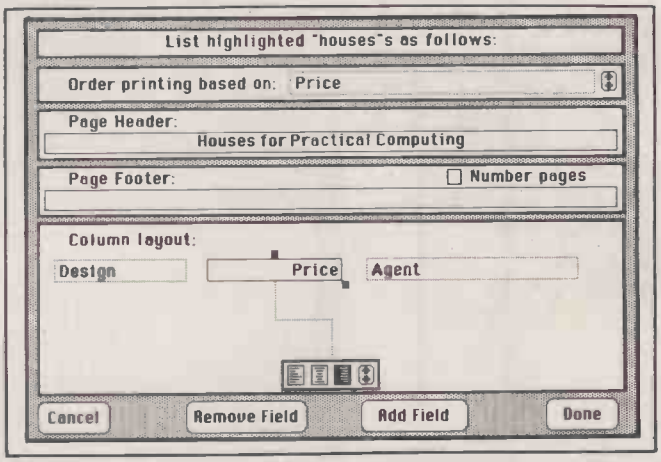
The power of Filevision becomes apparent after you have typed in your data and start interrogating your database. As well as simply pointing at objects and bringing up their records you can specify selection criteria. You could look for all



1. A typical application of Filevision: details of houses are kept behind a plan of an estate. Pointing to a house brings up the record associated with it.



3. Searching for houses meeting specified criteria. The selected houses are highlighted, and you can then go on to display or print details.



4. Designing a report layout on-screen using the mouse. You can produce several sorts of printed report, and dump screen graphics.

Mac printers

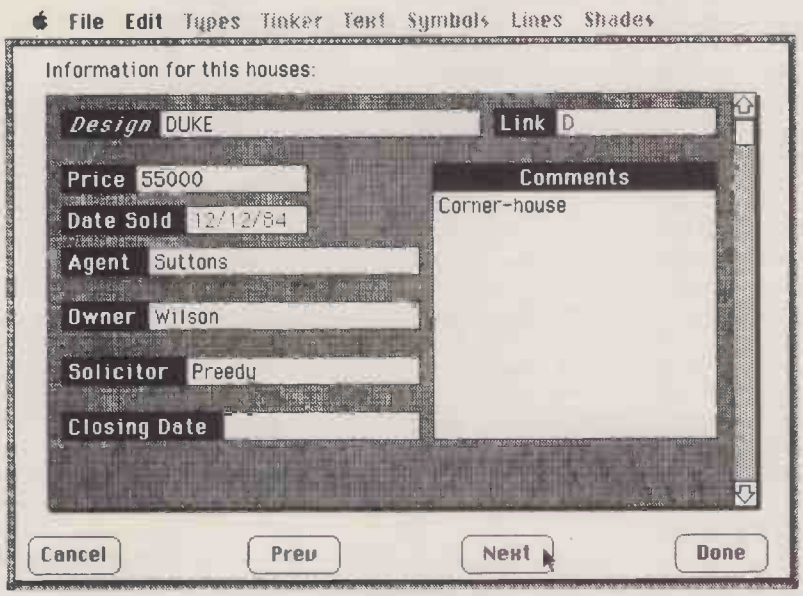
The screen dumps illustrating this article were produced on an Epson JX-80, with a Hanzon Imagewriter emulator board fitted. The Mac itself only supports Apple's own Imagewriter printer, but there are at least three products on the market to let you use other printers.

The Hanzon board, price £99.95 plus VAT, works with all RX, FX and JX series Epson printers. It directly emulates the Imagewriter so no mods are needed to your Mac software. We found it simple to install and from then on it worked perfectly. It also incorporates an RS-232 serial interface. You can switch back to Epson mode simply by sending the appropriate control code.

The £39.95 Epstart adopts a purely software approach to letting you use Epson FX- or JX-series printers. It works by modifying two files in the Mac's system folder, so the Mac can send the printer the information it expects. You need to install Epstart on every Mac startup disc you want to use with an Epson printer. The advantage of this approach is that you can get the Macintosh to work with an unmodified Epson printer, providing it has a standard serial card installed; the 8148 card we used cost £58. This would be useful if you frequently carry your Mac around to places which already have Epson printers. For most people, however, the Hanzon approach seems far better as it involves a quick once-only modification to your printer. We are also not altogether happy with anything that mucks about with system files in an undocumented and obscure way. We got Epstart to work successfully with Filevision and Macpaint, but we also managed to destroy the Mac system on a couple of discs, and now they will not boot.

The Daisywheel Connection, price £89, is designed to let you connect up to any of a range of daisywheel printers which respond to Epson/Diablo control codes. It again adopts a purely software approach. Obviously you cannot print Mac graphics, only text, and that in the typestyle of the print wheel you are using rather than the selected Mac fount.

All these products are available from Pete & Pam.



2. A house record. Pointing to the Next button lets you browse through the records without going back to the main plan.

unsold houses of a particular design within your price range, for example.

All the objects meeting your criteria are displayed highlighted on the screen. You can print out details of the selected houses or change the way they are shown on the screen — selecting a different shading for them, or representing them with a different symbol. The selection side of Filevision is quite powerful, allowing you up to four criteria at a time and permitting wildcard and midstring searches on text items.

Filevision provides three printing options apart from a straightforward dump of any of the displays that appear on the screen. You can print all the information in a record, create reports using selected information, or print mailing labels. These options will work with either entire files or just particular records meeting your specified criteria.

Throughout Filevision the mouse is used as much as possible to eliminate the need for typing. This works especially well when defining a printed report layout, which becomes a quick and very simple task. However, you do not have complete flexibility about the appearance of a report.

Most Filevision operations work on records of a single type, but it is possible to build more complex structure with the package. Every Filevision record contains a link field, which can contain the name of another drawing file — that is, another Filevision screen containing up to 16 new types of its own.

You could use the link field in the house record to point to a file containing floor plans of the different house designs. Clicking the mouse over the D shown in the Link field in the house record would then bring up a new screen showing the floor plan of a Duke design house. From this plan you could then get at records detailing room dimensions, window designs and so on. Filevision allows you to nest drawing files in this way up to six levels deep.

Obviously, the Macintosh hardware imposes some restrictions. There is a trade-off between the amount of information you can store and how elaborate your graphics are; Telos quotes typical figures of 300 to 400 records per drawing file on the 128K Mac, and 800 records on the 512K Mac. Filevision itself imposes a limit of 30 fields per record.

Filevision is an American product from Telos Software. In the U.K. it costs £159 and is distributed by Pete & Pam, telephone (0706) 217744; or Softsel, telephone 01-844 2040.

Conclusions

- **Filevision is a simple but effective package. I found it easy to understand, and I think it is quite useful as a record card replacement which lets you do some extra things with your data.**
- **Despite the Mac's superb drawing tools I found setting up new types of record quite time consuming — but I'm not used to drawing.**
- **Filevision may work best where it is used primarily to browse through information created somewhere else. Filevision is obviously well suited to presenting things like market research data in much more usable ways than the conventional paper report.**
- **Filevision definitely requires a second disc drive or extra memory to be of any practical use on the Mac.**

VIZASTAR

Barry Miles looks at a combined spreadsheet/database/graphics program for the Commodore 64.

VIZASTAR is an integrated software package that offers similar power to best sellers like Lotus 1-2-3, but at one-tenth of the price. The package itself costs just under £100, but the real savings come from the fact that you don't need an IBM PC with a graphics card and monitor to run it. Vizastar requires only a humble Commodore 64 and disc drive.

The package offers a spreadsheet, a database and a business-graphics facility. Like a few other spreadsheets it also allows simple word processing — you can type an 80-character message into a single cell and it will spill over into other empty cells. Unlike some spreadsheets, Vizastar allows you to edit the text instead of making you retype it if you make a mistake.

For real word processing in conjunction with Vizastar it is better to turn to the long-established companion program Vizawrite, reviewed in *Practical Computing* in December 1983. Data can be moved between the two programs, and together they cater for most needs for under £200, including VAT.

Two versions

There are two versions of Vizastar. The standard XL-4 version comprises a disc and a 4K cartridge, which must be plugged into the 64 for the program to run. An enhanced version, the XL-8, comes with an 8K cartridge which offers more sophisticated graphics, and enables the spreadsheet to hold 50 percent more data. It costs £129.95 including VAT.

While no one will dispute that the specification is excellent, it remains to be seen whether or not the performance lives up to it. There is only one way to find out: plug in the cartridge, turn on the power, hit the space bar to boot the disc, and away you go.

There is no real distinction between the spreadsheet and database, except that the data is kept in memory for the spreadsheet and on disc for the database. You are encouraged to treat the two sets of data as interchangeable. You can produce a combined report containing selected records from your database within the spreadsheet, where calculations can be performed on the data once it has been brought into the sheet from the database.

The resultant figures can also be displayed on a bar graph or line chart, which can be visible in a screen window. This is such a natural way to proceed that new users who are unaware of traditional ways of working will take to it quite naturally.

With the program loaded you obtain the menu by hitting the Commodore key. The line at the top of the screen displays six main options. You choose the one you want using the space bar to move the cursor through the words, or by pressing the Commodore key followed by the first letter of the command word. Each main heading leads to a further level of headings, displayed underneath.

The Stop key can always be used to terminate the current operation. Vizastar remembers the last command which you did not abort, and the pointer indicates that command next time you use the menu system. At power-up the defaults are File and then Directory.

You can load a file without typing the file name: use the cursor key to move down to the appropriate name and press Return. You can choose between eight different cell formats: left-justified, right-justified, centred text, integer, currency, data, scientific, and general for numbers.

When you start typing numbers or text you are switched into Edit mode. Otherwise pressing F1 switches you to Edit, allowing you to use the cursor keys normally. To enter a formula, you first press a plus or minus sign. A number can be displayed as text rather than as a value by using a single inverted comma. Text will spill over into adjacent columns, provided they are empty.

Formulae

Vizastar's worksheet formulae evaluate brackets first, then roots and powers, multiply and divide, and finally add and subtract. You can set up your formula easily by moving from cell to cell using a pointer. You hit the F1 function key to activate the cell pointer, which you can then move to the cell to be included in your formula cell.

When rows or columns are moved around a spreadsheet it is important that the user has a very clear understanding of whether the references within formulae are updated relatively or not. In Vizastar all references are relative unless you stipulate otherwise by preceding any reference with a $ sign. Vizastar will change absolute cell references if the cell that is referenced absolutely is moved; this can happen if

You can manipulate cell ranges in three ways: rows, columns and rectangles. You can also use cell ranges and lists of cells within formulae. Vizastar supports a wide range of logical operators, and you can build up a compound logical test of very considerable power. Look-up tables in Vizastar can be set up either horizontally or vertically.

All Vizastar functions must be preceded by the + sign followed by the @ symbol. Most normal functions are performed, like Sum and Average, as well as some more unusual ones. The program holds a calendar from 1 January 1900 internally which lets you calculate days between dates. The Average function enables you to find the average of the contents of a list of cells. The list may contain a rectangular reference, so any area of the spreadsheet may be accommodated.

Attractive

The @Err function is particularly attractive: it causes the cell to display as an error if there is an invalid entry. @ False returns a 0 if the test proves to be false. The spreadsheet evaluates an expression and puts a 0 or a 1 into the cell which can then be picked up for processing elsewhere. The function

@ ISERR (cell)

returns the value True if the cell is in error; otherwise it is False.

The sheet is normally recalculated row by row, but you can arrange for it to be recalculated column by column. Recalculation is not automatic on power-up, but can be made so. The function @ Round allows you to specify rounding before the decimal point. The only common functions which seem to be missing are Net Present Value and Internal Rate of Return, used in the assessment of the potential profitability of future capital investment projects.

Many users will not be interested in automating the activities of their spreadsheet and database. However, for the more adventurous Vizastar's ability to execute lists is a very powerful one. Sequences of keystrokes stored in a particular column can be made to execute as if they are typed in for immediate execution, which is particularly useful if you have more than one group of people using the worksheet.

Vizastar contains facilities for you to protect all the cells of the worksheet, and to unprotect only those which require data to be entered. Since Vizastar is fully integrated you can use the Exec system to extract data from the database, automatically insert it into the spreadsheet and then manipulate it. Standard runs can be fully automated. You can Label cells and

Goto a labelled cell, which is helpful when programming Exec commands. Using the Skip To command you can jump to the next unprotected cell or adjacent cell. If you choose Unprotected and Adjacent options the cursor will leap from cell to cell.

Insertion of rows or columns is easily accomplished in Vizastar, and you can copy the contents of areas as well as rows or columns. The Title command freezes headings either horizontally or vertically. You can scroll the data up and down or sideways without moving the descriptive matter.

Up to nine different views of the current worksheet are possible through windows of any size or shape. You can move from window to window using the F5 key, and then alter the display. When you hit Return, Vizastar cuts out a rectangle from the cursor position to the bottom right-hand corner of the screen display. Windows underneath this area are covered up or overlapped until the covering window is closed. You may title within a window, which reduces the number of windows to a minimum of four from the maximum of nine.

The Global command sets up standard formats for the entire sheet. Using Sort it is possible to sort rows in the spreadsheet vertically, in ASCII order alphabetically, and numerically in ascending or descending order. You select the column which is to determine the order. You can sort the sheet more than once, using different columns as the key, so you can achieve the effect of a sub-sort by choosing your sequence carefully.

Comprehensive

Filing operations on Vizastar are comprehensive. Suffixes are automatically added to file names to distinguish between three file types: Worksheet, Database and Layout of a Database File. When the file is saved, additional information is stored: the current cell pointer position; the worksheet file name; active window positions; active graphing; automatic recalculation setting; order of recalculation setting; skip to setting; display values or formulae; global format; colour settings; Exec column/row; all printer menu options; last commands used. You can then pick up exactly where you left off.

The Merge command consolidates the current worksheet with data from a file. You can bring in all or part of another worksheet, a word-processing document, sequential file or directory. When you load a worksheet from disc it may be added to or subtracted from the current worksheet.

It is very unusual to be able to move information between a spreadsheet and a word processor. With Vizastar you can construct a report by producing the text on a word processor such as Vizawrite, then saving the text file. You then produce your worksheet report and merge the text, formatted exactly as it was within the word processor.

To copy a database to disc you must use the backup program supplied, not the normal Copy command. Printing capabilities are very versatile: you can print one row at a time or the same row several times in different places as well as printing out areas of the sheet. You can even print in various degrees of magnification.

Vizastar offers a number of word-processor-like facilities when printing a spreadsheet. You can use headers, footers, page numbers and automatic paging to produce your report in a readable fashion. You can specify single sheets or continuous stationery; whether the printer requires a linefeed or not; paper length; left, right and top margins, and so on. The Setup command sends control codes to invoke the special capabilities of your printer, such as superscript, subscript, italic, emphasised, condensed, enlarged and so on.

The database section of Vizastar provides up to 15 files within a particular database. It is therefore possible to use information from a variety of files to

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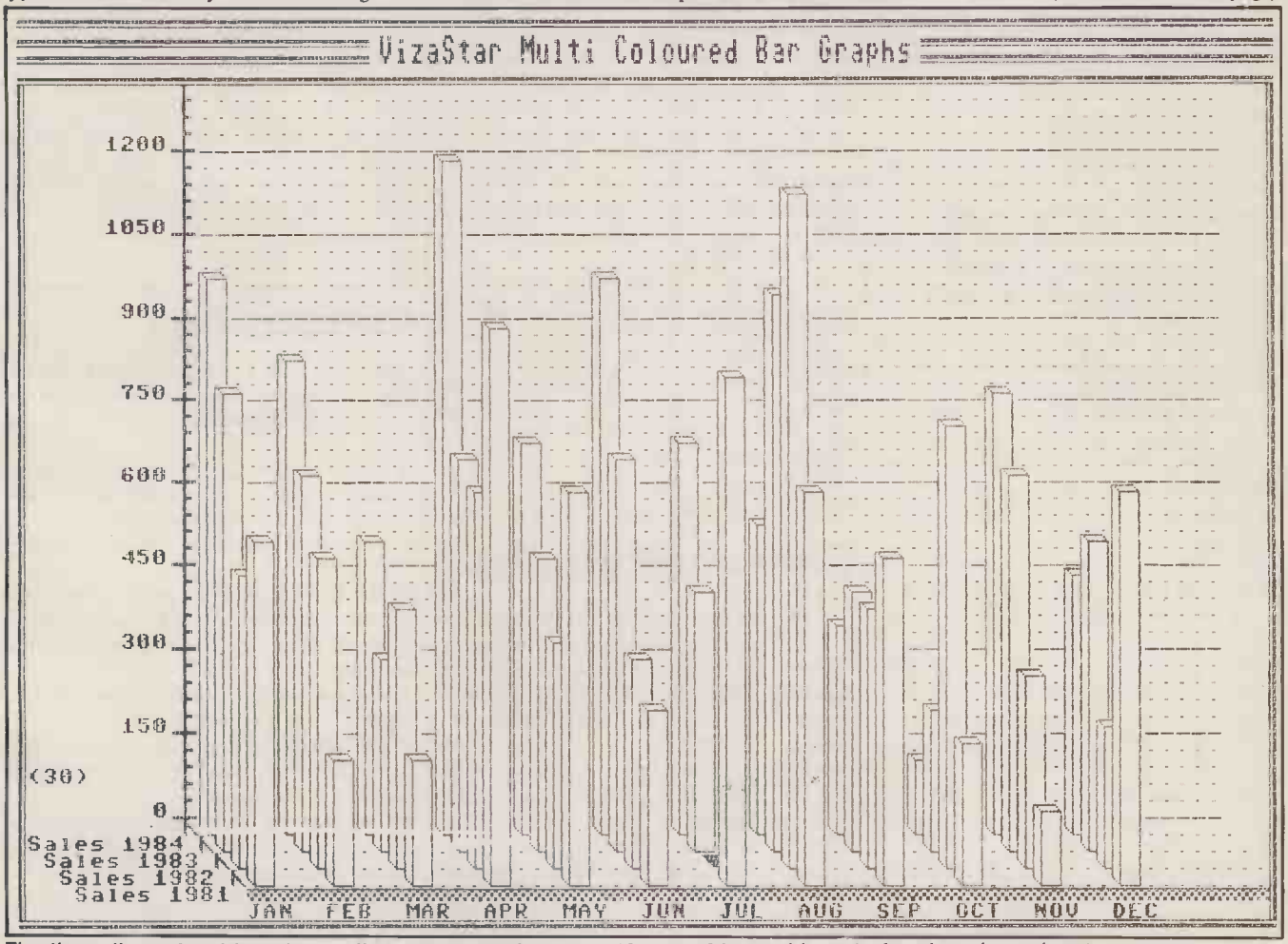

The three-dimensional bar charts allow you to display up to 13 sets of bars with up to four bars in each set.

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create a single report. To set up you enter the database section of the program using the Commodore key and then invoke the Setup command. The current database file layout is then displayed; you can use the existing layout or design a new one.

Record length in Vizastar is never likely to be a constraint: each record could consist of up to 8,000 characters. Vizastar is a free-form database which uses a sophisticated disc-block allocation to string together data from which you can do searches. You have nine screens on which to lay out the information contained in a single record, and it is possible to page through the screens.

When designing the layout you move around the screen typing any descriptive information that you want. Fields are defined by typing a < character at the start and a > character at the end. The space between the delimiter characters then appears dotted: it is like filling in a card index card along the dotted lines, which will help new users to feel familiar with the environment.

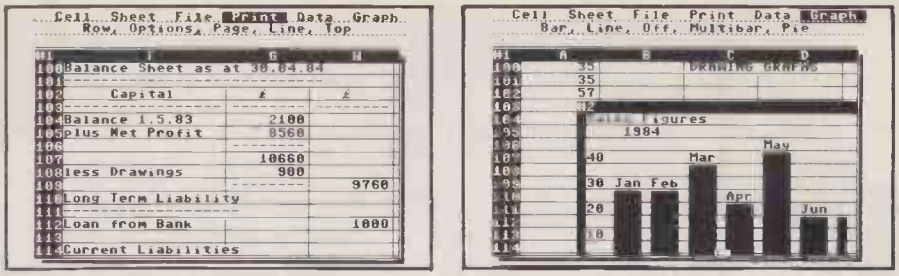
No worry

The maximum length of a field is 120 characters. As you work through the fields, Vizastar attributes a letter code to each field: field A is the key field. You obtain direct access to your records in this way, You may define any field as a formula field, which means it cannot be typed into when you are accessing the record. Because the spreadsheet and database environments are mingled together, any data drawn from the database can automatically be manipulated by a formula and the result displayed in a field. There is no need to worry about the design of your record too much, because you can insert, remove and add additional fields later, if necessary.

While you are designing the record layout, you can insert or delete a line at will. You can highlight particular areas on the screen to attract attention, and paint boxes with a particular character by putting your finger on a cursor key. Once a file layout is designed, you must save it on to the same disc as the file itself will be saved on.

You use the Access command to view the next, previous, first or the last record, or to amend, delete or store the information on disc. To recall a record you must give at least the first few characters of the key. If there is not an exact match, then the record with the best match is displayed, with a message suggesting that you use it to add a record. The cursor is moved to the first field, allowing you to use the previously accessed record as a basis of the new information.

Function key F2 clears all displayed fields, while the Clr key clears a single field from the cursor position. The Replace command alters any field in an existing record, other than the key. The Transfer command physically transfers data between the database and the spreadsheet. Field A will go into column A, field B will go into column B, and so on.



Up to nine different views of the current worksheets are possible through windows.

It is possible to export data field by field — selectively, in any order and according to chosen criteria — from your database file into a standard Commodore sequential file. You can create sequential files of spreadsheet or database information for use by other programs or for merging into documents created by the Vizawrite word processor.

You can also import standard Commodore ASCII sequential files into your database. So if you have data already stored in sequential files, perhaps originated by another database, you can set up a new Vizastar database without having to type in all the information. When setting up a Vizastar database you can leave fields vacant for selected items from other files.

The Criteria command lets you select records according to specified criteria. When you set up the file record layout, Vizastar gives each field a letter label. You simply place your matching criteria for each lettered field in the corresponding columns of any worksheet row. When the program asks you to enter the range you reply with the worksheet range which holds the criteria.

A number of matching options are available. You can use the * and ? symbols to carry out the normal Commodore pattern matching. You can also use the Left-arrow key to indicate an irrelevant field which you do not want to be matched. You can match against a string of characters, or on the conditions greater than or less than a specified value. Matching criteria can also be combined.

Enhanced graphs

Line and bar graphics can be produced automatically, based on any row or column in the worksheet. The graphs are updated automatically as the relevant figures are changed. Particularly impressive graphics are produced by the optional three-dimensional graphics overlay programs supplied as part of the XL-8 version of Vizastar or available for £14.95 for use with the standard XL-4 version. It is loaded into the data space in Vizastar to produce very pleasant pie charts and three-dimensional bar charts in various colours.

The three-dimensional bar charts are particularly impressive. You can display up to 13 sets of bars with up to four bars in each set. The bars are stacked, and cleverly overlapped so that every one is visible. Scaling is automatic; you can either fill the screen vertically, or you can display double-height bars which will require you to scroll upwards.You can also scroll sideways to bring invisible bars into view. The chart is 80 columns wide. You can dump graphs to a suitable printer, such as an Epson FX-80 or Commodore MPS-801.

Vizastar comes with an immaculately printed A5 manual. It manages to convey information at a fairly technical level where necessary without talking down to the reader. The chapters match the menus used in Vizastar. Information given includes a system overview, followed by detailed material on how to proceed. Unfortunately it lacks an index.

If you fill in the user registration slip when you buy Vizastar you will receive information on applications, Exec files and file-conversion programs as they become available. For the time being Viza is also sending out copies of a rapid reference card covering all the commands, complete with helpful hints and illustrations. Security copies of the program disc may be obtained for £10.

Conclusions

- **Vizastar is a totally integrated spreadsheet, database and graphics package which makes life natural and easy for the user.**
- **The price £99.95 including VAT for the standard version is extremely low for the facilities offered. The extra graphics pack is also good value at £14.95 including VAT.**
- **The user is helped greatly by the design of the program. Well-designed menus reduce the need to refer continually to the manual.**
- **The manual is well written but needs an index.**
- **The ability to merge documents fully formatted from the Vizawrite word processor is a real bonus.**
- **Printouts of high-resolution graphics displays are excellent for reporting, and can include paging, headers and footers.**
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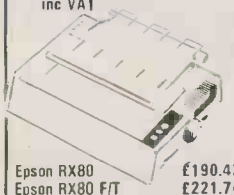

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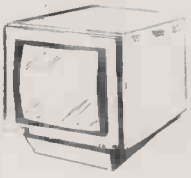

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ENTREPRENEUR

Bill Bennett takes his first steps on the path to becoming a successful tycoon with Triptych's self-education package for home micros.

HOME COMPUTERS have never been useful. They are good for learning to program on, and brilliant at keeping children amused, if not quiet. But there is little that they do which is truly worthwhile.

Even a Commodore 64 with discs, a printer and word-processing software is knocked into touch by a humble typewriter when it comes to utility. And what of "real" computing's prime function, the storage and retrieval of data? A 48K Spectrum with a cassette unit has nothing on a manual cardbox or a pocket diary.

Yet the chances are that if you have brought a home computer, you paid your money hoping it would be able to perform some, probably unspecified, useful task. The first software company able to meet those needs is going to make a fortune, as there are thousands of other users with the same hunger for a program that actually does something.

The Brainpower range of software from Triptych goes a long way towards filling the software gap. Among the packages currently available on cassette, disc and Microdrive for the Spectrum, Commodore 64, Amstrad and BBC computers are a number of programs designed to make life easier for the office user and budding executive.

Combining an applications program with some educational software to provide a background, the Brainpower recipe is a simple one. Take a book, a couple of tapes, a home computer and a rainy Sunday afternoon or two. Mix them all together and the result can be very interesting.

Entrepreneur is a typical Brainpower package. Inside the large video-cassette sized case is the fully illustrated book, a disc or two cassettes containing a teaching program and an applications program, and a somewhat stern-looking licensing agreement. Filling in a card will put you on the Brainpower mailing list, and you will be kept up to date with any additional information. There is also an upgrade service which allows you to swap your software at a reduced cost.

Entrepreneur describes itself as "a complete business start-up kit". It is a grandoise claim for a couple of cassettes and a thin book, but no worse than the kind that is fast becoming standard at the lower end of the software market.

In theory, a session or two with the package will convert a human being into an executive; as yet there is no antidote package. A few years ago such software would have been unsaleable. Society regarded entrepreneurs in the same light as child molesters. Now it is respectable, and closet entrepreneurs have been "coming-out" all over the country. To those people the Brainpower package must feel like some kind of therapy.

Microcomputing's greatest entrepreneur is Jack Tramiel, lately of Commodore and now in charge at Atari. He once said "business is war". War is fought by generals, and the tool of their trade is the

Availability and price

Entrepreneur is available now as a two-tape package for the Sinclair Spectrum and Commodore 64 or on disc for the Commodore 64

Sinclair Spectrum — £14.95
Commodore 64 (tape) — £19.95
Commodore 64 (disc) — £24.95

A version for the Amstrad, the BBC Micro and a Microdrive version for the Spectrum are promised soon. It is supplied by Triptych Publishing Ltd, Order Department, TBL Book Services Ltd, 17-23 Nelson Way, Tuscam Trading Estate, Camberley, Surrey GU15 3EU. Telephone: (0276) 62144

map — an abstraction of the battlefield. Business generals need maps too; the abstraction of their battlefield is the business plan. The better the business plan, the more secure the business.

This lesson is made very forcefully right at the start of Entrepreneur's teaching book. Almost the entire teaching section serves to drives this message home. If you get nothing else out of Entrepreneur then that lesson alone is worth the £15 or £25 you pay, depending on which version you buy.

That is not to say that knowing that one fact allows you to skip the rest. By working through the educational section, you learn why a business plan is so important. You also learn the necessary background to make use of the applications software. But it is seeing how the mathematics of business works, without committing any real money, that is so much better than just reading about it.

On the carpet

The bulk of the teaching is done through the book. It has been printed in such a way that you can stand it next to your computer as you sit at a desk and work — clearly the people at Brainpower are unaware that nearly all home computing is done sprawling on the living-room carpet in front of a commandeered television set. The computer is used to display in a spreadsheet format examples of what is going on in the text.

Entrepreneur's educational section takes about two to three hours to work through, depending on how much you know already and how numerate you are. Although you could plough through it all in one session it is wise to restrict yourself to 45 minutes at a time with long rests in between. This is because the average attention span is about this long and you do need to concentrate. Allow a week with a session every evening, and then a quick revision on the last night. It is also a good idea to take notes. At the end of the teaching section you should know about business plans, dual-entry accounting, cash flow and VAT.

An accountant, or somebody with an in-depth knowledge of how business works, could skip the teaching package and launch straight into the applications package. The teaching software is in no way a tutorial for the application. It is thought provoking, and that really says it all about the entire Entrepreneur package.

Almost everything included could be done with a pocket calculator, a good textbook and the back of an envelope. The point is that no one would ever get round to doing it that way. With this package you have to sit down and work through things logically, and you have to stop and think about things that you might have omitted if left to your own devices.

A number of factors concerning a business require items of information, such as the tax bands for company tax. Such information can be found in the book when it is required. Before you use the learning software, the book asks you to stop and think about a whole range of questions, from "Who will run your business?" to "What are the strengths of your competitors?".

No cheating

Using Entrepreneur is easy. The educational part is almost too user-friendly, as before long it will seem that running any business and making a profit is no more than juggling the figures until they fit. Although there is a stern warning that you should be absolutely honest with the figures you enter into the program, the temptation is always there to cheat slightly Because it feels like playing a management simulation game, albeit a far more sopisticated one than Lemonade Stand, you begin to find that you want to "win". And this leads you to make dangerous adjustments to your figures.

At the end of the day, the most important part of the package is the applications software. It is in effect, two separate programs: a single-product cost analysis and one which handles multi-product lines. In theory, they organise your thoughts into a coherent business plan, which you may print out and take along to impress your bank manager or financier. In practice the printout aspect is sloppy and badly thought-out. It would not have taken much effort to optimise the printout.

Entrepreneur is a package to be mulled over. Before you take the plunge you need to get a lot of information together in order to use the applications package. Every question must have an answer — the package does not allow any vagueness. You may be tempted to guess, and much of the information you supply will by its nature have to be guesswork. Not many businesses know in advance exactly what their sales figures will be, at least not at this stage.

The applications package is not as easy to use as the teaching package. The program is identical in use on all the machines, which has the advantage of only requiring a single set of documentation; in this case it means that the book is the same for all three micros. On the other hand, it has the disadvantage of not making full use of the facilities offered on each machine. For example, the Commodore's function keys would be easier to use a lot of the time.

Start again

The menu only allows you to select those items which are currently valid, which is some concession to ease of use, but on the whole this aspect of the program is a little clumsy. The useful thing about this kind of program is that you can plough through, entering projected data and making assumptions. After a complete session you are presented with what is effectively a report. Should the analysis show up a fatal or undesirable aspect to your plan, you can go back and make some adjustments and start all over again.

Yet there is no true What-If? capability, the feature which launched a thousand VisiCalcs. Given an adequate template to follow, all the facilities and functions of Entrepreneur could be better implemented on VisiCalc or any of its clones. For example, going back and changing something trivial early in an Entrepreneur model can take a long time to filter through to the final balance sheet.

Of all Entrepreneur's features, the most interesting is the sensitivity analysis. This points out which of the factors have the most effect on the bottom-line profit figure. For example, the sensitivity analysis might show that cutting sales costs by 10 percent has the effect of increasing profit by 25 percent. It is not sophisticated enough to take into account the fact that cutting sales costs may decrease actual sales, but it is a useful indicator.

The real reason why Entrepreneur might be better as a VisiCalc template is that its model is so rigid. It is an excellent model if the business you intend to start is in manufacturing or retailing. But it does not really relate to magazine publishing for example, and despite claims to the contrary in the book is not much use in the service sector. But then it is important to remember that Entrepreneur is not Multiplan, and it only costs £15 to £25. If you intend to go into business Entrepreneur is an essential investment.

Conclusions

● Entrepreneur is an impressive example of the kind of software that can be implemented on low-cost computers.

● It is not intended to be much more than a way of organising ideas and information into a format that could be the nucleus of a business plan. As such it excels, though it is slightly inflexible.

● The booklet included with the package is packed with useful information essential for a business start up. Entrepreneur could pay for itself a hundredfold.

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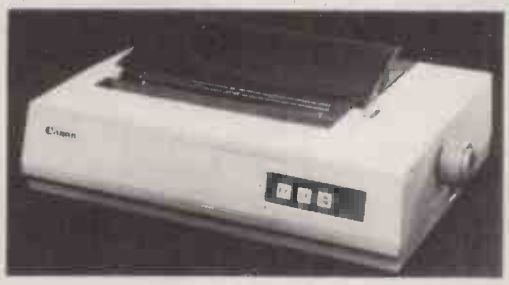

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Halma

David Levy turns his attention to algorithms for a board game which deserves to be better known: it is easy to learn yet develops in a complex way.

THE GAME of Halma, which was once also known as Hoppity, was invented in England during the 1880s. It can be played by two, three or four players, but this article only deals with the two-person version. The blurb on the box that I have at home says that the game is suitable for anyone from eight to adult, but my five-year-old son enjoyed it from the start and picked up the idea very quickly. It has the two essential ingredients for a really good game: it is very easy to learn and is quite complex in nature.

256 squares

The game is played on a 16-by-16 board between two players who each use pieces of a different colour — say black and white. Each player starts with 19 pieces arranged on the 19 squares in his own home camp. The players move alternately, and the object of the game is to get all of your own pieces into the 19 squares of your opponent's camp.

A move consists of either moving one of your own pieces to any adjacent vacant square, or moving one of your own pieces in such a way that each part of its move consists of a jump over an adjacent piece of either colour on to a vacant square. Having made one such jump the piece may remain on its new square or may immediately make another jump, and so on until the player decides to leave it where it lands.

Two things become obvious fairly quickly. First, the game is a race to get your own pieces into the opposite camp as quickly as possible. Hence it is advantageous to make moves which consist of as many jumps as possible. If you make a move which consists of five jumps in the general direction of the opposite camp, you are two steps closer to your goal than if you had made only four jumps.

Forced draw

The second point is that the rules allow a player who is losing to avoid defeat simply by leaving one or more of his own pieces in his home camp, and moving any other pieces back and forth *ad infinitum*. His opponent would then be unable to occupy every square needed to win the game.

This particular problem does not appear to have been considered in the games literature. None of the books in my games library mentions this situation, and one can only surmise that English gentlemen of the 1880s would never dream of stooping so low as to play for a draw. The problem can be solved by creating one simple additional rule: if a player's home camp is completely full, and if his pieces in that camp are in the minority, then he loses the game.

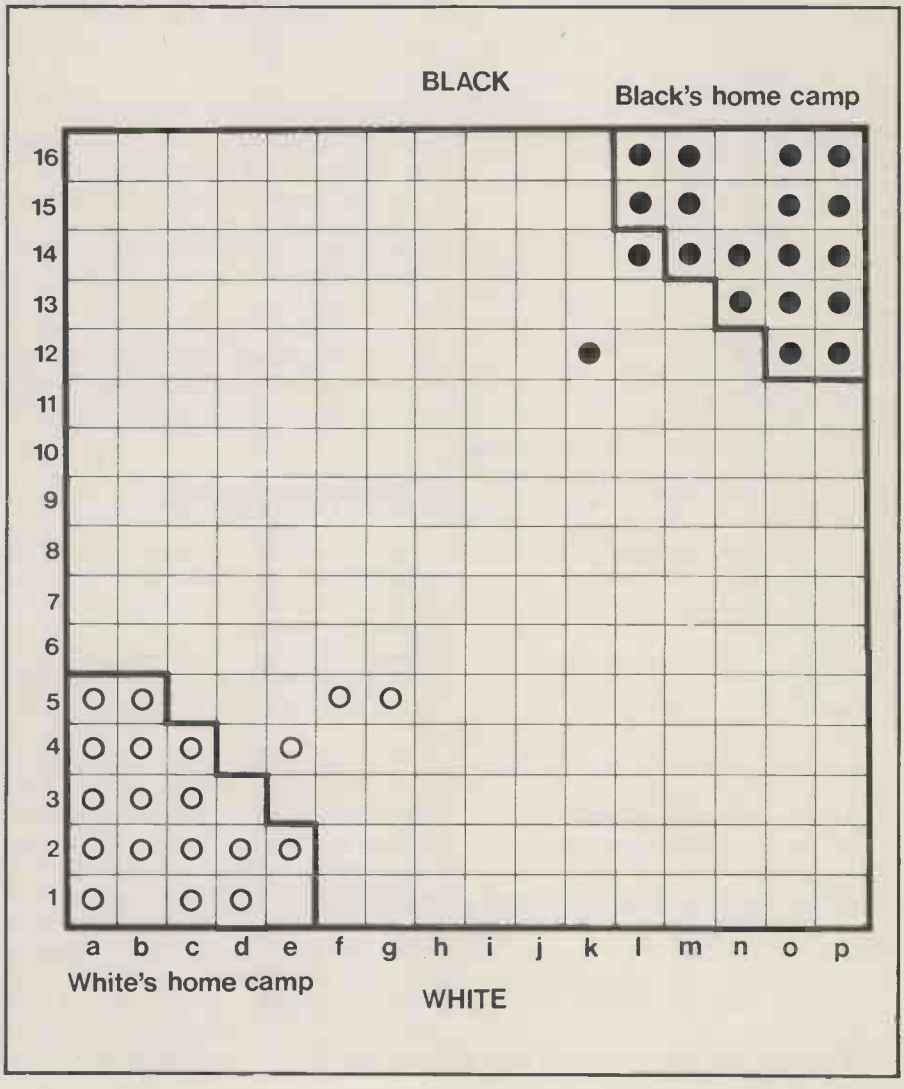
It is easy to grasp the concept of a multi-step move by studying the board position shown in the diagram. The position has arisen after three moves by each side. White's first move was from d3 to e4, his second from b1 via d3 to f5, and his third from e1 via e3 and e5 to g5. Black started more slowly by moving from n16 to l14, then from n15 to l13, then from l13 to k12. If it is White's move next, he can take advantage of the structure he has created by playing from b2, via d4 and f4, to h6.

The ideal strategy is clearly to set up and utilise ladders for multi-jump moves while trying to minimise the use that your opponent can make of such structures. It is no easy matter, however, to achieve both these aims simultaneously, simply because if a ladder is there it can be used by either player. I would therefore suggest that in writing a Halma program you are best advised to take advantage of the computer's facility for thinking ahead, and to base the program's play entirely on maximising its progress relative to that of its opponent.

Progress

How can you measure progress in Halma? Since the object of the game is to get your own pieces into the opposing home camp, a suitable measure must be found for this feature. The obvious one is the sum of the Manhattan distances of all of your pieces from the corner square in the opponent's home camp.

(continued on next page)



Halma

(continued from previous page)

The term "Manhattan distance" is simply the total number of horizontal and vertical steps that a piece needs to make on an otherwise empty board to reach the desired corner square from its current location. Thus a piece standing on the square a1 on an otherwise empty board would be at a Manhattan distance of 30 away from the p16 square — 15 horizontal plus 15 vertical.

Using this measure you can produce an evaluation function by taking the difference between the sum of White's Manhattan distances and the sum of Black's Manhattan distances. Near the end of the game the evaluation function will need to be modified. The Manhattan distances measured should then be to the nearest vacant square in the opponent's home camp, rather than to the corner square.

Evaluation

In some ways Halma is very much suited to the usual techniques employed in a traditional two-person game-playing program, that is a tree search using the alpha-beta algorithm. The problem about using such as approach is that the number of legal moves in many positions can be quite large — well over 100, in fact — so the enormity of the tree can be of the same order of magnitude as in go.

You can speed up the search by generating and examining moves in an intelligent order, and this can best be achieved by using a table-driven move generator. If a piece is standing on the square e4, the program would first examine a jump to g6, followed by jumps to e6 and g4, then the move to f5, then to e5 and f4, and so on. The moves examined first are those which take the piece nearest to its target corner square, and by using this method of intelligently ordering its move generation a program makes good use of the alpha-beta algorithm.

Even with intelligent ordering, a traditional tree search could be extremely time consuming. I would therefore advocate the following novel approach:

1. Perform a one-ply search of the game tree — a one-ply move can be the whole of a multi-jump move — evaluate the terminal positions and sort the moves on the basis of this evaluation.
2. Perform a two-ply search, evaluate the terminal positions and re-sort the root moves if necessary; that is, whenever a two-ply search indicates that a root move is better than the best root move examined so far, sort the newly examined root move to the top of the list.

   Up to now the tree search has been a normal two-ply iteratively deepening search. Now comes the novelty.
3. For all searches to a depth greater than two-ply, ignore all moves after the second ply that make negative progress — those that increase the Manhattan distance of the moving piece from the target corner — and ignore all moves after the second ply by the opponent.

   Ignoring all moves which make negative progress is an obvious heuristic, but one which cannot realistically be applied during the first two-ply of look ahead. That might cause the program to overlook subtle negative-looking moves which had some deeper point, such as preventing the opponent from making good use of a ladder, or setting up a ladder for the program's own use.

Ignoring opponent's moves is a rather more radical idea. Its purpose is to encourage the program to set up ladders and to determine how useful these ladders might be. In order to implement the idea in a well-balanced manner, the program must take into account the actual merit of the positions at a depth of two ply, as determined by the evaluation function, and the potential merit of these positions. Potential merit is determined by examining the one-person game trees which have their roots at the two-ply nodes, and is based on the same evaluation function. The actual evaluation used in this hybrid tree search is:

actual two-ply score + (W × potential progress)

where W is a weighting parameter which can be determined by experiment.

In the one-person game trees which are rooted at the two-ply nodes, the average number of legal moves examined will be rather smaller than the 100 or more possible moves of the first two ply of search. A piece which is surrounded by eight empty squares would have eight legal moves to be examined during the first two ply of search, but only five during the third and subsequent plies.

Refinement

One possible refinement is to try to estimate the likely maximum potential progress from a node, and to use this to determine whether or not it is at all necessary to conduct any examination of the one-person game tree. Variable Maxpot can be be set up for this purpose. If

(score at two ply) + (W × MAXPOT)

is less than the best evaluation of a two-ply position found so far, then it will probably not be worthwhile looking at the one-person game tree from this particular two-ply node. This is because its contribution to the evaluation will not be sufficient to make any change in the decision regarding which is the best move in the root position.

At the very start of the game Maxpot can be set to something in the region of twice the number of ply in the one-person game tree. During the course of the search of the first one-person game tree that it encounters, the program keeps note of the greatest potential that it finds, which could be called Grpot. At the end of the search of this particular one-person game tree the value of Maxpot is changed according to the formula

new MAXPOT: = 1/2 × (old MAXPOT + GRPOT)

This means that the program will continually be modifying the value of Maxpot in the light of what it discovers about the actual potential in different areas of the game tree. The search of a one-person game tree will modify the value of Maxpot, and by combining this with a judicious choice for the value of W the program can prune off whole one-person game trees as being unworthy of its attention.

Trial games

The appropriate value of W can be determined by experiment, playing one version of the program with one value of W against another version with a different value of W. Your experiments should be conducted for one-person game trees of different depths so that the value of W can implicitly include a suitable but different safety margin for each depth of search.

After a certain stage in the game it is not necessary for the program to consider its opponent's moves at all. From a practical point of view this is true once it is possible to draw a straight line across the board from any point on the left edge of the board to any point on the right edge, which leaves all the program's pieces on the target side of the line and all of the opponent's pieces on his own target's side.

From that point on you are in the endgame, where no move made by one player is likely to affect in any way what can or cannot be done by the other. When the endgame stage is reached, the program can simply examine a one-person game tree from the root, and no move ordering is required.

I suggest that if it is written in assembler, your program be given six levels of play:

- one-ply search
- two-ply search, two-person game
- two-ply two-person, one-ply one-person
- two-ply two-person, two-ply one-person
- two-ply two-person, three-ply one-person
- two-ply two-person, four-ply one-person

In the endgame, level n is simply an n-ply search of a one-person game tree, so the program will play faster in the endgame than during the earlier stages of the game. If the program is written in Basic you will probably not get beyond level 3 in a reasonable amount of thinking time.

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An awkward phage

by Andy Oldfield

The four-minute warning finally sounded but no one was surprised, not any more.

Third-world and terrorist groups boasted their new found technological superiority as soon as news broke that Nato and the Eastern bloc had no computer defences. Of course, appeal to reason and all the "there can be no winners after a holocaust" arguments came spilling out — a nicely ironic touch seeing as they came from spokesmen who had previously discounted such arguments as ludicrous oversimplifications. Before long, old scores were being settled as ancient first-generation bombs hurtled towards the now inadequately defended cities of the East and West.

Duncan's mind retraced the miserable events of the past few weeks. He remembered the night that he'd swung a kick at the discarded fish and chip wrapper, it had flown across the campus walkway. He'd wished he could do the same to his supervisor — patronising old goat!

The reason for Duncan's mood was that earlier he'd mentioned the outlines of a chapter on direct thought input. His supervisor's reaction had annoyed him. "Is this supposed to be a doctorate in witchcraft or computer science? You're not old enough to be eccentric — it's got to be a joke, yes?"

It was no joke. Duncan had tried to explain, but Professor Dredge could only ridicule. "So what you want is for us to do away with monitors and keyboards and scramble our heads with telepathic machine code!" Professor Dredge had a way with words, a way that Duncan didn't like.

"Don't be so gross," Duncan had countered. "It's not like that at all. It's more like a different way of thinking. You know the stuff on brainwave patterns and altered states of consciousness."

"Witchcraft! Witchcraft!"

Duncan hadn't bothered pursuing the matter, but he had been upset. Why wouldn't anyone take him seriously? He knew it wasn't mumbo jumbo. He'd done plenty of research and he knew it worked — he'd already used it.

Out of spite rather than anything else, Duncan had stopped at the cash-point machine. Momentarily, slipping his mind into a different way of working, he waited. Cash appeared in the machine's till. "Witchcraft? I don't think so."

The meeting hall was warm and dimly lit. Several people had already turned up. Duncan wasn't surprised; after all, this was the finals. Whoever won here tonight would be the university phage champion.

In the centre of the room on a slightly raised dais were two terminals and VDUs separated by a partition. High on each of the four walls were more monitors which would be switched in after the combatants had inputted their programs. Duncan was confident that the audience would have an interesting time.

It was a pity that his girlfriend wouldn't come. Sharon made no secret of the fact that she thought the games were ludicrous. Duncan had explained the basic concept: the challenge of devising a program that could destroy another program, yet avoid meeting a similar fate itself. Sharon wanted to know why, if he was so smart, he didn't get rich or famous using a phage on the superpowers' military computers. Duncan's answer was nothing if not honest; he hadn't thought about it, it was just a game.

The contest was announced and Steve, a fairly nondescript student, sat at one keyboard. Duncan glanced at his opponent and then took the other seat. This was going to be a walkover. They both started the tedious business of typing their programs in. The umpires scrutinised, alert for obscenities and illegal instructions. Duncan finished his program in about 10 minutes. Steve took twice that time. The umpires conferred and decided that it was finally time for battle to commence.

Duncan knew his program would win; he reckoned it would wipe Steve's out in under two minutes — a new university record. But he wasn't content with that; this was a marvellous opportunity to show off. Closing his eyes and relaxing, he reached out with his mind. Seconds later his eyes were wide open, he couldn't suppress a mischievous grin.

The audience monitors switched in, and the graphic displays started. They were nothing to do with the real programs which were grappling invisibly, intent on demolition. But pictures did give the audience something to watch. And a convention had evolved amongst the players that the graphic display should bear some sort of relation to the hidden warfare.

Steve's program had some pretty interesting graphics. Straightaway the monitors filled with pictures of marching soldiers. Duncan thought that the animation was okay, but he didn't rate it very high on the imagination scale. His own graphics were simple: a solitary tabby cat that cowered at the soldiers' feet. It looked as though Steve's program would whitewash Duncan's. But Duncan knew better. A mushroom cloud obliterated the soldiers, the screen cleared to show a skeleton waving a banner saying "Duncan is champ".

The umpires exchanged puzzled glances; they hadn't seen that entered in the program. What happened next was even more outrageous. A lifelike image of Professor Dredge appeared, naked apart from a strategically placed witch's hat. An objection was immediately lodged. But when the umpires tried to print out program lists, all they got was blank paper and error reports. Duncan smiled. That was some phage he'd unleashed. It didn't stop at the program level, it burned the usefulness out of the hardware itself.

Duncan was something of a whizz kid when it came to computing, but his skills didn't carry over into other fields — especially where other people's reactions were concerned. He had expected genuine amusement at the little extra touches he'd surreptitiously slipped in. The reality was more complicated.

A lot of the audience appreciated his talent. They clapped and he stood to receive their applause. The officials took another view altogether and disqualified him for breaking the rules, though they couldn't work out how he did it, or even which rules he had broken.

Duncan appealed, and as a result found himself at the centre of a disciplinary hearing. The university principal didn't take kindly to having his senior staff lampooned. And when Duncan claimed to have used direct-thought inputting in the phage contest, the principal didn't know what to believe. He contacted Professor Dredge, who told him in no uncertain

terms that as far as respectable science went, Duncan was a lying charlatan.

Next day, Duncan received the verdict: guilty of cheating, lying and gross deception. The penalty: immediate termination of studies.

Duncan lay in bed rereading the letter that curtly told him not to bother going back to the university. His emotions were mixed: depression and anger. He wanted revenge.

It was after lunch when Sharon turned up, she was surprised to find Duncan still in bed. He poured out his troubles. Sharon listened sympathetically, and said: "That's too bad, but surely you're not surprised?"

"Surprised, of course I'm surprised. It was only a joke that went a bit wrong."

"Some joke. What are your going to do next?"

"I don't know . . . look for a job, burn the university . . . I don't know."

"Why not use your phage thing on their computers?"

A smile slowly spread across Duncan's face. Of course, the obvious thing. "You're a genius," he said.

"How will you do it though? Won't you have to sneak into the place?"

Duncan explained about his work on thought inputting. Sharon seemed over-awed by the possibilities. "So you don't even have to get out of bed?"

"I suppose not."

That evening Duncan got ready to wreak his revenge. Sharon came to give him moral support. It seemed a trifle odd to just sit down and close his eyes and let his mind slip out of its normal way of operating. No incense, no chants, no noticeable ritual. About five minutes later Duncan opened his eyes, and sighed with an air of satisfaction.

"Is that it?" asked Sharon.

"Should be. Let's find out." Duncan went to his own computer and plugged into the phone line. He dialled up the university computer and tried to gain access. No success, only a blank screen. "It's worked!" Duncan couldn't contain his delight.

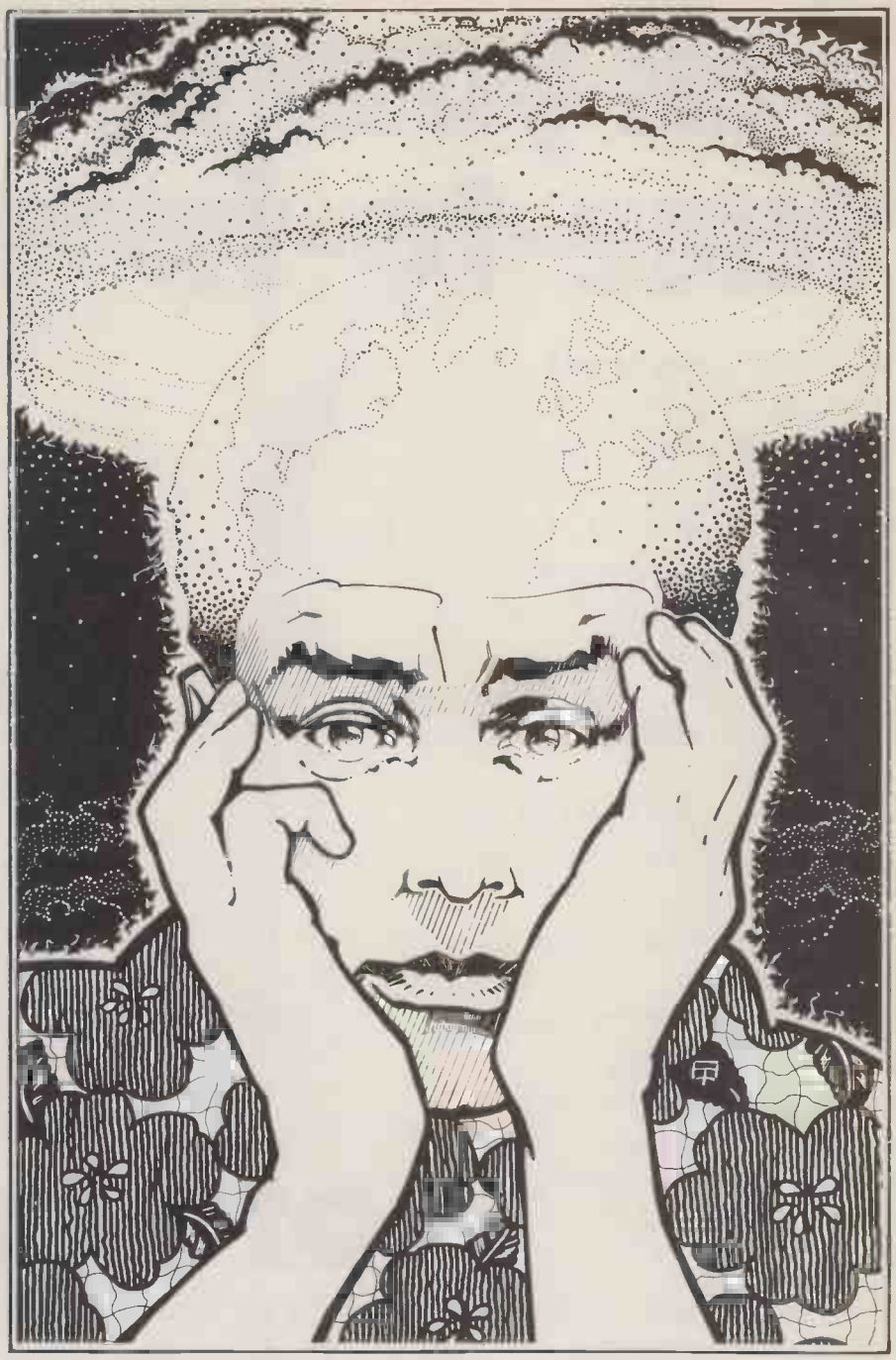
Sharon was impressed with the possibilities. "Could you do that with any computer, anywhere?"

"I suppose so. That's the first time that I've wiped anything out that big."

Sharon was quick to play on his sense of self-importance. "They must be mad to throw someone like you out. Don't you realise what a gold mine this is?"

"I suppose some companies might be interested in buying up the idea," said Duncan modestly.

"Companies, nothing! This is big-league stuff. Why not go for military computers? That would make your university professors and principals look real idiots. And anything that screws up the superpowers and their irresponsibility has to be a good thing." Missionary zeal sounded in her voice.



"It's a bit over the top, isn't it?"

Over the top it may have been, but pressure from Sharon, coupled with indignation at his treatment by academia, combined to eventually sway his mind.

Partly for practice and partly to reassure himself about his own abilities, Duncan put off the idea for a while. Instead he concentrated on disrupting a few commercial databases and financial systems. Strangely, as he left a trail of useless systems in his wake, his instinct for revenge wasn't satisfied. If anything he felt the need to carry on to grander, more ambitious schemes. Sharon's quiet insistence fuelled that need.

And so the fateful day arrived. The plan was simple, and according to Sharon beautiful. With the superpowers' military computers taken out of commission, all their nuclear hardware would be rendered obsolete. Duncan got out of bed and said: "Today is the day I rewrite history."

It certainly was rewritten. An almost total and instantaneous reversal of global economic and military resources. A desperate race to rebuild the lost hardware and rewrite the software. A race that seemed well and truly lost. All the obsolete weaponry that had been fobbed off on the underdeveloped nations was coming back to settle centuries of exploitation.

Duncan watched the sky, waiting for relics from a pre-computer age to deliver atomic death. Relics his phage had effectively raised from the dead. He felt a perverse sense of pride as oblivion loomed.

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File transfer under CP/M

John and Timothy Lee have developed a program which allows your CP/M micro to receive text, data or program files from any other CP/M machine.

IT IS OFTEN necessary to transfer files from one microcomputer to another. For example, you may be unable to buy your favourite word processor, spreadsheet, compiler or game in the correct disc format for your machine. In that case you are forced to buy it in another format, which you can read on a second computer, and then copy it to the original machine.

You may also need to copy files of text for word processing from the computer on which it was entered to another on which it will be printed. In statistical work or in a laboratory, data from an experiment may be collected on one machine, and need to be transferred to another for statistical analysis. The files to be exchanged may therefore be numeric data, text or machine code.

If both micros have compatible floppy-disc formats, there is no problem. Discs containing the required files can be swapped back and forth between them more or less at will. However, the chances of this being possible are very small, given the number of possible permutations of disc sizes and formats in use. There are 8in., 5.25in.,3.5in., 3.25in. and 3in. discs, which may be hard sectored with 16 or 10 sectors, or soft sectored with a variety of sectorings. Then discs may be single or double density, and single or double sided. Finally there may be 35, 40 or 80 tracks on each side of the disc.

It is sometimes possible to copy from one CP/M machine to another using Pip, but the method has several limitations which may prevent it being used for a particular file. Our own CPM2CPM program allows you to copy files from any eight-bit computer running CP/M to any other CP/M machine, irrespective of the type or format of the discs used on each machine. With a little modification the program can be made to accept files from any 16-bit computer running DDT86 under CP/M-86 or Debug under MS-DOS and PC-DOS.

CPM2CPM is useful for copying either ASCII or machine-code files. No special communications program is needed, and CPM2CPM itself needs to be installed only in the receiving computer. A standard program, provided as part of CP/M, is used to encode data on the transmitting computer. If you need to do a lot of

```
0100                    ORG     100H

FFFF =          TRUE    EQU     -1
0000 =          FALSE   EQU     0
                ;RDR    EQU     FALSE           ;Do not use CP/M Reader Device
                ;UART   EQU     TRUE            ;Use UART instead
FFFF =          RDR     EQU     TRUE            ;Use CP/M Reader Device
0000 =          UART    EQU     FALSE           ;Do not use UART
0050 =          PORTNUM EQU     50H             ;PORT NUMBER for North* Advantage
0800 =          BUFFER  EQU     800H            ;Address of Buffer used to
                                                ;store data from RS232 line
0007 =          BELL    EQU     7               ;ASCII Bell character
000A =          LF      EQU     10              ;ASCII LineFeed
000D =          CR      EQU     13              ;ASCII Carriage Return
001A =          EOF     EQU     26              ;CP/M End Of File character
003E =          PROMPT  EQU     '>'             ;CP/M Prompt Character
                                                ;CDOS users change to '.'
                                                ;CLIP users change to ')'

0000 =          REBOOT  EQU     0               ;Address to Reboot CP/M
0005 =          CPM     EQU     5               ;Address to call CP/M
005C =          FCB     EQU     05CH            ;Address of default FCB
0080 =          CPMBUF  EQU     080H            ;Address of default CP/M BUFfer
0016 =          CREATE  EQU     22              ;CP/M CREATE file command
001A =          SETBUF  EQU     26              ;CP/M SET disk BUFfer

0100 C37D02             JMP     START
                ;
0103 0D0A43502F         DB      CR,LF,'CP/M to CP/M transfer program version 2.0'
012E 0D0A777269         DB      CR,LF,'written by T.D.Lee'
0142 0D0A4C6173         DB      CR,LF,'Last Revised 20 Aug 1984',CR,LF,LF,EOF
0160 0D0A0A4350SIGNON:  DB      CR,LF,LF,'CP/M to CP/M transfer program '
0181 7665727369         DB      'version 2.0',CR,LF,'$'
018F 0A546F2075SIGNON2: DB      LF,'To use this program:',CR,LF
01A6 436F6E6E65         DB      'Connect Crossed Lead from the printer port of '
01D4 7468652074         DB      'the transmitting computer',CR,LF
01EF 746F207468         DB      'to the socket for the '
                        IF      UART
                        DB      'UART you have chosen'
                        ENDIF

                        IF      RDR
0205 43502F4D20         DB      'CP/M  READER  device'
                        ENDIF

0219 206F6E2074         DB      ' on this computers',CR,LF
022D 4F6E206F74         DB      'On other computer type:',CR,LF
0246 44554D5020         DB      'DUMP filename.COM',CR,LF
0259 666F6C6C6F         DB      'followed by Control P and RETURN',CR,LF,LF,'$'
                ;
027D 316807     START:  LXI     SP,STACK
0280 116001             LXI     D,SIGNON
0283 CD1907             CALL    PRINT
                ;
0286 3A8000             LDA     CPMBUF
```

```
0289 B7              ORA     A               ;Check if a filename was given
028A C20103          JNZ     ISANAME
028D 119302          LXI     D,ENONAME
0290 C33006          JMP     EXIT            ;Print Error message & Reboot CP/M
0293 0D0A074572ENONAME:DB    CR,LF,BELL,'Error - no file name specified'
02B4 0D0A0A5468      DB      CR,LF,LF,'The format for using CPM2CPM is :'
02D8 0D0A0A4350      DB      CR,LF,LF, 'CPM2CPM filename.filetype '
02F5 3C52455455      DB      '<RETURN>', CR,LF,LF,'$'
                ;
0301 115C00     ISANAME:LXI  D,FCB
0304 0E0F            MVI     C,15            ;CP/M Open File command
0306 CD0500          CALL    CPM             ;Try to open file
0309 112503          LXI     D,MEXISTS
030C 3C              INR     A
030D C20804          JNZ     MAIN            ;Jif OK
                ;
                ;       File does not exist, so try to create it
                ;
0310 115C00          LXI     D,FCB
0313 0E16            MVI     C,CREATE
0315 CD0500          CALL    CPM             ;Try to create file
0318 118A03          LXI     D,MCREATE
031B 3C              INR     A
031C C20804          JNZ     MAIN            ;Jif OK
031F 119F03          LXI     D,ECREATE
0322 C33006          JMP     EXIT            ;Print Error message & Reboot CP/M


0325 0D0A074669MEXISTS:DB    CR,LF,BELL,'File specified already exists and '
034A 77696C6C20      DB      'will be overwritten.',CR,LF,'You can '
0368 61626F7274      DB      'abort the transfer by typing ^C',CR,LF,'$'
038A 0D0A2A2A2AMCREATE:DB    CR,LF,'*** New File ***',CR,LF,'$'
039F 0D0A074572ECREATE:DB    CR,LF,BELL,'Error whilst trying to create the '
03C4 66696C652E      DB      'file.',CR,LF,'Is the disk directory full or '
03E9 6973207468      DB      'is the disk Write Protected?', CR,LF,'$'
                ;

0408 D5         MAIN:   PUSH    D
0409 118F01             LXI     D,SIGNON2
040C CD1907             CALL    PRINT
040F D1                 POP     D
0410 CD1907             CALL    PRINT
0413 2A6807     GETLINE:LHLD    POINTR
0416 24                 INR     H
0417 3A0700             LDA     7               ;Get Bottom of CP/M
041A BC                 CMP     H
041B CAB904             JZ      MEMFULL         ;Jump if Memory is FULL
                ;
                ;       Test if the next data-byte will be in a new disk sector
                ;

041E 7D                 MOV     A,L
041F E67F               ANI     07FH
0421 FE7F               CPI     07FH
0423 C22D04             JNZ     SKIP
0426 2A6A07             LHLD    NSECTOR         ;Get Number of Sectors
0429 23                 INX     H               ;Increment it
042A 226A07             SHLD    NSECTOR         ;and save it
                ;
                ;       Read Characters till a space is found.  This skips the
                ;       address at the start of each line from DUMP.  If a '>'
                ;       is found, the transmitting machine has returned to the
                ;       CP/M CCP and the transfer is complete.
                ;

042D CD1F07     SKIP:   CALL    RS232           ;Get a Character from RS232
0430 FE3E               CPI     PROMPT          ;If Character is >
0432 CABF04             JZ      WRITE           ;then transfer is finished
0435 FE20               CPI     020H
0437 C22D04             JNZ     SKIP            ;else loop till a space is found
                ;
043A 0610               MVI     B,16            ;16 Bytes on a DUMP output line
043C C5         GETBYTE:PUSH    B
043D CD9E06             CALL    GETDATA         ;Get a Data Byte from RS232
0440 2A6807             LHLD    POINTR          ;Get pointer to buffer in RAM
0443 23                 INX     H               ;update the pointer
```

(listing continued on next page)

copying, proprietary programs such as BSTAM and Moveit will perform file-transfers quite a lot faster, but they cost money and you must buy and mount the program on both the transmitting and receiving computers.

The easiest way of linking two microcomputers is to connect them through their RS-232 serial ports. It is still necessary to communicate with both the computers via a terminal or VDU. If the computer has an integral screen and keyboard, then only one RS-232 for the cable to the other computer is needed.

The most direct way of establishing such an RS-232 connection under CP/M is to use the RS-232 designated as the List device on the transmitting computer, usually the one used for a printer. It must be connected to the RS-232 designated as the paper-tape Reader on the receiving device. At its simplest the connecting lead need only consist of two wires: pin 7, earth, connected at both ends; pin 2, Transmit Data, at the transmitting computer connected to pin 3, Receive Data, at the receiving computer.

Data can be read from a disc file and transmitted to the port designated as the List device of the first machine by entering

PIP LST:=filename.ext

where filename.ext is the name of the file to be transmitted. The data can be received by the port designated as the

(continued on next page)

RS-232 connection

The vital link between the two computers requires a non-standard lead. The connections necessary to build such a lead are

- pin 7 to pin 7 — earth to earth
- pin 2 to pin 3 — Transmit to Receive
- pin 3 to pin 2 — Receive to Transmit

Strictly only one of the last two connections need be made, but by connecting both the lead becomes symmetrical and either plug can go into either computer.

One further complication may arise if the Printer RS-232 of the transmitting computer is wired for Printer Busy. This is the wire in RS-232 by which the printer is able to tell the computer when to send characters and when not to send them. If this is implemented then the crossed lead must tell the computer to transmit characters; otherwise the computer will wait for ever, thinking that the printer is busy, instead of transmitting characters down the crossed lead. You can avoid this problem by joining pins 7 and 20 in the RS-232 plug for the transmitting computer, or in both plugs to keep the lead symmetrical. On other systems we have had to join pin 5 to pin 7, or pin 7 to pin 8 to make the computer transmit characters.

(continued from previous page)

paper tape Reader on the second computer, and stored on disc by entering

PIP filename.ext = RDR:

where filename.ext is the name under which you want the data to be saved.

The Pip file-transfer procedure works satisfactorily as long as three conditions are satisfied. First, the receiving machine must have CP/M's RDR: defined so that it takes input from the RS-232 port, something which is impossible on some machines. Secondly, the file of data transmitted must occupy less than 16K because the receiving computer automatically starts to store the data on disc when 16K has been received. While it is doing this, the first computer continues to transmit data, so those characters transmitted during this time will be lost.

The third condition is that the top bit or parity bit of each byte of data must not be important, as it may well be reset by CP/M on the transmitting computer. ASCII files containing Basic, Fortran, Cobol or machine-code source program and other text files will be copied correctly since they only use the lower seven bits. Microsoft Basic programs may be stored in ASCII form using the command

SAVE "filename", A

but by default are stored in a compact form which uses the top bit; other Basic interpreters store their programs in a variety of ways. WordStar text files will not copy correctly since the program uses the high bit to distinguish between spaces and linefeeds which it has inserted itself and those actually typed.

The Pip copying procedure will not work for copying machine-code programs for two reasons. First, the top bit of each data byte may be corrupted in the transfer. Secondly, the transmission may be terminated prematurely before the end of the file if the receiving computer detects Control-Z, which is understood by CP/M as the End of File marker. ASCII files cannot contain Control-Z, but it corresponds to the Zilog instruction

LD A,(DE)

It is possible to use Pip with the [0] option, which suppresses checking for Control-Z as the End of File marker, but the receiving computer does not then know when the transmission is complete.

The CPM2CPM program uses an alternative approach. The two computers must be connected together as before. The difference is that instead of transmitting ASCII characters as stored, all eight bits of each byte are converted into hexadecimal which is transmitted as a pair of characters. Thus the instruction

LD A,(DE)

corresponds to 1A hex and is transmitted as the character 1 followed by the character A. The receiving computer must then translate each pair of ASCII characters back into machine code. The only valid characters to be transmitted are then the digits 0 to 9 and the upper-case letters A to

(listing continued from previous page)

```
0444 77              MOV     M,A             ;store Data Byte in Buffer RAM
0445 226807          SHLD    POINTR          ;Save pointer to buffer in RAM
                ;
                ;       Read next character - this should be a space following
                ;       the first 15 data-bytes and a <CR> following the 16th
                ;       data-byte.  The space is not checked since who cares if
                ;       it is corrupt.  The <CR> must be correct and is checked
                ;       to ensure no chars have been dropped on the RS232 line.
                ;
0448 CD1F07          CALL    RS232           ;read next character
044B C1              POP     B               ;Restore number of data bytes
044C 05              DCR     B               ;decrement number of data bytes
044D C23C04          JNZ     GETBYTE         ;loop until 16 bytes received
                ;
0450 FE0D            CPI     CR              ;Was the last character a <CR>
0452 CA1304          JZ      GETLINE         ;if so, loop back for more data
0455 116904          LXI     D,ERETURN       ;No <CR> at end of line
0458 CD1507     TRY2SAV:CALL ERPRINT         ;print an error message
                ;
                ;       Abort Transfer and TRY_to_SAVe as much as possible to disk
                ;
045B 2A6807     TRY2SA: LHLD    POINTR          ;Add End Of File marker to
045E 361A            MVI     M,EOF           ;end of characters received.
0460 110306          LXI     D,MCLOSE
0463 CD1907          CALL    PRINT
0466 C3BF04          JMP     WRITE


0469 0D0A074572ERETURN:DB    CR,LF,BELL,'Error - Corrupt or missing characters'
0491 206F6E2074      DB      ' on the RS232 line - transfer aborting',CR,LF

04B9 11F804     MEMFULL:LXI  D,EMEMFUL
04BC CD1507          CALL    ERPRINT         ;Print Error Message
04BF 2A6A07     WRITE:  LHLD    NSECTOR
04C2 7C              MOV     A,H
04C3 B5              ORA     L
04C4 CA0000          JZ      REBOOT          ;Reboot if no sectors to save
04C7 114B05          LXI     D,MSAVING
04CA CD1907          CALL    PRINT           ;Print message "Saving to Disk"
04CD 110008          LXI     D,BUFFER        ;start of buffer
04D0 D5         DISKWR: PUSH    D               ;save current position in buffer
04D1 0E1A            MVI     C,SETBUF
04D3 CD0500          CALL    CPM             ;Set CP/M Buffer to a chunk of
                                             ;the received bytes buffer.
04D6 0E15            MVI     C,21            ;CP/M Write Sector command
04D8 115C00          LXI     D,FCB
04DB CD0500          CALL    CPM             ;Write a Sector to disk.
04DE B7              ORA     A
04DF C26F05          JNZ     DISKERR         ;Jump if an error occured

04E2 2A6A07          LHLD    NSECTOR         ;Get number of sectors to write
04E5 2B              DCX     H               ;decrement it
04E6 226A07          SHLD    NSECTOR         ;save it
04E9 7C              MOV     A,H
04EA B5              ORA     L
04EB D1              POP     D               ;restore current buffer position
04EC CA8505          JZ      CLOSE           ;Close file if all sectors written
04EF 218000          LXI     H,80H
04F2 19              DAD     D
04F3 54              MOV     D,H
04F4 5D              MOV     E,L             ;Move DE on by 80H = 128 bytes
04F5 C3D004          JMP     DISKWR
04F8 0D0A075468EMEMFUL:DB    CR,LF,BELL,'The memory in this computer has '
051B 6265636F6D      DB      'become FULL before the transfer was completed'
0548 0D0A24          DB      CR,LF,'$'
054B 0D20202020MSAVING:DB    CR,'      ',CR,LF,'Saving buffer to disk file$'


                ;
                ;       Jump here if an error occurs whilst writing to the file
                ;
056F 11AF05     DISKERR:LXI  D,EENTRY
0572 FE01            CPI     01
0574 CA8205          JZ      DISKER2
0577 11D205          LXI     D,EDSKFUL
```

```
057A FE02              CPI     02
057C CA8205            JZ      DISKER2
057F 11E805            LXI     D,EDIRFUL
0582 CD1507    DISKER2:CALL    ERPRINT         ;Print Error Message

0585 0E10      CLOSE:  MVI     C,16            ;CP/M Close File command
0587 115C00            LXI     D,FCB
058A CD0500            CALL    CPM             ;Close the Output File
058D 3C                INR     A
058E C22D06            JNZ     CLOSEOK
0591 119705            LXI     D,ECLOSE        ;Print "Error Closing File"
0594 C33006            JMP     EXIT
0597 0D0A074572ECLOSE: DB      CR,LF,BELL,'Error closing file',CR,LF,'$'
                ;
05AF 0D0A456E74EENTRY: DB      CR,LF,'Entry Error during disk write.',CR,LF,'$'
05D2 0D0A457272EDSKFUL:DB      CR,LF,'Error - Disk full',CR,LF,'$'
05E8 0D0A457272EDIRFUL:DB      CR,LF,'Error - Directory full',CR,LF,'$'
0603 070D0A    MCLOSE: DB      BELL,CR,LF
0606 417474656D        DB      'Attempting to close the partial file',CR,LF,'$'

                ;
                ;       Jump here when all the buffer has been written to disk
                ;
062D 113606    CLOSEOK:LXI     D,MFINISH       ;Print "Transfer finished"
0630 CD1907    EXIT:   CALL    PRINT
0633 C30000            JMP     REBOOT
0636 0D0A0A5472MFINISH:DB      CR,LF,LF,'Transfer completed with '
0651 3020657272ERRORS: DB      '0 errors.',CR,LF,'$'

                ;
                ;       Subroutine Check_for_CONTROL-C
                ;
                ;       Check if a character has been typed on the Keyboard
                ;       Reboot CP/M if it is Control C.
                ;
065D 0E0B      CONTC:  MVI     C,11            ;CP/M Console Status command
065F CD0500            CALL    CPM             ;Test if a char has been typed
0662 B7                ORA     A
0663 C8                RZ                      ;Return in no character typed
0664 0E01              MVI     C,1             ;CP/M Console Input command
0666 CD0500            CALL    CPM             ;Read Character
0669 E67F              ANI     07FH            ;zero parity bit
066B FE03              CPI     3
066D C0                RNZ                     ;Return unless char was Control-C
066E 117706            LXI     D,ECONTC
0671 CD1907            CALL    PRINT           ;Print Warning Message
0674 C35B04            JMP     TRY2SA          ;and abort.
0677 0D0A075E43ECONTC: DB      CR,LF,BELL,'^C'
067C 0D0A547261        DB      CR,LF,'Transfer aborted by Control-C',CR,LF,'$'

                ;
                ;       Subroutine Get_Data_Byte
                ;       This subroutine reads two characters from the RS232 line
                ;       and converts them from hexadecimal ASCII to a single
                ;       binary byte.  The valid data byte is returned in A
                ;       If either of the characters is invalid, an error is printed
                ;       and the program aborts.
                ;
069E CDAD06    GETDATA:CALL    GETHEX          ;Get First Hexadecimal value
06A1 87                ADD     A
06A2 87                ADD     A
06A3 87                ADD     A
06A4 87                ADD     A               ;multiply by 16
06A5 F5                PUSH    PSW
06A6 CDAD06            CALL    GETHEX          ;get second hexadecimal value
06A9 47                MOV     B,A
06AA F1                POP     PSW
06AB 80                ADD     B               ;add values to get databyte
06AC C9                RET

                ;
                ;       Subroutine Get_Hexadecimal_Value
                ;       This subroutine reads a character from the RS232 line
                ;       and converts it into a hexadecimal value if possible.
                ;       If this is not possible an error message is printed
                ;       and the program aborts.
```

(listing continued on next page)

F. Any other character can then be used as an End of File marker.

Plainly two programs are needed, one to convert a byte into hex and transmit it, and the other to receive hex data and convert it back to binary. Fortunately a utility program called Dump.Com is provided with CP/M-80 to take a file and print it in hexadecimal form on the console. This fits the requirement for the transmitting program, and so saves the effort of writing a transmission program and mounting it on the transmitting computer. If you type Control-P after the Dump command but before pressing Return then the hex data will be sent to the printer as well as being displayed on the screen. To transmit a file to the List device, and to the other computer, type

DUMP filename.ext

followed by Control-P and Return.

The program CPM2CPM is mounted in the receiving computer. To use it type

CPM2CPM filename.filetype

where filename.filetype is the name you wish to give to the file containing the data being received. The computer displays a message explaining what to type on the transmitting computer. CPM2CPM receives pairs of ASCII characters as data, interprets them as hexadecimal, converts this into the binary equivalent and stores the binary equivalent of the data in memory starting at 800 hex, which is above the CPM2CPM program.

Because the program only writes to disc when the transmission is finished, it avoids the 16K limitation encountered using Pip. After the transmission of a file is complete, the Dump program on the transmitting computer returns control to the CP/M CCP, which issues a prompt of A> or B>, depending whether A or B is the logged-in drive. CPM2CPM detects the > symbol as the End of Transmission marker, and then writes the data that has been transmitted to a disc file. Cromemco users and users of the Clip command processor, which use a different prompt, should change one byte of CPM2CPM.

The .PRN file produced by the CP/M assembler ASM is provided. Though Z-80 code runs faster, the program is written using only Intel 8080 instructions, and has been coded in 8080 mnemonics. It can be assembled using the standard CP/M assembler ASM.Com and typing

ASM CPM2CPM

This produces the output file called CPM2CPM.HEX, which must then be loaded with Load.Com by typing

LOAD CPM2CPM

to produce the executable machine-code file CPM2CPM.COM.

The .PRN file produced by ASM.Com contains both the source mnemonics and comments. To produce a working copy of the program, part of this file must be typed in to produce the file CPM2CPM.ASM. Each line of mnemonics in the listing is preceded by 15

(continued on next page)

(continued from previous page)

characters, which should not be typed in, containing either the value of defined symbols and spaces or the address and hexadecimal representation of each machine-code instruction. All the comments in the source code start with a ;.

CPM2CPM loads at the bottom of the TPA, and occupies memory between 100 hex and 800 hex. The data file being received is placed in memory starting at 800 hex and working upwards.

CP/M is located at the top of available memory; the bottom of CP/M is usually about 56K on a 64K machine, so about 54K buffer space is available to hold the received data. Files larger than this cannot be transferred and must be split into two pieces, which can then be transmitted separately and joined together afterwards. If you attempt to transfer a file that is too big to fit in the buffer space, CPM2CPM aborts the transfer when the buffer becomes full.

CPM2CPM obtains characters from the RS-232 link either by accessing the CP/M Reader or by communicating directly with the Intel 8251 or 8250 Uarts. If the Reader has been implemented in the CP/M on the receiving machine then it is simplest to use it to get characters from the RS-232 line. Otherwise CPM2CPM will have to communicate directly with the Uart that is to receive characters.

If you wish to use the Uart driver you must set the RDR flag False and the Uart flag True at the start of the CPM2CPM.ASM file. You must also specify the data port number for the Uart — 50 hex for a North Star Advantage. If you have a Uart that is incompatible with the 8251 you will have to rewrite the last subroutine in the program.

CPM2CPM checks the characters received from the RS-232 line to ensure validity. CPM2CPM gives an error message if a hex character is not 0 to 9 or A to F, or if characters are dropped during the transmission. CPM2CPM will thus detect seven-eighths of all possible corruptions and all dropped characters that may occur during transmission.

The time taken to transmit a file depends on the size of the file and the baud rate used. At 1,200 baud approximately 2K of useful data is transmitted each minute. We have transferred files to a North Star Advantage at 4,800 baud without any problems, giving about 8K a minute, and to a North Star Horizon at 9,600 baud, giving about 16K a minute.

Transmission of large files takes an appreciable amount of time at low baud rates. The program CPM2CPM echoes characters received from the RS-232 line to the console so that the transfer can be seen to be functioning.

The program has extensive error diagnostics. Should an error of any sort occur, the transfer is aborted prematurely and CPM2CPM attempts to save the partial file to disc.

(listing continued from previous page)

```
                ;
06AD CD1F07     GETHEX: CALL    RS232           ;Get a character from the RS232
06B0 E67F               ANI     07FH            ;Clear the Parity bit
06B2 FE30               CPI     030H
06B4 FAC606             JM      INVALID         ;If the Char < '0' then INVALID
06B7 DE30               SBI     030H
06B9 FE0A               CPI     10
06BB F8                 RM                      ;If Char between 0 & 9 then OK
06BC FE07               CPI     'A'-030H-10
06BE FAC606             JM      INVALID         ;If between 9 & A then INVALID
06C1 DE07               SBI     'A'-10-030H
06C3 FE10               CPI     10H
06C5 F8                 RM                      ;If Char between A & F then OK
                                                ;else Char > F and INVALID
06C6 11CC06     INVALID:LXI     D,ECORRUP
06C9 C35804             JMP     TRY2SAV         ;Print Error Message and abort
                ;
06CC 0D0A074572ECORRUP:DB       CR,LF,BELL, 'Error - Invalid Hex Character on '
06F0 7468652052         DB      'the RS232 line - Transfer aborting',CR,LF,'$'
                ;
0715 215106     ERPRINT:LXI     H,ERRORS
0718 34                 INR     M               ;Increment the number of errors


                ;
                ;       Subroutine to a Print a String on the console
                ;
0719 0E09       PRINT:  MVI     C,9             ;CP/M Print String command
071B CD0500             CALL    CPM             ;Print String
071E C9                 RET
                ;

                ;       Subroutine RS232
                ;       This subroutine reads a character from the RS232 line.
                ;       All characters are echoed to the console, so that the
                ;       transfer can be monitored.
                ;
071F CD5D06     RS232:  CALL    CONTC           ;Check for Control C
                        IF      UART
                        CALL    I8251           ;Get Char from Intel 8251 UART
                        ENDIF
                        IF      RDR
0722 CD3007             CALL    READER          ;Get Char from CP/M READER
                        ENDIF
                ;
0725 E67F               ANI     07FH            ;Strip parity
0727 F5                 PUSH    PSW             ;Save the Character
0728 5F                 MOV     E,A
0729 0E02               MVI     C,2
072B CD0500             CALL    5               ;Print character on the console
072E F1                 POP     PSW             ;Restore Character
072F C9                 RET


                ;
                ;       Subroutine Reader
                ;       Get a Character from the CP/M Reader Device
                ;
0730 0E03       READER: MVI     C,3             ;CP/M Input from READER command
0732 CD0500             CALL    CPM             ;Get Char from CP/M READER Device
0735 C9                 RET
                ;

                ;       Subroutine Intel_8251
                ;       Get a character from an Intel 8251 or 8250 UART
                ;
0736 DB51       I8251:  IN      PORTNUM+1
0738 E602               ANI     2
073A CA3607             JZ      I8251
073D DB50               IN      PORTNUM
073F C9                 RET
                ;
0740                    DS      40
                STACK:
0768 FF07       POINTR: DW      BUFFER-1
076A FFFF       NSECTOR:DW      -1
076C                    END
```

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RAM reader

Peter Hodson's disassembler utility for the BBC Micro also displays the contents of any area of memory and can be used to shift blocks of code to any desired locaction.

SOONER OR LATER, many users of the BBC Microcomputer want to learn more about how their machine works, or perhaps try some assembly-language programming. An invaluable aid in getting to grips with these tasks is a program which will display areas of memory in hexadecimal and/or character format, and also disassemble a machine-code program back to assembly-language instructions.

This Dump/Edit/Disassembler program is designed with those functions in mind. It includes some extra utility functions such as copying a block of code from one location to another, changing the contents of a byte, and finding all occurrences of a given string or hexadecimal value between two addresses. The program will read the contents of any sideways ROM. Output can be directed to a printer, where appropriate.

Before loading the program, you may wish to reset Page so that the area of memory you want to look at is not overlaid. The program uses mode 7 and needs about &1A00 bytes, including variables, so Page can be set to any address between &E00 — or &1900 if you have a disc system — and about &6200.

The program uses two text windows. The upper window containing blue text on yellow is used to input commands, and the lower window with a black background displays the results. Scrolling in the lower window can be stopped by pressing any key, and restarted by pressing the space bar; holding down the space bar gives a continuous slow scroll.

The main prompting message asks you to select a function. Pressing ? will display a list of the functions available. The options are:

D—disassemble
V—view memory, in hexadecimal and character format
F—find occurrences of a given string or hexadecimal number
C—change a byte to a new value
M—move a block of memory to a new address
*—perform any OS call, such as *FX, *Save, etc.
R—list the titles of the ROMs in the sideways-ROM sockets
E—end the program

In most cases, additional input is required, such as start and end addresses; the progam prompts for these inputs in the upper text window. Numeric input may be in decimal or hexadecimal forms or any variable or expression which yields the required value, such as Himem or Top-Page — in fact any string which is a valid parameter for the Eval function in BBC Basic.

If the area of memory being looked at is wholly or partly within the address space occupied by sideways ROMs — that is &8000 to &BFFF — there is the option to select which ROM is to be read. The ROM is identified by a number in the range 0 to 15; the sockets on the unexpanded BBC Micro are numbers 12 to 15. Press Return without entering a number if you want to read the Basic ROM. To find out the socket number of any ROM use the R function.

	Mode	Example
0	immediate	LDA #&FF
1	absolute	JSR &FFEE
2	implicit	RTS
3	accumulator	ROR A
4	pre-indexed indirect	LDA (&80,X)
5	post-indexed indirect	LDA (&80),Y
6	absolute X-indexed	LDA &1900,X
7	absolute Y-indexed	ADC &64FF,Y
8	indirect	JMP (&2200)
9	relative	BEQ label

Table 1. Codes for addressing modes.

The output can be directed to a printer as well as to the screen. To interrupt a function and return to the main prompting message, press Escape.

The program is well structured and should be fairly easy to understand and to extend to include additional functions. The main processing is controlled by the Repeat-Until structure in lines 110 to 230, which calls a procedure for each of the options according to the selection made.

ProcInit prints mode 7 control characters in the first six lines of the display to produce blue text on a yellow background in the upper text window. It also initialises some control variables. The *FX 212-214 calls alter the VDU 7 bleep to a quieter,

```
    1 REM  Dump/Editor/Disassembler
    2 REM
    3 REM  P.R.Hodson
    5 :
   10 MODE7
   20 DIM 0% 24
   30 PROCinit
   40 ON ERROR REPORT:PRINTCHR$3
  100 :
  110 REPEAT
  120 PROCtop
  130 VDU7,157,131:PRINT"Select C,D,E,F,M,R,V,*,?";CHR$157;CHR$132;
  140 S$=FNinkey("CDEFMRV*?")
  150 IF S$="D" PROCdisass
  160 IF S$="V" PROCview
  170 IF S$="F" PROCfind
  180 IF S$="C" PROCchg
  190 IF S$="M" PROCmove
  200 IF S$="*" PROCoscall
  210 IF S$="R" PROCroms
  220 IF S$="?" PROChelp
  230 UNTIL S$="E"
  300 :
  310 *FX212,144
  320 *FX213,101
  330 *FX214,7
  340 MODE7
  350 END
  360 :
  370 :
  400 DEFPROCinit
  410 FORI%=0TO5:PRINTCHR$131;CHR$157;CHR$132:NEXT
  420 Y%=0:W%=TRUE:P%=FALSE:H%=TRUE
  430 PROCtop:FORI%=0 TO 1:PRINTTAB(0,I%);CHR$141;CHR$129;CHR$157;CHR$
135;"Memory Editor/Disassembler ";CHR$131;CHR$157:NEXT
  440 PROChelp
  450 *FX212,168
  460 *FX213,128
  470 *FX214,4
  480 ENDPROC
  500 :
 1000 DEFPROCdisass
 1010 PROCinput("Disassemble")
 1020 REPEAT
 1030 op%=FNbyte(A%)
 1040 I%=10000+(op%DIV8)*10:RESTORE I%
 1050 FOR I%=0TOop%MOD8:READA$:NEXT
 1060 IFA$>"*" op$=LEFT$(A$,3):len%=VAL(MID$(A$,4,1)):type%=VAL(RIGHT$
(A$,1)) ELSEop$="***":len%=1:type%=2
 1070 IFA%<4096 PRINT"0";:IFA%<256 PRINT"0";:IFA%<16 PRINT"0";
 1080 PRINT;~A%;"  ";op$;" ";
 1090 IFlen%=2 I%=FNbyte(A%+1)
 1100 IFlen%=3 I%=FNbyte(A%+1)+256*FNbyte(A%+2)
```

```
 1110 ONtype%+1 GOSUB1300,1310,1320,1330,1340,1350,1360,1370,1380,1390
 1120 PRINTTAB(23);"/";CHR$134;
 1130 FORI%=0TO1en%-1
 1140 J%=FNbyte(A%+I%):IFJ%<16 PRINT"0";
 1150 PRINT;~J%;
 1160 NEXT
 1170 PRINTTAB(33);CHR$131;
 1180 FORI%=0TO1en%-1
 1190 J%=FNbyte(A%+I%):IFJ%<32 ORJ%>126 VDU46 ELSE VDUJ%
 1200 NEXT
 1210 PRINT
 1220 IFNOTINKEY(0) PROCwait
 1230 IFop%>0 A%=A%+len% ELSE I%=0:REPEAT:I%=I%+1:UNTILFNbyte(A%+I%)=0
:PROChex(A%+1,A%+I%):A%=A%+I%+1
 1240 UNTIL A%>B%
 1250 ENDPROC
 1260 :
 1300 PRINT"#&";~I%;:RETURN
 1310 PRINT"&";~I%;:RETURN
 1320 RETURN
 1330 PRINT"A";:RETURN
 1340 PRINT"(&";~I%;",X)";:RETURN
 1350 PRINT"(&";~I%;"),Y";:RETURN
 1360 PRINT"&";~I%;",X";:RETURN
 1370 PRINT"&";~I%;",Y";:RETURN
 1380 PRINT"(&";~I%;")";:RETURN
 1390 IF I%<128 PRINT"&";~A%+I%+2; ELSE PRINT"&";~A%+I%-254;
 1400 RETURN
 1410 :
 2000 DEFPROCview
 2010 PROCinput("View memory")
 2020 PROChex(A%,B%)
 2030 ENDPROC
 2040 :
 2200 DEFPROCfind
 2210 INPUT LINE"Find",Q$:IFLEN(Q$)>24 Q$=LEFT$(Q$,24)
 2220 $Q%=Q$:L%=LEN(Q$)
 2230 IFLEFT$(Q$,1)="&" !Q%=EVAL(Q$):L%=L%DIV2
 2240 PROCinput("Search")
 2250 PRINTCHR$131;"Searching for";CHR$134;Q$;CHR$131;"..."
 2260 L%=L%-1:O%=0
 2270 FORI%=A%TOB%:hit%=TRUE
 2280 FORJ%=0TOL%:IFFNbyte(I%+J%)<>Q%?J% hit%=FALSE:J%=L%
 2290 NEXT
 2300 IFhit% PRINT~I%;:O%=O%+1
 2310 NEXT
 2320 PRINTTAB(0);CHR$131;O%;" occurrences."
 2330 ENDPROC
 2340 :
 2500 DEFPROCchg
 2510 INPUT"Address of change",A$:A%=EVAL(A$):IF A%>&7FFF PRINT "Can't
change ROM!":ENDPROC
 2520 PRINT"Change from &";
 2530 IF?A%<16 PRINT"0";
 2540 PRINT;~?A%;:INPUT" to "A$:B%=EVAL(A$):?A%=B%
 2550 rom%=-1
 2560 PROCbottom:PROChex(A%-A%MOD8,A%+1)
 2570 ENDPROC
 2580 :
 3000 DEFPROCmove
 3010 INPUT"Move from",A$:A%=EVAL(A$)
 3020 INPUT"No of bytes",A$:B%=EVAL(A$)
 3030 rom%=FNromsel(A%,A%+B%)
 3040 INPUT"To",A$:C%=EVAL(A$)
 3050 IF C%<A% J%=0:K%=B%-1:L%=1 ELSE J%=B%-1:K%=0:L%=-1
 3060 FORI%=J% TO K% STEP L%:C%?I%=FNbyte(A%+I%):NEXT
 3070 ENDPROC
 3080 :
 3200 DEFPROCoscall
 3210 INPUT"*"A$
 3220 PROCbottom
 3230 y%=Y%
 3240 $Q%=A$:X%=Q%MOD256:Y%=Q%DIV256:CALL&FFF7
 3250 Y%=y%
 3260 ENDPROC
 3270 :
 3400 DEFPROCroms
 3410 PROCbottom
 3500 Q%=@%:@%=5
 3520 PRINT"  ROM  Type  Title"'"  ___  ____  ____________________"
 3540 FOR rom%=0 TO 15
 3550 IFrom%?&2A1>0 PRINTrom%,~(rom%?&2A1),"   ";:PROCromname
 3560 NEXT
 3570 @%=Q%
 3580 ENDPROC
 3590 :
 3600 DEFPROCromname
 3610 FORI%=&8009 TO &801F:A%=FNbyte(I%):IF A%>31 VDUA% ELSEI%=&801F
 3640 NEXT
 3650 PRINT
 3660 ENDPROC
 3670 :
 4000 DEFPROChelp
 4010 PROCbottom
 4020 CLS:VDU15:H%=TRUE
 4030 PRINT'CHR$131;"FUNCTIONS:"
 4040 PRINTCHR$134;"  C  Change a byte"
 4050 PRINTCHR$134;"  D  Disassemble"
 4060 PRINTCHR$134;"  F  Find string or hex"
 4070 PRINTCHR$134;"  M  Move data"
 4080 PRINTCHR$134;"  R  List ROM titles"
 4090 PRINTCHR$134;"  V  View memory"
 4100 PRINTCHR$134;"  *  Execute OS command"
 4110 PRINTCHR$134;"  ?  Display this 'help' screen"
 4120 PRINTCHR$134;"  E  End the program"
```

(listing continued on next page)

higher-pitched and shorter tone. The standard values are reinstated when the program ends.

ProcDisass is the driver for the Disassembly function. It calls ProcInput to get the address range to be disassembled: A% is the start and B% the end of the range. As each byte is read, it is decoded using the Data statements in lines 10000 to 10310.

Each Data item represents one of the 256 possible values of a byte. An asterisk indicates that it is not a valid 6502 instruction code; otherwise the item contains the three-character instruction mnemonic followed by the length of the instruction and the addressing mode, which is encoded according to table 1.

The technique of reading data for each instruction as it is disassembled is somewhat slower than the more obvious method involving a 256-element array which is initialised once at the start. Its advantage is that it saves about 2K of memory, which may be important if you want to get this program into the space left after loading another program.

There is a computed Restore in line 1040, so change this line if the program is renumbered.

When disassembling a BRK instruction, the program will display in hexadecimal and character form the following bytes up to the next occurrence of &00. This makes it easier to find and decipher error messages which are placed immediately after the BRK instruction, in line with the convention adopted in the BBC operating system.

ProcView calls ProcInput to get the address range to be viewed, and ProcHex to display the memory between addresses A% and B%.

ProcFind finds the addresses of all occurrences of a string or hexadecimal number between two addresses. The string to be found is entered in Q$. If the first character is & it is taken as a hexadecimal number, otherwise as a string. It is stored in the area of memory addressed by Q% and allocated by a Dim statement at the start of the program. This allows the same area to be used for a string or a number and makes the search easier to generalise. If the search field is a hexadecimal number it is reversed in memory in accordance with the 6502 microprocessor's rule: an input of &0102 will find occurrences of &02 and &01 in successive bytes.

ProcChg changes the content of the byte at address A% to a new value.

ProcMove moves a block of memory of length B% from address A% to address C%. The initial and destination areas may overlap.

ProcOscall allows any OS command to be executed without leaving the program. The input data A$ is passed directly to the command-line interpreter — see the *User Guide* page 463. The program has been written to be compatible with Basic 1; if

(continued on next page)

(continued on previous page)

you have Basic 2 you can replace lines 3230 to 3250 with the single statement OSCLI(A$).

ProcRoms lists active ROMs — that is those with a non-zero entry in the ROM type table at &2A1 to &2B0 — calling ProcRomname to find the title of each ROM.

ProcHelp is executed when ? is selected as the function. It displays a list of functions available.

ProcTop switches the text window to the upper part of the screen and places the cursor on the bottom line of the window. W% is False when the upper window is in use and True when the lower window is being used. Y% is used to save the current vertical position within the lower window so that it can be properly repositioned when the lower window is selected.

ProcBottom switches the text window to the lower part of the screen. It also enables the printer if P% is True.

FNInkey is used to input single characters from the keyboard. It repeats until the key pressed — after conversion from lower to upper case if necessary — is one of the characters in the string A$ passed to the function, and then returns that character.

ProcInput is used by several of the main functional procedures to input the start and end addresses for the function and select the hard-copy Print option.

ProcHex displays in hexadecimal and character form the contents of the memory from address A% to address B%.

ProcWait is called by several procedures if a key is pressed while the display is scrolling. The effect is to stop the scrolling until the space bar is pressed. If the space bar is held down the display scrolls slowly.

FNByte returns the value of the byte at address A%. It only justifies being coded as a function because of the facility to look at sideways ROMs. If the address A% is outside the range &8000 to &BFFF, or if the Basic ROM has been selected, the result is simply ?A%. It appeared at first that an assembly-language program was needed to read a byte in a ROM other than the Basic ROM, when it is the Basic language ROM which must be selected in the paged ROM area to be able to interpret the program statement. However, the *Advanced User Guide* describes the OSRDRM call which does just what is needed. The address of the byte to be read is placed in zero-page locations &F6 and &F7, and the ROM socket number in Y%. A call to OSRDRM at &FFB9 returns the value of the byte in A%. Although this is inevitably slower than a simple ?A%, it is fast enough for this purpose.

FNRomsel prompts for input of the number of the ROM to be used if the address range A% to B% falls at least partly within the paged ROM area. If no number is input −1 is returned, indicating that the currently selected ROM, the Basic ROM, is to be read.

(listing continued from previous page)

```
 4150 PRINT'"Commands are entered in the upper part"'"of the screen, a
nd results are shown"'"in the lower part."
 4160 PRINT'"To return to the main command prompt at"'"any time press"
;CHR$131;"ESCAPE."
 4200 ENDPROC
 4210 :
 5000 DEFPROCtop
 5010 PRINT:VDU3:P%=FALSE
 5020 IF W% Y%=VPOS:VDU28,3,4,37,0,31,0,4:W%=FALSE
 5030 ENDPROC
 5040 :
 5100 DEFPROCbottom
 5110 IF W%=FALSE VDU28,0,24,39,6,31,0,Y%:W%=TRUE
 5120 IF H% CLS:H%=FALSE
 5130 VDUP%+3:*FX15,1
 5140 ENDPROC
 5150 :
 5200 DEFFNinkey(A$)
 5210 *FX15,1
 5220 REPEAT:I%=GET:I%=I%+32*(I%>96 AND I%<123):UNTIL INSTR(A$,CHR$I%)
 5230 PRINTCHR$I%
 5240 =CHR$I%
 5250 :
 5300 DEFPROCinput(M$)
 5310 PRINTM$;
 5320 INPUT" - start",A$:A%=EVAL(A$)
 5330 INPUTTAB(LEN(M$))" - end",A$:B%=EVAL(A$)
 5340 rom%=FNromsel(A%,B%)
 5350 PRINT"To printer? (Y/N)";
 5360 IF FNinkey("YN")="Y" P%=TRUE
 5370 PROCbottom
 5380 ENDPROC
 5390 :
 5500 DEFPROChex(A%,B%)
 5510 LOCAL I%
 5520 FOR I%=A%TO B% STEP8
 5530 IFI%<4096 PRINT"0";:IFI%<256 PRINT"0";:IFI%<16 PRINT"0";
 5540 PRINT;~I%;" ";CHR$131;
 5550 FOR J%=0TO7
 5560 K%=FNbyte(I%+J%):IFK%<16 PRINT"0";
 5570 PRINT;~K%;" ";
 5580 NEXT
 5590 VDU134
 5600 FOR J%=0TO7
 5610 K%=FNbyte(I%+J%):IFK%<32 ORK%>126 VDU46 ELSE VDUK%
 5620 NEXT
 5630 PRINT
 5640 IFNOTINKEY(0) PROCwait
 5650 NEXT
 5660 ENDPROC
 5670 :
 5800 DEFPROCwait
 5810 LOCAL T%
 5820 T%=TIME:REPEATUNTILTIME>T%+20
 5830 *FX15,1
 5840 REPEAT UNTIL GET=32
 5850 ENDPROC
 5860 :
 6000 DEFFNbyte(A%)
 6010 LOCAL C%,P%,X%,Y%
 6020 IFrom%<00RA%<&8000 ORA%>&BFFF THEN =?A%
 6030 Y%=rom%:!&F6=A%
 6040 =USR(&FFB9)AND&FF
 6050 :
 6200 DEFFNromsel(A%,B%)
 6210 LOCAL A$
 6220 IF(A%<&8000 OR A%>&BFFF)AND(B%<&8000 OR B%>&BFFF)=TRUE THEN =-1
 6230 INPUT"ROM Number",A$:IF A$="" THEN =-1
 6240 =EVAL(A$)
 6250 :
 6260 :
10000 DATA BRK12,ORA24,*,*,*,ORA21,ASL21,*
10010 DATA PHP12,ORA20,ASL13,*,*,ORA31,ASL31,*
10020 DATA BPL29,ORA25,*,*,*,ORA26,ASL26,*
10030 DATA CLC12,ORA37,*,*,*,ORA36,ASL36,*
10040 DATA JSR31,AND24,*,*,BIT21,AND21,ROL21,*
10050 DATA PLP12,AND20,ROL13,*,BIT31,AND31,ROL31,*
10060 DATA BMI29,AND25,*,*,*,AND26,ROL26,*
10070 DATA SEC12,AND37,*,*,*,AND36,ROL36,*
10080 DATA RTI12,EOR24,*,*,*,EOR21,LSR21,*
10090 DATA PHA12,EOR20,LSR13,*,JMP31,EOR31,LSR31,*
10100 DATA BVC29,EOR25,*,*,*,EOR26,LSR26,*
10110 DATA CLI12,EOR37,*,*,*,EOR36,LSR36,*
10120 DATA RTS12,ADC24,*,*,*,ADC21,ROR21,*
10130 DATA PLA12,ADC20,ROR13,*,JMP38,ADC31,ROR31,*
10140 DATA BVS29,ADC25,*,*,*,ADC26,ROR26,*
10150 DATA SEI12,ADC37,*,*,*,ADC36,ROR36,*
10160 DATA *,STA24,*,*,STY21,STA21,STX21,*
10170 DATA DEY12,*,TXA12,*,STY31,STA31,STX31,*
10180 DATA BCC29,STA25,*,*,STY26,STA26,STX27,*
10190 DATA TYA12,STA37,TXA12,*,*,STA36,*,*
10200 DATA LDY20,LDA24,LDX20,*,LDY21,LDA21,LDX21,*
10210 DATA TAY12,LDA20,TAX12,*,LDY31,LDA31,LDX31,*
10220 DATA BCS29,LDA25,*,*,LDY26,LDA26,LDX27,*
10230 DATA CLV12,LDA37,TSX12,*,LDY36,LDA36,LDX37,*
10240 DATA CPY20,CMP24,*,*,CPY21,CMP21,DEC21,*
10250 DATA INY12,CMP20,DEX12,*,CPY31,CMP31,DEX31,*
10260 DATA BNE29,CMP25,*,*,*,CMP26,DEC26,*
10270 DATA CLD12,CMP37,*,*,*,CMP36,DEC36,*
10280 DATA CPX20,SBC24,*,*,CPX21,SBC21,INC21,*
10290 DATA INX12,SBC20,NOP12,*,CPX31,SBC31,INC31,*
10300 DATA BEQ29,SBC25,*,*,*,SBC26,INC26,*
10310 DATA SEC12,SBC37,*,*,*,SBC36,INC36,*
```

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ACCESSORIES					
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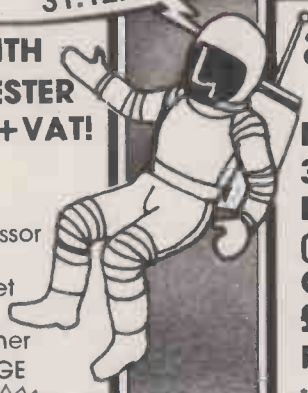

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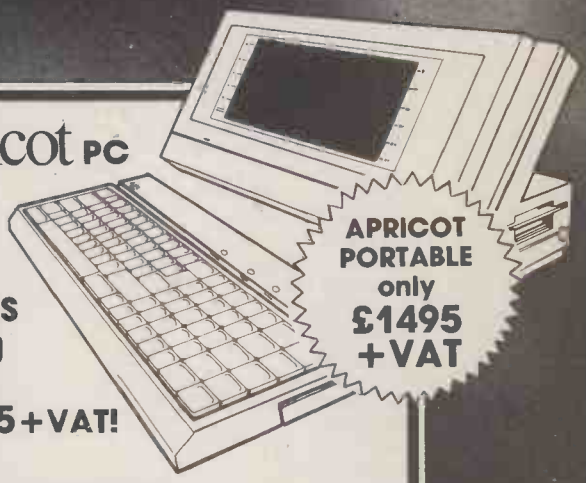

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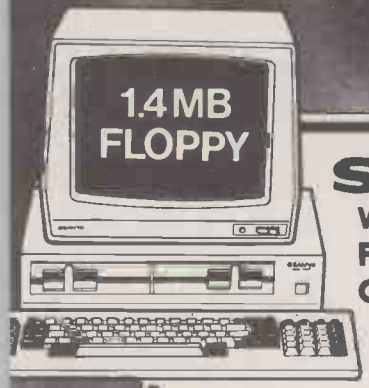

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Skydiver

PETER HEXTALL of Harrow, Middlesex has produced a program that kept me amused for some time. In it you are a parachutist flying along the top of the screen in a plane. On hitting the Return key, you jump from the plane and begin to freefall towards the ground. You then have to locate the landing pad somewhere on the ground below before the wind changes, watching the wind sock for strength and direction.

Once you have located the landing pad, you have to parachute on to it. To open the parachute you press the space bar. The longer you wait to open it, the more points you score. But if you leave it too late, you will end up on the ground in need of an ambulance.

The program consists of three Repeat-Until loops. The first loop is done while the player still has either a jump or a life left. The other two loops are within the first loop. The second loop moves the plane across the sky until the Return key is pressed. The program then enters the third loop which covers the time during the player's descent until landfall.

Skydiver.

```
  1 REM ************************
  2 REM *       SKYDIVE        *
  3 REM * FOR THE BBC MODEL B *
  4 REM *         BY           *
  5 REM *    PETER HEXTALL     *
  6 REM ************************
 10 MODE7
 20 PROCINSTRUCTIONS
 30 DIMA$(1)
 40 PROCINIT
 50 REPEAT
 60 MODE2
 70 PROCSCREEN
 80 FORI=1 TO 1400:NEXT
 90 REPEAT
100 PROCPLANE
110 PROCWIND
120 UNTIL INKEY(-74)=-1 OR G4%=2
130 X%=PX%:X1%=PX%
140 IF G4%=2 THEN M=M-1:GOTO330
150 REPEAT
160 IF CHUTE THEN PROCOPEN ELSE PR
OCFREE_FALL:GOTO220
170 A=INKEY(0)
180 *FX15,0
190 IFA=90 THEN A%=1:GOTO280
200 IFA=88 THEN A%=2:GOTO280
210 GOTO280
220 IFY%<450 THEN 280
230 IF INKEY(-99)=0 THEN 280
240 CHUTE=-1:GCOL3,5:SOUND0,-10,12
,2
250 IFN%=0 THEN 270
260 PROCFREE_FALL
270 MOVEX1%,Y1%:VDU230
280 PROCPLANE
290 PROCWIND
300 IFY%<350THEN LANDFALL=TRUE
310 UNTIL LANDFALL
320 IFNOT CHUTE THEN PROCCRASH ELS
E PROCLAND
330 PROCVARS
340 J=J-1
350 UNTIL M=0 OR J=0
360 VDU4
370 VDU17,129,17,7:PRINTTAB(3,2);J
;SPC(6);M;SPC(6);SC%;" "
380 VDU17,128:PRINTTAB(5,6);"ANOTH
ER GO?";
390 G$=GET$:IFG$="Y"THEN40
400 IFG$<>"N" THEN 390
410 MODE7
420 *FX12,0
430 *FX15,0
440 END
450 DEFPROCFREE_FALL
460 GCOL3,5
470 IFG1%=1 THEN G1%=0:GOTO500
480 MOVEX1%,Y1%:PRINTA$(N%)
490 N%=N% EOR1
500 MOVEX%,Y%:PRINTA$(N%)
510 X1%=X%:Y1%=Y%
520 Y%=Y%-12
530 S%=Y%
540 ENDPROC
550 DEFPROCOPEN
560 GCOL3,5
570 MOVEX1%,Y1%:VDU227,10,8,229
580 IFA%=1THENX%=X%-8
590 IFA%=2THENX%=X%+8
600 A%=0
610 X%=X%+4*W%
620 IFX%<5 OR X%>1215 THEN X%=X1%
630 MOVEX%,Y%:VDU227,10,8,229
640 X1%=X%:Y1%=Y%
650 Y%=Y%-4
660 ENDPROC
670 DEFPROCWIND
680 GCOL3,6
690 IFG%=1 THEN G%=0:GOTO740
700 IFRND(150)=50 THEN W1%=3-RND(5
)
710 IFW1%=W%THENENDPROC
720 IFW%<0THEN MOVE628,188 ELSE MO
VE704,188
730 VDU(233+W%)
740 IFW1%<0THEN MOVE628,188 ELSE M
OVE704,188
750 VDU(233+W1%)
760 W%=W1%
770 ENDPROC
780 DEFPROCPLANE
790 IFPX%>1087 THEN G4%=2:ENDPROC
800 GCOL3,3
810 IFG2%=1THENG2%=0:MOVEPX%,880:V
DU237,238,239:GOTO830
820 PX%=PX%+16
830 MOVEPX%,880:VDU237,240,241
840 ENDPROC
850 DEFPROCSCREEN
860 VDU17,129
870 PRINTSPC(20);" JUMPS   MEN  SC
ORE ";SPC(40)
880 PRINTTAB(3,2);J;TAB(7);M;TAB(1
4);SC%
890 VDU19,0,4;0;
900 VDU19,5,7;0;
910 COLOUR130
920 VDU28,0,31,19,23
930 CLS
940 VDU28,0,31,19,0
950 PAD=3+INT(RND(1)*15)
960 VDU17,6,17,130:PRINTTAB(PAD,23
);PAD$
970 VDU17,7:PRINTTAB(10,26);POLE$;
980 VDU5
990 ENDPROC
1000 DEFPROCLAND
1010 IFX%<64*PAD OR X%>64*PAD+24 TH
EN 1040
1020 SOUND1,-15,2,4
1030 SC%=SC%+(800-S%)/34
1040 MOVEX%,Y%+4:GCOL3,5:VDU230
1050 FORI=1TO2000:NEXT
1060 ENDPROC
1070 DEFPROCCRASH
1080 MOVEX%,Y%+12:GCOL3,5
1090 VDU228,10,8,229
1100 VDU19,5,1;0;
1110 SOUND0,-15,85,5
1120 MOVEX%,316:VDU236
1130 PROCAMB
1140 M=M-1
1150 IFSC%>3 THEN SC%=SC%-4 ELSE SC
%=0
1160 ENDPROC
1170 DEFPROCINIT
1180 J=10:SC%=0:M=3
1190 ENVELOPE 1,1,4,-4,4,10,20,10,1
27,0,0,-5,126,126
1200 VDU23,224,255,255,255,255,0,0,
0,0
1210 VDU23,226,224,224,224,224,0,0,
0,0
1220 VDU23,225,3,3,3,3,3,3,3,3
1230 VDU23,227,60,126,255,195,153,1
89,189,90
1240 VDU23,228,0,0,0,0,24,60,60,153
1250 VDU23,229,90,60,24,24,24,36,66
,129
1260 VDU23,230,60,126,255,195,129,1
29,129,195
1270 PAD$=CHR$224+CHR$226
1280 POLE$=STRING$(5,(CHR$225+CHR$1
0+CHR$8))
1290 VDU23,231,3,15,63,255,255,63,1
5,3
1300 VDU23,232,1,7,31,7,1,0,0,0
1310 VDU23,233,0,0,0,0,0,0,0,0
1320 VDU23,234,128,224,248,224,128,
0,0,0
1330 VDU23,235,192,240,252,255,255,
252,240,192
1340 VDU23,236,0,0,0,129,66,36,255,
219
1350 VDU23,237,0,1,1,1,1,1,0,0
1360 VDU23,238,0,128,129,194,255,25
5,255,0
1370 VDU23,239,0,0,128,64,224,240,2
24,0
1380 VDU23,240,0,224,225,178,128,12
8,192,0
1390 VDU23,241,0,0,224,208,24,12,24
,0
1400 VDU23,242,0,124,111,69,109,127
,93,34
1410 VDU23,243,0,62,246,162,182,254
,186,68
1420 VDU23,244,0,0,0,0,24,60,60,24
1430 VDU23,245,24,60,90,153,24,36,6
6,129
1440 A$(0)=CHR$228+CHR$10+CHR$8+CHR
$229
1450 A$(1)=CHR$244+CHR$10+CHR$8+CHR
$245
1460 PROCVARS
1470 *FX11,5
1480 ENDPROC
1490 DEFPROCINSTRUCTIONS
1500 PRINTTAB(15);CHR$(130);"SKY-DI
VER"
1510 PRINT CHR$(131);"Your task is
to land the sky-diver on"
1520 PRINT CHR$(131);"the";CHR$(134
);"CYAN";CHR$(131);"landing pad, but
beware the"
```

```
 1530 PRINT CHR$(131);"changeable wi
nd which can blow you off"
 1540 PRINT CHR$(131);"course, so ke
ep an eye on the wind"
 1550 PRINT CHR$(131);"strength. As
the plane flies across"
 1560 PRINT CHR$(131);"the sky you h
ave to make your man jump"
 1570 PRINT CHR$(131);"from the airc
raft, this is done by"
 1580 PRINT CHR$(131);"pressing the"
;CHR$(129);"RETURN";CHR$(131);"key.
To open your"
 1590 PRINT CHR$(131);"parachute pre
ss the"CHR$(130);"SPACE BAR.";CHR$(1
31);"The"
 1600 PRINT CHR$(131);"later you lea
ve opening your chute the"
 1610 PRINT CHR$(131);"higher the sc
ore you will obtain on a"
 1620 PRINT CHR$(131);"successful la
nding. But come too low"
 1630 PRINT CHR$(131);"and the chute
 will not open and you"
 1640 PRINT CHR$(131);"will be";CHR$
(133);"SPLATTERED";CHR$(131);"on the
 gound"
 1650 PRINT CHR$(131);"losing you 4
points and 1 life, the"
 1660 PRINT CHR$(131);"maximum score
 is 10 points per jump"
 1670 PRINT CHR$(134);"To control yo
ur man when the chute is"
 1680 PRINT CHR$(134);"open ";CHR$(1
29);"Z";CHR$(134);"- Left"
 1690 PRINT"      ";CHR$(129);"X";CH
R$(134);"- Right"
 1700 PRINT
 1710 PRINT CHR$(133);"You start of
with 10 jumps and 3 lives"
 1720 PRINTTAB(9);"Press";CHR$(136);
"SPACE";CHR$(137);"when ready"
 1730 REPEAT UNTIL GET=32
 1740 ENDPROC
 1750 DEFPROCVARS
 1760 LANDFALL=0
 1770 CHUTE=0
 1780 X1%=0:Y1%=794:X%=0:Y%=Y1%:G4%=
0:N%=1
 1790 W%=3-RND(5):W1%=W%:G%=1:G1%=1:
G2%=1
 1800 PX%=0
 1810 ENDPROC
 1820 DEFPROCAMB
 1830 IFX%<640 THEN Q%=1216:W%=0:E%=
-8:R%=243:ELSEQ%=0:W%=1216:E%=8:R%=2
42
 1840 FORI=1TO1000:NEXT
 1850 GCOL0,7
 1860 SOUND1,1,100,80
 1870 K=TIME
 1880 FORT%=Q% TO W% STEP E%
 1890 GCOL0,7:MOVET%,316:VDUR%
 1900 IFABS(T%-X%)<8 THEN FORI=1TO10
00:NEXT
 1910 GCOL0,0:MOVET%,316:VDUR%
 1920 NEXT
 1930 ENDPROC
>
```

Graph plotter

Mark Callaway of Lesbury, Northumberland has submitted a three-dimensional graph plotter that draws two types of graph using perspective and hidden-line removal.

It is simple to draw graphs of two-dimensional functions. For example, the graph

$$y = \sin(X)$$

is represented by a single curve. Three-dimensional functions are not represented by lines and curves but by surfaces. This program allows you to examine three-dimensional surfaces defined by equations of the form

$$Z = F(X,Y)$$

The program produces two sorts of graph. The first is a solid graph which shows a picture of a cuboid. The top surface is defined by the function being plotted; the bottom surface has the constant value ZMin. The second type is a surface graph which shows a picture of the surface defined by the function. All the graphs are drawn as seen from a fixed viewpoint using a perspective projection.

The program is mainly explained in Rem statements, but if you are interested in how the hidden-line removal works insert some delays into the program and watch it run in mode 1.

Graph plotter.

```
   10 REM ***************************
************************
   20 REM ***
                  ***
   30 REM *** 3 Dimensional Graph Pl
otter for 32K BBC   ***
   40 REM *** Copyright Mark Callawa
y & EDPA  31/3/83   ***
   50 REM ***
                  ***
   60 REM ***************************
************************
   70 :
   80 REM Ask for the function HAT i
f you want a Mexican Hat
   90 :
  100 MODE7
  110 :
  120 REM Ask user for function and
it's range
  130 :
  140 INPUT'"X-MIN,X-MAX ",XMIN,XMAX
  150 INPUT"Y-MIN,Y-MAX ",YMIN,YMAX
  160 INPUT"FUNCTION OF X AND Y: Z="
,F$
  170 INPUT"ESTIMATED Z-MIN,Z-MAX",Z
MIN,ZMAX
  180 :
  190 IFF$="HAT"THENXMIN=0:YMIN=0:XM
AX=20:YMAX=20:ZMIN=-.25:ZMAX=.8
  200 IFF$="HAT"THENF$="SIN(SQR((X-1
0)^2+(Y-10)^2)+.01)/(SQR((X-10)^2+(Y
-10)^2)+.01)"
  210 :
  220 INPUT"Number of squares along
X axis",XSQ
  230 INPUT"Number of squares along
Y axis",YSQ
  240 INPUT"Do want (1) a surface gr
aph or (2) a    solid graph ",S
  250 IF S<>1 AND S<>2 THEN 240
  260 :
  270 REM Draw Graph
  280 :
  290 MODE0  : REM or try MODE 1
  300 DIM Z(XSQ,S-1,1)
  310 FOR Y=YMAX TO YMIN STEP (YMIN-
YMAX)/YSQ
  320 Y1=((Y-YMIN)/(YMAX-YMIN)*10)+2
0
  330 XX=-1
  340 FOR X=XMAX TO XMIN STEP (XMIN-
XMAX)/XSQ
  350 XX=XX+1
  360 Z=EVAL(F$)
  370 :
  380 REM X1, Y1 and Z1 are the imag
es of X,Y and Z
  390 REM when the graph is mapped i
nto the 10 by 10 by 20
  400 REM cuboid with lower near ver
tex at (20,20,-30).
  410 :
  420 X1=((X-XMIN)/(XMAX-XMIN)*10)+2
0
  430 Z1=((Z-ZMIN)/(ZMAX-ZMIN)*20)-3
0
  440 :
  450 REM X2 and Z2 are the images o
f (X1,Y1,Z1) when
  460 REM when viewed in perspective
 from (0,0,0).
  470 REM They are scaled so the gra
ph fills the screen
  480 REM if correct value of ZMAX a
nd ZMIN are entered.
  490 :
  500 X2=(X1/Y1)*1400-900
  510 Z2=(Z1/Y1)*600+1100
  520 IFS=1THEN950
  530 :
  540 REM A 'solid graph' is made up
 of many solid cuboids.
  550 REM The bottoms of these are g
iven by ZMIN and the
  560 REM tops given by Z.  The prog
ram draws then bottoms
  570 REM tops and nearest two faces
 of the cuboids.
  580 REM To show that they are soli
d, hidden edges are
  590 REM removed by plotting them i
n the order bottom then
  600 REM top then faces.  When each
 facet is displayed,
  610 REM the area it is first fille
d completely with colour
  620 REM to delete any lines behind
 it which it obscure and
  630 REM then the edges of the face
t are draw in colour 1.
  640 REM As well as plotting the fa
ces of the cuboids in a
  650 REM definite order the cuboids
 themselves are plotted
  660 REM in order. You will notice
that the X and Y loops
  670 REM scan down from XMAX and YM
AX.  Hence each graph
  680 REM is draw starting at the ba
ck and working towards
  690 REM the front.  This means the
 cuboids at the back
  700 REM tend to be overprinted by
the cuboids at the
  710 REM front.  This obliterates h
idden lines and surfaces
  720 REM correctly.
  730 :
  740 Z3=-30
  750 Z4=(Z3/Y1)*600+1100
  760 IF Y=YMAX OR X=XMAX THEN 910
  770 :
```

(continued on next page)

(continued from previous page)

```
 780 REM Draw bottom face of cuboid
 790 :
 800 MOVEZ(XX,1,0),Z(XX,1,1)
 810 MOVEZ(XX-1,1,0),Z(XX-1,1,1)
 820 GCOL0,2
 830 PLOT85,X2,Z4
 840 PLOT85,0X2,0Z4
 850 GCOL0,1
 860 MOVEZ(XX,1,0),Z(XX,1,1)
 870 DRAWZ(XX-1,1,0),Z(XX-1,1,1)
 880 DRAW0X2,0Z4
 890 DRAWX2,Z4
 900 DRAWZ(XX,1,0),Z(XX,1,1)
 910 IFXX=0THEN940
 920 Z(XX-1,1,0)=0X2
 930 Z(XX-1,1,1)=0Z4
 940 0Z4=Z4
 950 IF Y=YMAX OR X=XMAX THEN 1370
 960 :
 970 REM Draw top face of cube.
 980 :
 990 MOVEZ(XX,0,0),Z(XX,0,1)
1000 MOVEZ(XX-1,0,0),Z(XX-1,0,1)
1010 GCOL0,2
1020 PLOT85,X2,Z2
1030 PLOT85,0X2,0Z2
1040 GCOL0,1
1050 MOVEZ(XX,0,0),Z(XX,0,1)
1060 DRAWZ(XX-1,0,0),Z(XX-1,0,1)
1070 DRAW0X2,0Z2
1080 DRAWX2,Z2
1090 DRAWZ(XX,0,0),Z(XX,0,1)
1100 IFS=1THEN1370
1110 :
1120 REM Draw faces of cuboid.
1130 :
1140 MOVEX2,Z4
1150 MOVE0X2,0Z4
1160 GCOL0,2
1170 PLOT85,X2,Z2
1180 PLOT85,0X2,0Z2
1190 GCOL0,1
1200 MOVEX2,Z4
1210 DRAW0X2,0Z4
1220 DRAW0X2,0Z2
1230 DRAWX2,Z2
1240 DRAWX2,Z4
1250 :
1260 MOVEX2,Z4
1270 MOVEZ(XX,1,0),Z(XX,1,1)
1280 GCOL0,2
1290 PLOT85,X2,Z2
1300 PLOT85,Z(XX,0,0),Z(XX,0,1)
1310 GCOL0,1
1320 MOVEX2,Z4
1330 DRAWZ(XX,1,0),Z(XX,1,1)
1340 DRAWZ(XX,0,0),Z(XX,0,1)
1350 DRAWX2,Z2
1360 DRAWX2,Z4
1370 IFXX=0THEN1400
1380 Z(XX-1,0,0)=0X2
1390 Z(XX-1,0,1)=0Z2
1400 REM
1410 0Z2=Z2
1420 0X2=X2
1430 NEXT
1440 IFS=2THENZ(XX,1,0)=X2:Z(XX,1,1
)=Z4
1450 Z(XX,0,0)=X2:Z(XX,0,1)=Z2
1460 NEXT
>
```

Calendar

Saveniers Dimitri of Bercham, Belgium has submitted a program which will produce a neatly formatted calendar of any year specified. It uses a 120-column printer, but this could be changed. An A4 sheet printed in 15-pitch would probably do, or a condensed mode dot-matrix print.

ProcShrikkel calculates the days of February. ProcInit1 initialises the variables and strings. ProcBepaaldag gives I a value between 1 and 7: Sunday for 1, Monday for 2, etc. D% corresponds to the day, M% corresponds to the month and J% corresponds to the year.

Calendar.

```
  10 REM
  20 REM Calender
  30 REM
  40 REM Saveniers Dimitri
  50 REM
  60 REM September 1983
  70 REM
  80 REM
  90 REM
 100 REM********************
 110 MODE3
 120 DIM DAT$(6)
 130 PROCinit1
 140 REPEAT
 150 INPUT"For which year do you wa
nt a calender :"year%
 160 PROCschrikkel
 170 INPUT"To the printer (Y/N) " G
$: IF G$="Y" OR G$="y" THEN VDU2
 180 PRINT''''TAB(54)year%
 190 PRINT''''
 200 PRINTm1$
 210 PRINT''d$
 220 PRINT
 230 PROCinit2
 240 PROCbereken(JAN%,10,1)
 250 PROCbereken(FEB%,38,2)
 260 PROCbereken(MAR%,66,3)
 270 PROCbereken(APR%,94,4)
 280 FOR J%=1 TO 6
 290 PRINTLEFT$(DAT$(J%),120)
 300 NEXT J%
 310 PROCinit2
 320 PROCbereken(MAY%,10,5)
 330 PROCbereken(JUN%,38,6)
 340 PROCbereken(JUL%,66,7)
 350 PROCbereken(AUG%,94,8)
 360 PRINT''''m2$
 370 PRINT''d$
 380 PRINT
 390 FOR J%=1 TO 6
 400 PRINTLEFT$(DAT$(J%),120)
 410 NEXT J%
 420 PROCinit2
 430 PROCbereken(SEP%,10,9)
 440 PROCbereken(OCT%,38,10)
 450 PROCbereken(NOV%,66,11)
 460 PROCbereken(DEC%,94,12)
 470 PRINT''''m3$
 480 PRINT''d$
 490 PRINT
 500 FOR J%=1 TO 6
 510 PRINTLEFT$(DAT$(J%),120)
 520 NEXT J%
 530 VDU3
 540 INPUT"Do you want another (Y/N
) "A$
 550 UNTIL LEFT$(A$,1)<>"Y"
 560 END
 610 DEF PROCschrikkel
 620 r1=year% DIV 4
 630 rest1=year% MOD 4
 640 r2=year% DIV 100
 650 rest2=year% MOD 100
 660 r3=year% DIV 400
 670 rest3=year% MOD 400
 680 IF (rest3=0 AND rest2=0 AND re
st1=0) OR (rest1=0 AND NOT(rest2=0)
AND NOT(rest3=0)) THEN FEB%=29 ELSE
FEB%=28
 690 ENDPROC
 730 DEF PROCinit2
 740 FOR J%=1 TO 6
 750 DAT$(J%)=STRING$(130," ")
 760 NEXT J%
 770 ENDPROC
 810 DEF PROCinit1
 820 CLS
 830 JAN%=31:MAR%=31:APR%=30
 840 MAY%=31:JUN%=30:JUL%=31: AUG%=
31
 850 SEP%=31:OCT%=31:NOV%=30: DEC%=
31
 860 m1$=STRING$(17," ")+"January"+
STRING$(20," ")+"Febuary"+STRING$(22
," ")+"March"+STRING$(22," ")+"April
"
 870 m2$=STRING$(19," ")+"May"+STRI
NG$(24," ")+"June"+STRING$(24," ")+"
July"+STRING$(23," ")+"August"
 880 m3$=STRING$(16," ")+"September
"+STRING$(20," ")+"October"+STRING$(
21," ")+"November"+STRING$(19," ")+"
December"
 890 hulp$="Su Mo Tu We Th Fr Sa "
 900 d$=STRING$(10," ")+hulp$+STRIN
G$(7," ")+hulp$+STRING$(7," ")+hulp$
+STRING$(7," ")+hulp$
 910 ENDPROC
 920 DEF PROCbepaaldag(D%,M%,J%)
 930 IF M%=1 THEN M%=M%+12: J%=J%-1
 940 IF M%=2 THEN M%=6: J%=J%-1
 950 X%=D%+INT(2.6*M%-.4)+INT(1.25*
J%)-INT(J%/100)+INT(J%/400)+INT(J%/4
000)+2
 960 I=(X% MOD 7)+1
1000 ENDPROC
1040 DEF PROCbereken(month%,tab%,mm
%)
1050 R%=1
1060 FOR dd%=1 TO month%
1070 PROCbepaaldag(dd%,mm%,year%)
1080 IF dd%<10 THEN 1090 ELSE 1110
1090 DAT$(R%)=LEFT$(DAT$(R%),tab%+1
+(I-1)*3)+STR$(dd%)+RIGHT$(DAT$(R%),
130-(I-1)*3-tab%)
1100 GOTO 1120
1110 DAT$(R%)=LEFT$(DAT$(R%),tab%+(
I-1)*3)+STR$(dd%)+RIGHT$(DAT$(R%),13
0-(I-1)*3-tab%)
1120 IF I=7 THEN R%=R%+1
1130 NEXT dd%
1140 ENDPROC
>
```

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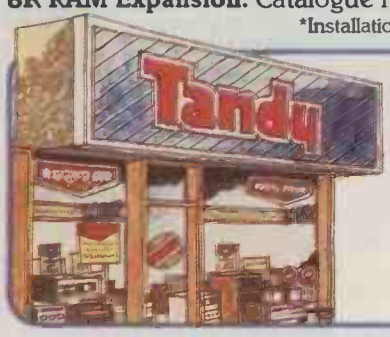

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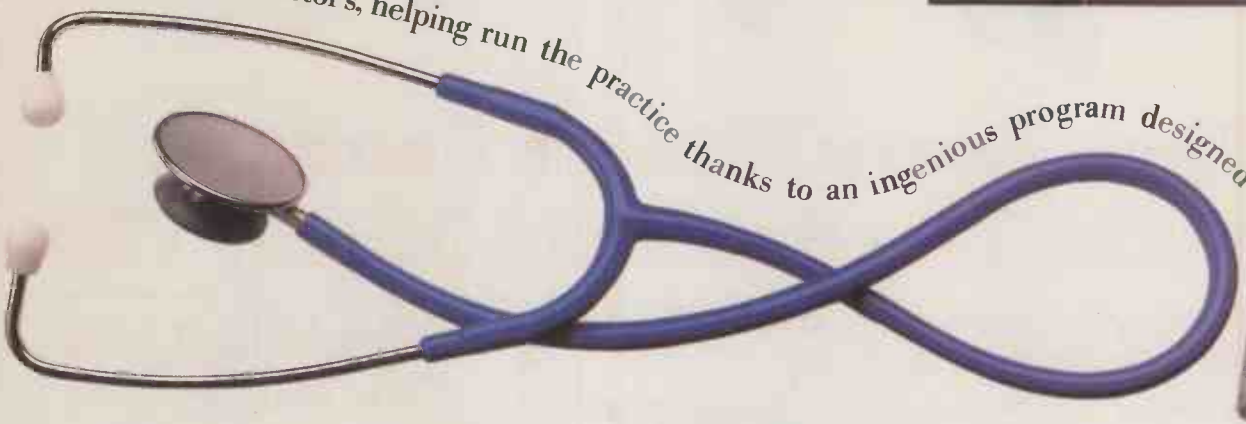
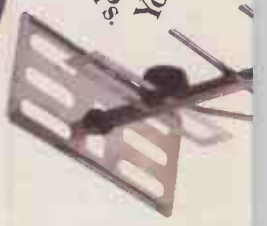
The BBC Micro is only 16" long. But it stretches indefinitely.

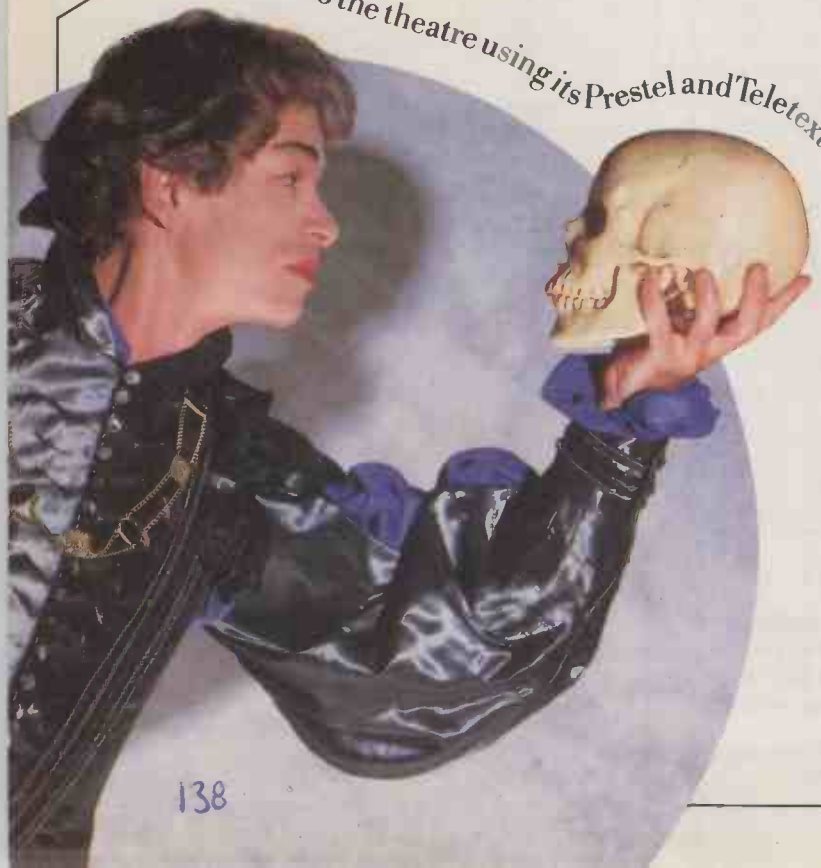
It stretches into schools where BBC Basic and the Econet networking system have helped make it Britain's number one

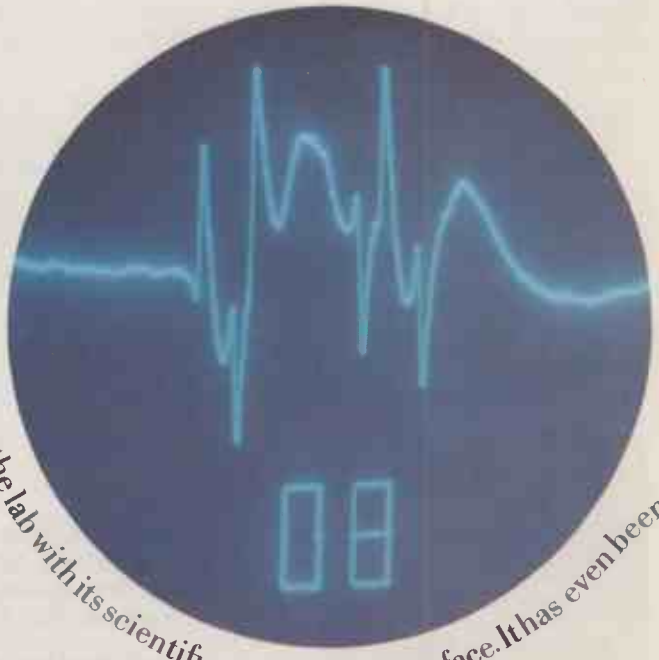
It's down at the doctor's, helping run the practice thanks to an ingenious program designed by two GPs. You'll catch it



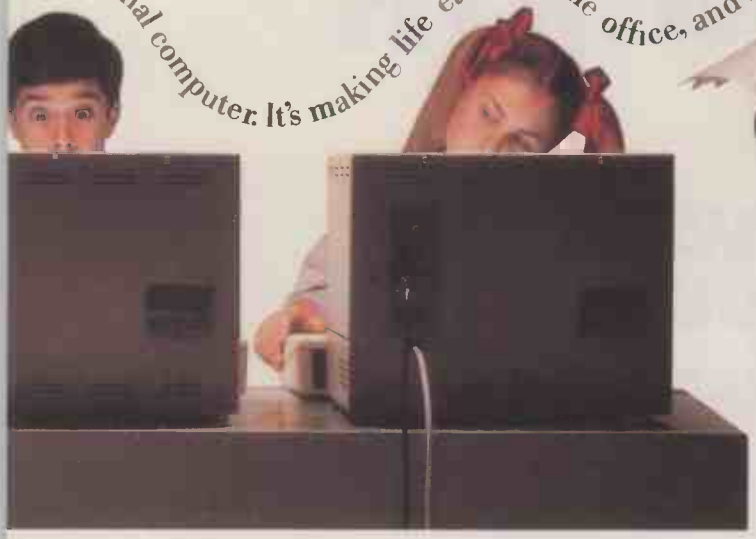


It can take you to the theatre using its Prestel and Teletext adaptors. While helping out at the lab with its scientific monitoring interface. It has even been

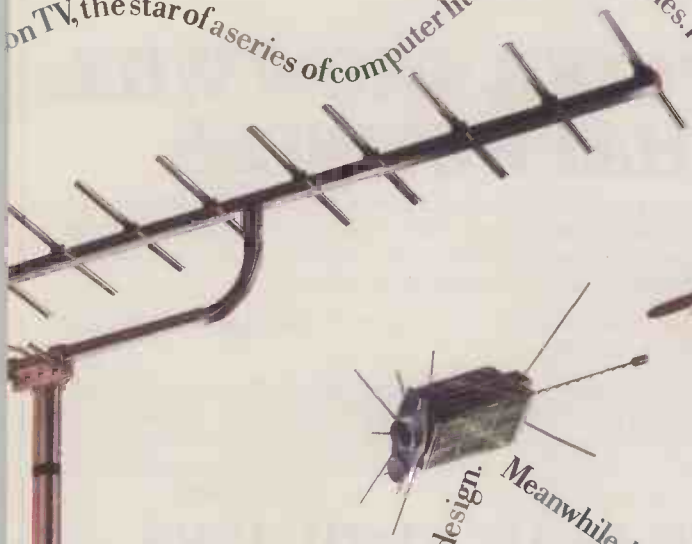




ducational computer. It's making life easier in the office, and has grown into the country's top micro for small businessmen.



on TV, the star of a series of computer literacy programmes. Its colour graphics and new Bitstik make it welcome in design studios.



working in space, tracking a satellite it also helped design. Meanwhile, back on Earth at 49 Acacia Avenue, Kingswood, Middle...

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PC

Accessor

DONALD TELFER of Fort Victoria, Zimbabwe wrote the Accessor utility to display shape table contents with various values of colour, scale and rotation. It allows elements within a full shape table to be placed on the screen. When one table has been finished with, another can be selected. It is surprising how much can be achieved with such a short utility program.

```
1  REM **********************
2  REM **   ACCESSOR        **
3  REM **   D. TELFER       **
4  REM **   JUNE  1984      **
5  REM **********************
10  HOME : PRINT "HGR SHAPE TABLE
     ACCESSOR":D$ =  CHR$ (13) +
     CHR$ (4): POKE 34,2: PRINT

20  PRINT "PUT YOUR DISK IN THE D
     RIVE, THEN": INPUT "PRESS <R
     ETURN>. ";R1$: PRINT D$;"CAT
     ALOG"
30  INPUT "FILE NAME OF SHAPE TAB
     LE: ";F$
40  PRINT D$;"BLOAD ";F$: ONERR  GOTO
     130
50 A1% =  PEEK ( - 21902):A2% =  PEEK
     ( - 21901):A3% =  PEEK (A1% +
     256 * A2%): REM 48K MEM ONLY

51  REM **********************
52  REM **  32K             **
53  REM **  A1%=PEEK(27250) **
54  REM **  A2%=PEEK(27251) **
55  REM **  36K             **
56  REM **  A1%=PEEK(31346) **
57  REM **  A2%=PEEK(31347) **
58  REM **********************
60  POKE 232,A1%: POKE 233,A2%
70  HGR : VTAB 24: PRINT F$;" CON
     TAINS "A3%;" SHAPE"; CHR$ (
     32 + (A3% > 1) * 51);"."
80  INPUT "       SCALE: ";R2%: INPUT
     "      HCOLOR: ";R3%: INPUT
     "    ROTATION: ";R4%: INPUT
     "SHAPE NUMBER: ";R5%
90  SCALE= R2%: HCOLOR= R3%: ROT=
     R4%
100  DRAW.R5% AT 120,65
110  VTAB 24: HTAB 23: INPUT "ANO
     THER? Y/N > ";RG$: IF RG$ =
     "Y" THEN 70
120  VTAB 24: HTAB 21: INPUT "ANO
     THER TABLE? > ";R7$: IF R7$ =
     "Y" THEN  TEXT : RUN
130  POKE 34,0: TEXT : END
```

Star Blast

Tony Sinnett of Headington has sent a game requiring the player to line a gunsight on marauding spacecraft, using the keyboard for control. The high-resolution screen gives several spacecraft shapes, as well as cylindrical fuel dumps which can be used to prolong each life. Active keys are I, J, K and M for movement, and A to fire. A Best Score table is maintained for each session.

Star Blast.

```
10  IF  PEEK (103) = 1 AND  PEEK
     (104) = 64 THEN 30
20  POKE 103,1: POKE 104,64: POKE
     16384,0: PRINT  CHR$ (4);"RU
     N STAR BLAST"
30  REM *************************

40  REM *STAR BLAST BY T.SINNETT*

50  REM *    COPYRIGHT  1984    *

60  REM *************************

70  GOSUB 1450
80  POKE 232,0: POKE 233,08
90  GOSUB 1610
100  GOSUB 1180
110  HGR : SCALE= 1: ROT= 0: HCOLOR=
     7: HOME :A = 110
120 B = 100: DIM Z(1):F = 1:P = 0
     :G = 1
130 H = 0:I = 500: DIM Y$(4): DIM
     Y(4)
140  FOR C1 = 0 TO 4:Y(C1) = 500 -
     C1 * 100:Y$(C1) = "T.SINNETT
     ": NEXT
150  FOR C1 = 1 TO 200:A1 =  INT
     ( RND (1) * 279) + 0:A2 =  INT
     ( RND (1) * 160) + 0: HPLOT
     A1,A2: NEXT
160  REM  ** KEY FUNCTIONS **
170 KY =  PEEK ( - 16384):KY = KY
     - 128
180 I = I - 1: IF I = 0 THEN 950
190  HTAB 20: VTAB 22: PRINT "FUE
     L= "I" "
200  HTAB 4: VTAB 22: PRINT "SCOR
     E="H
210  IF KY =  ASC ("J") THEN 280
220  IF KY =  ASC ("K") THEN 320
230  IF KY =  ASC ("I") THEN 360
240  IF KY =  ASC ("M") THEN 400
250  IF KY =  ASC ("A") THEN 440
260  HCOLOR= 7: DRAW 10 AT A,B
270  GOSUB 630: GOTO 170
280  REM  ** MOVE LEFT **
290  GOSUB 590
300  ON (A = 10) GOSUB 600
310 A = A - 10: GOSUB 600
320  REM  ** MOVE RIGHT **
330  GOSUB 590
340  ON (A = 250) GOSUB 600
350 A = A + 10: GOSUB 600
360  REM  ** MOVE UP **
370  GOSUB 590
380  ON (B = 10) GOSUB 600
390 B = B - 10: GOSUB 600
400  GOSUB 590
410  REM  ** MOVE DOWN **
420  ON (B = 140) GOSUB 600
430 B = B + 10: GOSUB 600
440  REM  ** FIRE **
450 J = 1:V% = A + 6:W% = B + 12:
     POKE  - 16368,0
460  HPLOT 79,159 TO V%,W%: HPLOT
     200,159 TO V%,W%
470 XX =  - 16336
480 Y =  PEEK (XX) -  PEEK (XX) +
     PEEK (XX) -  PEEK (XX) +  PEEK
     (XX) -  PEEK (XX) +  PEEK (X
     X) -  PEEK (XX) +  PEEK (XX)
     -  PEEK (XX) +  PEEK (XX) -
     PEEK (XX) +  PEEK (XX) -  PEEK
     (XX) +  PEEK (XX)
490  IF A2 = 1 OR A2 = 4 OR A2 =
     7 THEN  GOSUB 560
500  IF A2 = 2 OR A2 = 5 OR A2 =
     8 THEN  GOSUB 570
510  IF A2 = 3 OR A2 = 6 OR A2 =
     9 THEN  GOSUB 570
520  HCOLOR= 0: HPLOT 79,159 TO V
     %,W%
530  HPLOT 200,159 TO V%,W%: HCOLOR=
     7
540  IF V% > X% - 1 AND V% < X% +
     M AND W% > Y% - 1 AND W% < Y
     % + N THEN 1110
550 J = 0: GOTO 610
560 M = 12:N = 14
570 M = 15:N = 20
580 M = 20:N = 26
590  HCOLOR= 0: DRAW 10 AT A,B: RETURN

600  HCOLOR= 7: DRAW 10 AT A,B: POP

610  IF J = 1 THEN 440
620  GOSUB 630: GOTO 170
630  REM  ** SPACESHIP MOVE **
640  IF Z(0) = 1 THEN 720
650  IF Z(1) = 1 THEN 810
660 X% =  INT ( RND (1) * 130) +
     40:Y% =  INT ( RND (1) * 60)
     + 20
670  IF X% > 39 AND X% < 86 THEN
     690
680  IF X% > 85 AND X% < 131 THEN
     780
690 C% =  INT ( RND (1) * 10) + 1

700  IF C% = 8 THEN A2 = 7: GOTO
     720
710 A2 = 1
720  GOSUB 930:Z(0) = 1:Z(1) = 0
730  ON C GOSUB 870,870,880,880,8
     90,890
740 F = F + 1: IF F = 5 THEN A2 =
     A2 + 1:F = 1
750  IF A2 = 4 OR A2 = 10 THEN A2
     = 1:Z(0) = 0:Z(1) = 0: GOTO
     770
760  GOSUB 940:C = C + 1: IF C =
     5 THEN C = 1
770  RETURN
780 C% =  INT ( RND (1) * 10) + 1

790  IF C% = 8 THEN A2 = 7: GOTO
     720
800 A2 = 4
810  GOSUB 930:Z(0) = 0:Z(1) = 1
820  ON C GOSUB 900,900,910,910,9
     20,920
830 G = G + 1: IF G = 5 THEN A2 =
     A2 + 1:G = 1
840  IF A2 = 7 OR A2 = 10 THEN A2
     = 1:Z(0) = 0:Z(1) = 0: GOTO
     860
850  GOSUB 940:C = C + 1: IF C =
     5 THEN C = 1
860  RETURN
870 X% = X% + 5:Y% = Y% + 5: RETURN

880 X% = X% + 5: RETURN
890 X% = X% + 9:Y% = Y% - 9: RETURN

900 X% = X% - 5:Y% = Y% + 5: RETURN

910 X% = X% - 5: RETURN
920 X% = X% - 5:Y% = Y% - 9: RETURN

930  HCOLOR= 0: DRAW A2 AT X%,Y%:
     RETURN
940  HCOLOR= 7: DRAW A2 AT X%,Y%:
     RETURN
950  REM  ** SCORE BOARD
960  TEXT : HOME :C2 = 10
970  PRINT "YOU SCORED "H" POINTS
     "
980  FOR C1 = 1 TO 500: NEXT
990  PRINT : PRINT : PRINT
     "ENTER NAME = ": INPUT Y$
1000  IF H < Y(4) THEN  PRINT : PRINT
     : PRINT "BAD LUCK ";Y$;" YOU
     DIDN'T GET ON THE SCORE BOA
     RD BETTER LUCK NEXT TIME": GOTO
     1090
1010  IF H < Y(3) THEN Y(4) = H:Y
     $(4) = Y$: GOTO 1070
1020  IF H < Y(2) THEN Y(4) = Y(3
     ):Y(3) = H:Y$(4) = Y$(3):Y$(
     3) = Y$ THEN 1070
1030  IF H < Y(1) THEN Y(4) = Y(3
     ):Y(3) = Y(2):Y(2) = H:Y$(4)
     = Y$(3):Y$(3) = Y$(2):Y$(2)
     = Y$: GOTO 1070
1040  IF H < Y(0) THEN Y(4) = Y(3
     ):Y(3) = Y(2):Y(2) = Y(1):Y(
     1) = H:Y$(4) = Y$(3):Y$(3) =
     Y$(2):Y$(2) = Y$(1):Y$(1) =
     Y$: GOTO 1070
1050  IF H = Y(0) OR H > Y(0) THEN
     Y(4) = Y(3):Y(3) = Y(2):Y(2)
     = Y(1):Y(1) = Y(0):Y(0) = H
     :Y$(4) = Y$(3):Y$(3) = Y$(2)
     :Y$(2) = Y$(1):Y$(1) = Y$(0)
     :Y$(0) = Y$: GOTO 1070
1060  IF H < Y(4) THEN  PRINT : PRINT
     : PRINT "BAD LUCK ";Y$;" YOU
     DIDN'T GET ON THE SCORE BOA
     RD BETTER LUCK NEXT TIME": GOTO
     1090
1070  HOME : HTAB 17: VTAB 5: PRINT
     "SCORES": HTAB 17: PRINT "--
     ----"
1080  FOR C1 = 0 TO 4:C2 = C2 + 2
     : VTAB C2: PRINT Y$(C1): HTAB
     30: VTAB C2: PRINT Y(C1): NEXT
```

(continued on next page)

(continued from previous page)

```
1090  FOR C1 = 1 TO 5000: NEXT C1

1100 A = 110:B = 100:Z(0) = 0:Z(1
     ) = 0: HCOLOR= 7: ROT= 0:H =
     0:I = 500:G = 1:F = 1:J = 0:
      HOME : HGR : GOTO 150
1110  REM  ** EXPLOSION **
1120  HCOLOR= 0: DRAW A2 AT X%,Y%
     : FOR C1 = 1 TO 7:P = P + 8:
      ROT= P: SCALE= 1: HCOLOR= 7
     : DRAW A2 AT X%,Y%
1130 X =  PEEK ( - 16336) -  PEEK
     ( - 16336) +  PEEK ( - 16336
     ): HCOLOR= 0: DRAW A2 AT X%,
     Y%: NEXT
1140  ROT= 0: SCALE= 1: HCOLOR= 7
     :H = H + 10:Z(0) = 0:Z(1) =
     0
1150 P = 0:G = 1:F = 1: DRAW 10 AT
     A,B
1160  IF A2 > 6 AND A2 < 10 THEN
     I = I + 100:A2 = 1
1170  GOTO 620
1180  REM  ** INSTRUCTIONS **
1190  HOME : HTAB 15: VTAB 4: PRINT
     "STAR BLAST"
1200  HTAB 15: VTAB 5: PRINT "---
     -------"
1210  VTAB 8: PRINT "THE OBJECT O
     F THE GAME IS TO DESTROY AS"

1220  VTAB 10: PRINT "MANY ENEMY
     FIGHTERS AS YOU CAN WITHIN
     "
1230  VTAB 12: PRINT "THE FUEL LI
     MIT.  YOU CAN GAIN MORE FUEL
     "
1240  VTAB 14: PRINT "BY SHOOTING
      FUEL CYLINDERS,  YOU ALSO
     "
1250  VTAB 16: PRINT "GAIN POINTS
     .  YOU USE THE 'A' KEY TO
     "
1260  VTAB 18: PRINT "FIRE AND,  A
     ND THE 'J' KEY TO MOVE LEFT,
     "
1270  VTAB 20: PRINT "THE 'K' TO
     MOVE RIGHT"
1280  VTAB 22: PRINT "PRESS 'RETU
     RN' TO CONTINUE"
1290  IF  PEEK ( - 16384) > 127 THEN
     1310
1300  GOTO 1280
1310  HOME : VTAB 2: PRINT "YOU U
     SE THE 'I' TO GO UP AND THE
     'M' TO"
1320  VTAB 4: PRINT "MOVE DOWN"
1330  VTAB 6: PRINT "WANT TO SEE
     THE INSTRUCTIONS AGAIN(Y/N)"
     : GET A$
1340  IF A$ = "Y" THEN 1180
1350  IF A$ = "N" THEN 1370
1360  GOTO 1330
1370  DATA  173,48,192,136,208,4
     ,198,7,240,8,202,208,246,166
     ,6,76,0,3,96
1380  DATA  116,4,78,4,86,1,92,
     1,104,1,58,4,78,4,86,1
1390  DATA  92,1,104,1,58,4,78,4
     ,86,1,92,1,86,1,104,4
1400  RESTORE
1410  FOR C1 = 0 TO 18: READ A: POKE
     768 + C1,A: NEXT
1420  FOR C1 = 1 TO 16: READ A,B
1430  POKE 6,A: POKE 7,B * 50: CALL
     768: NEXT
1440  RETURN
1450  REM  ** DATA FOR SHAPES **
1460  FOR C1 = 0 TO 18: READ A: NEXT
     : FOR C1 = 1 TO 16: READ A,B
     : NEXT
1470  FOR C1 = 0 TO 726: READ A: POKE
     2048 + C1,A: NEXT
1480  RETURN
1490  DATA 10,0,22,0,66,0,153,0,2
     6,1,72,1,154,1,37,2,83,2,134
     ,2,185,2,54,54,54,54,54,54,4
     6,36,36,36,44,46,44,44,45,46
     ,45,36,36,36,53,54,54,54,54,
     54,54,39,36,36,60,63,62,63,6
     0,63,39,36,44,54,36,36
1500  DATA 36,0,54,54,54,54,54,54
     ,54,54,54,54,46,36,36,36,36,
     36,36,36,36,44,54,54,54,54,5
     4,37,44,54,53,46,45,37,44,36
     ,53,46,36,36,36,36,36,53,54,
     54,54,54,54,54,54,54,54,37,3
     6,36,36,36,36,36,36,36,36,63

1510  DATA  223,146,146,50,38,36,
     63,63,54,54,254,51,54,54,54,
     110,73,73,9,36,36,36,36,36,0
     ,54,54,54,54,54,54,54,54,54,
     54,54,54,46,36,36,36,36,36,3
     6,36,36,36,36,36,36,36,44,54,54
     ,54,54,54,54,54,54,54,54,54,
     54,46
1520  DATA  36,36,36,36,36,36,36,
     53,46,36,53,46,54,45,45,37,4
     4,45,53,54,54,54,54,54,46,36
     ,36,36,36,36,36,36,36,36,36,
     36,36,44,54,54,54,54,54,54,5
     4,54,54,54,54,54,46,36,36,36
     ,36,36,36,36,36,36,36,36,36,
     60
1530  DATA 63,54,54,54,54,54,54,3
     9,55,39,55,36,60,63,63,54,38
     ,252,27,36,36,36,36,36,39,0,
     18,53,55,53,55,53,55,53,55,5
     3,47,46,44,54,45,45,37,44,46
     ,36,36,36,36,36,53,54,54,54,
     54,60,31,60,63,63,38,76,36,3
     6
1540  DATA 36,36,53,54,54,54,54,0
     ,146,54,54,54,54,54,54,46,38
     ,36,36,36,36,36,36,44,54,54,
     54,54,54,54,54,54,37,53,53,46,4
     5,45,36,45,37,36,36,36,36,36
     ,36,44,54,54,54,54,54,54,54,
     44,36,36,36,36,36,36,60,255,
     147
1550  DATA 146,146,146,18,36,63,6
     3,55,38,44,37,36,36,36,36,36
     ,36,44,54,54,54,54,54,54,54,
     0,146,18,54,54,54,54,54,54,5
     4,54,53,36,36,36,36,36,36,36
     ,36,44,53,55,53,55,53,55,53,
     55,53,55,53,55,53,55,53,55,5
     3,55
1560  DATA  45,36,53,46,54,45,45,
     45,37,44,45,37,37,37,36,36,3
     6,36,36,36,36,60,54,54,54,54
     ,54,54,54,62,36,36,36,36,36,
     36,36,60,54,54,54,54,54,54,5
     4,54,61,62,60,62,36,36,63,63
     ,63,55,54,54,36,36,100,33,36
     ,36
1570  DATA  36,36,36,36,36,36,53,
     54,54,54,54,54,54,54,54,45,6
     0,39,44,46,36,39,37,39,37,39
     ,37,39,37,39,37,39,37,39,61,
     63,0,73,73,145,146,18,45,44,
     45,44,45,46,45,46,53,63,63,6
     2,63,63,60,63,55,54,54,54,54
     ,54
1580  DATA 54,46,53,45,53,45,45,3
     7,45,44,37,36,36,36,36,36,36
     ,36,0,73,73,146,146,146,46,4
     4,46,36,45,37,45,53,45,53,46
     ,44,46,52,54,54,54,54,54,54,
     54,63,55,63,55,63,39,63,39,6
     3,39,36,36,36,36,36,36,44,45
     ,45
1590  DATA 46,45,45,44,45,0,73,73
     ,146,146,18,46,44,46,36,45,3
     7,45,53,45,53,45,53,63,63,55
     ,63,63,39,63,63,55,54,54,54,
     54,54,54,46,45,46,45,45,44,4
     4,45,44,45,36,36,36,36,36,36
     ,52,54,0,146,146,146,146,46,
     44,46
1600  DATA 44,174,49,54,54,37,36,
     36,69,44,46,44,46,228,219,27
     ,39,36,36,53,54,54,0
1610  DATA  173,48,192,136,208
1620  DATA  4,198,1,240
1630  DATA  10,202,208,246,166
1640  DATA  0,100,0
1650  DATA  76,0,3,96
1660  FOR C1 = 1 TO 21
1670  READ S: POKE 767 + C1,S: NEXT
     C1
1680  FOR C1 = 1 TO 255: POKE 0,C
     1: POKE 1,5: CALL 768: NEXT

1690  IF  PEEK (768 + 15) = 240 THEN
      POKE 768 + 15,100: GOTO 170

1700  POKE 768 + 15,240: RETURN
```

Diary

Designed for use with printers using the Epson control set, this program from J C R Eaton of Mottingham in south-east London prints calendar pages. Each page covers one month, and allows one line per day. The correct days of the week are shown. Mr Eaton suggests that thin card be used for the printing, rather than paper, but this might be difficult to obtain. Μ

Diary.

```
100  REM ****************
110  REM * MONTH A PAGE *
120  REM * DIARY        *
130  REM * J.C.R.EATON  *
140  REM * MARCH 1984   *
150  REM ****************
160 PI = 66:D$ =  CHR$ (4): HOME

170  DATA SUNDAY,MONDAY,TUESDAY,W
     EDNESDAY,THURSDAY,FRIDAY,SAT
     URDAY
180  FOR X = 1 TO 7: READ DA$(X):
      NEXT
190  DATA JANUARY,31,FEBRUARY,28,
     MARCH,31,APRIL,30,MAY,31,JUN
     E,30,JULY,31,AUGUST,31,SEPTE
     MBER,30,OCTOBER,31,NOVEMBER,
     30,DECEMBER,31
200  INVERSE : PRINT  SPC( 12);"D
     IARY PRINTER"; SPC( 12): NORMAL
     : POKE 34,2: PRINT
210  VTAB 5: INPUT "ENTER YEAR TO
      BE PRINTED, ";Y
220  VTAB 10: PRINT "SET PRINTER
     TO TOP OF PAGE AND PRESS ": PRINT
     "     <RETURN> TO START PRIN
     TING";: GET A$
230  VTAB 15: HTAB 10: INVERSE : PRINT
      "PRINTING DIARY": NORMAL
240  PRINT D$;"PR#1": POKE 1657,8
     0
250 D = Y - 1900
260 L =  INT (D / 4)
270 S = D + L
280  FOR Z = 1 TO 30
290  IF S >  = 7 THEN S = S - 7
300  IF S < 7 THEN Z = 30
310  NEXT Z
320 C = 1
330  FOR K = 0 TO S:C = C + 1: NEXT

340  FOR X = 1 TO 12
350 LN = 0
360  READ M$,D
370  IF Y / 4 -  INT (Y / 4) = 0 AND
     M$ = "FEBRUARY" THEN D = 29
380 LN = LN + 1: PRINT "I
                    ";M$;: FOR Z =
     1 TO 12 -  LEN (M$): PRINT "
     ";: NEXT Z: REM (21 SPACES)

390  PRINT Y;"
                         I": REM (36
      SPACES)
400 LN = LN + 1: FOR V = 1 TO 77:
      PRINT "=";: NEXT : PRINT
410  FOR J = 1 TO D
420 LN = LN + 1: PRINT DA$(C); SPC(
     11 -  LEN (DA$(C)));J; SPC(
     63);: IF J < 10 THEN  PRINT
     " ";
430  PRINT "I"
440  IF C = 7 THEN C = 0
450 LN = LN + 1: FOR V = 1 TO 77:
      PRINT "-";: NEXT : PRINT
460 C = C + 1
470  NEXT J
480 SP = PI - LN: FOR V = 1 TO SP
     : PRINT : NEXT
490  NEXT X
500  FOR V = 1 TO 10: PRINT : NEXT

510  PRINT D$;"PR#0"
520  END
```

Validated data

WHEN ENTERING a long series of data values, it is easy to mistype and enter the wrong data. It would be useful to be able to periodically check back over what had been typed.

E Pue of Blackpool has produced a program to allow data validation. Each item is typed in the normal way, and after the 20th item is entered you can modify each one in turn. Pressing Return re-enters the data, after modification if necessary, and the space bar resumes data input.

The input process is terminated by inputting an asterisk, which is easily changed in line 250. The program will work on any Commodore machine.

```
100 REM *** VALIDATED DATA ***
110 :
120 PRINT "[CLS]";
130 INPUT "MAXIMUM NUMBER OF DATA VALUES"; N
140 DIM A(N)
150 PRINT "[CLS]";
160 :
170 REM *** DATA INPUT ***
180 GOSUB 430
190 FOR I=1 TO N
200 IF I<10 THEN PRINT SPC(1);
210 IF I<100 THEN PRINT SPC(1);
220 PRINT I; SPC(2);
230 GOSUB 470
240 A(I)=VAL(I$)
250 IF I$<>"*" AND I<>N THEN 290
260 GOSUB 340
270 IF I$=CHR$(32) THEN I=N
280 GOTO 300
290 IF I/20=INT(I/20) THEN GOSUB 340
300 NEXT I
310 PRINT "[CLS]"
320 GOTO 500
330 :
340 REM *** RE-ENTER IF NECESSARY ***
350 PRINT"[HOME][22CD]";
360 PRINT SPC(7); "PRESS <SPACE> TO CONTINUE"
370 PRINT SPC(8); "OR <RETURN> TO RE-ENTER"
380 GET I$ : IF I$="" THEN 380
390 IF I$=CHR$(32) THEN PRINT "[CLS]"; : GOTO 440
400 IF I$<>CHR$(13) THEN 350
410 I=INT((I-1)/20)*20
420 :
430 REM *** CONTINUE DATA INPUT ***
440 PRINT "[HOME]ENTER DATA (TERMINATE WITH *):-"
450 RETURN
460 :
470 REM *** CRASHPROOF INPUT ***
480 OPEN1,0 : INPUT#1,I$ : CLOSE1
490 PRINT : RETURN
500 :
510 REM ***                          ***
520 REM *** DATA PROCESSING HERE ***
530 REM ***                          ***
```

Relative file handling

A Commodore 1541 disc drive plus the Commodore 64 is a powerful combination, given the right software, but the apparent lack of relative file handling is often seen as a problem. However, the 1541 does support relative files, and Howard Jackson of Liverpool demonstrates their use with this database program.

A relative file is like a data array, but on disc. Any item can be read, modified and written back again, without having to read a complete file — unlike sequential files. The penalty is that the maximum number of characters in each record is fixed.

The program allows you to create a file, enter or edit data and find specific entries. The program is built around subroutines at 100 to 1240.

When the Create option is chosen, each of the items within the record has to be named and then the program will create two files. The main data file and a parameter file, suffixed -PRM, hold details of the file and the first field from each file entry.

Accessing data in a relative file is fast, provided the record number is known. But to identify which record is wanted a search has to be made through the whole file. By keeping the first field of each record in a separate file, and loading it into the computer at the start, the search is rapid and allows the record number to be evaluated. This is known as indexing, and the field that this is performed on is the key field.

Entering data into the file is done in a batch mode. That is, you are asked how many records you are going to enter and proceed to enter the data for each record. When the last is entered, the program returns to the menu. The program will not allow two records with the same key field.

Records within the file can be found by specifying the key field. This does not have to be complete as the program will show all entries which start with the characters typed.

The main variables used are

F$ — file name
R% — maximum number of records in file
L% — size of each record in bytes
F% — number of fields within record
K% — record number being accessed
F$( ) — array to hold fields in record
E$( ) — title of each field in record
K$( ) — array holding key fields

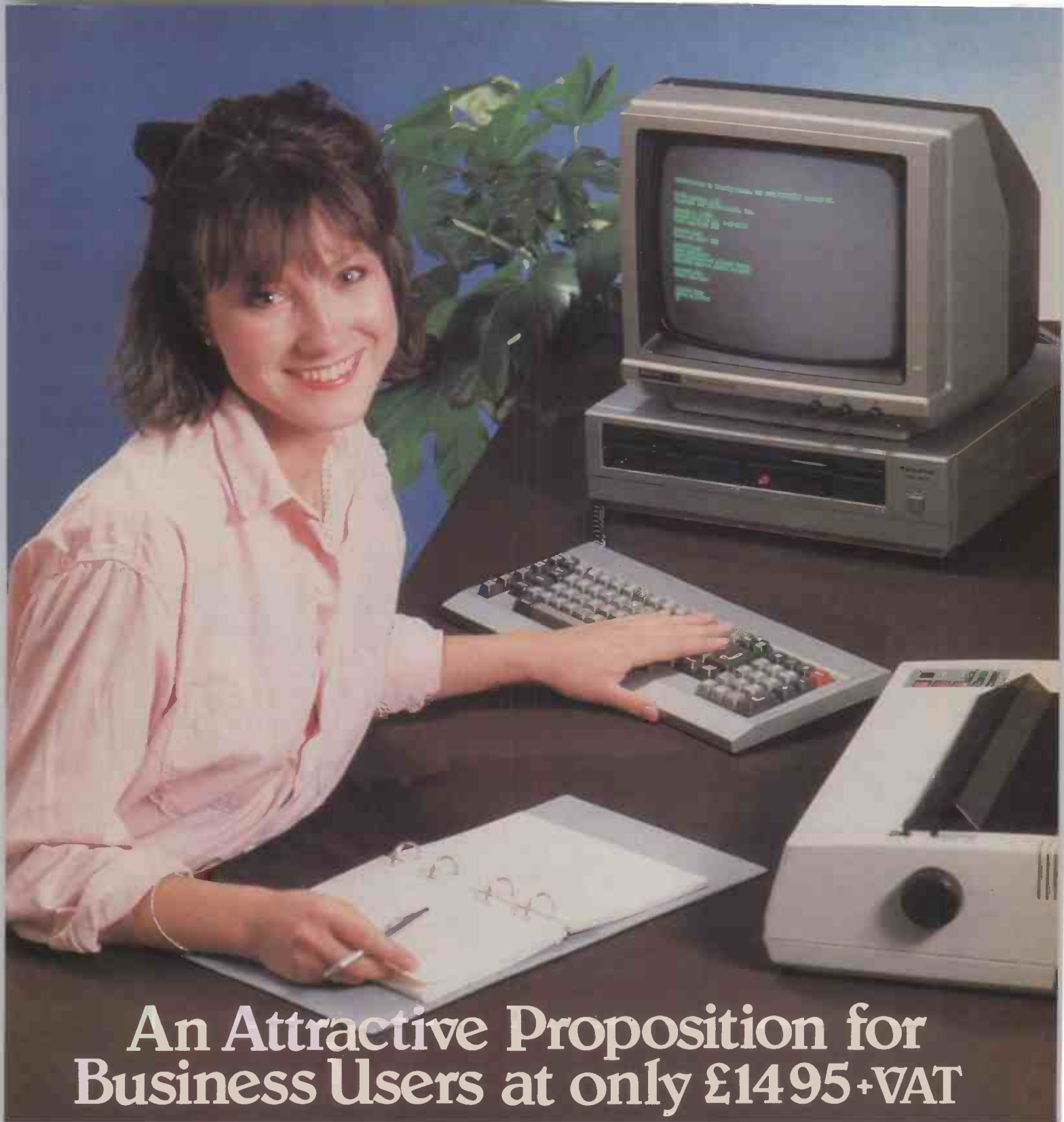
Relative file handling.

```
10 CLR:PRINT"[CLEAR]   HIRAM DATABASE"
   :PRINT
20 PRINT"1  CREATE DATA FILE":PRINT
30 PRINT"2  ENTER  MORE DATA":PRINT
40 PRINT"3  EDIT DATA RECORDS":PRINT
50 PRINT"4  FIND DATA RECORDS":PRINT
60 PRINT"5  QUIT HIRAM SYSTEM":PRINT
70 INPUT O%
80 ON O% GOSUB 1500,1800,2000,2200,1300
90 GOTO 10
95 :
100 REM *** CREATE REL FILE P$ -
101 REM     L% CHARS PER RECORD
102 REM     F% FIELDS
103 REM     R% RECORDS
104 :
110 CLOSE 1:OPEN 1,8,15,"I"
120 CLOSE 2:OPEN 2,8,2,F$+",L,"+CHR$(L%)
130 RH%=INT(R%/256):RL%=R%-RH%*256
140 PRINT#1,"P";CHR$(2);CHR$(RL%);
    CHR$(RH%);CHR$(0)
150 INPUT#1,A,A$,B,C:PRINT A$
160 PRINT#2,"END"
170 CLOSE 2:CLOSE 1
180 RETURN
```

(continued on next page)

(continued from previous page)

```
185 :
200 REM WRITE RECORD K%, F% FIELDS IN F$()
210 CLOSE 1:OPEN 1,8,15,"I"
220 OPEN 2,8,2,"@:"+F$+",L"
230 KH%=INT(K%/256):KL%=K%-KH%*256
240 PRINT#1,"P";CHR$(2);CHR$(KL%);
    CHR$(KH%);CHR$(0):F$(0)=""
250 FOR I=1 TO F%
260 F$(0)=F$(0)+F$(I)+CHR$(13)
270 NEXT
280 PRINT#2,F$(0)
290 CLOSE 2:CLOSE 1:RETURN
295 :
300 REM READ RECORD K%, F% FIELDS IN F$()
310 CLOSE 1:OPEN 1,8,15,"I"
320 OPEN 2,8,2,F$+",L"
330 KH%=INT(K%/256):KL%=K%-KH%*256
340 PRINT#1,"P";CHR$(2);CHR$(KL%);
    CHR$(KH%);CHR$(0)
350 FOR I=1 TO F%
360 INPUT#2,F$(I)
370 NEXT
390 CLOSE 2:CLOSE 1:RETURN
395 :
500 REM OPEN FILE F$ - PARAM + KEY FILES
510 PRINT:PRINT"READ PARAM FILE"
515 OPEN 1,8,15,"I"
520 OPEN 2,8,2,F$+"-PRM"
530 INPUT#2,N%,R%,L%,F%:INPUT#1,A,A$,B,C
535 IF A<>0 THEN PRINT A$:CLOSE 2:CLOSE 1
    :RETURN
540 FOR I=1 TO F%
550 INPUT#2,E$(I)
560 NEXT
570 CLOSE 2
580 PRINT:PRINT"READ KEY FILE"
590 FF$=F$:F$=F$+"-NDX":FF%=F%:F%=1
600 DIM K$(R%):IF N%=0 THEN 650
610 FOR K=1 TO N%
620 K%=K:GOSUB 300
630 K$(K%)=F$(1)
640 NEXT
650 PRINT F$;" HAS";N%;"RECORDS"
660 F$=FF$:F%=FF%
670 FOR I=1 TO 1000:NEXT
680 RETURN
685 :
700 REM ENTER A BATCH OF RECORDS
710 PRINT"[CLEAR]  HIRAM DATABASE":PRINT
715 PRINT"ENTER A BATCH OF DATA":PRINT
720 INPUT"BATCH SIZE";B%
725 IF B%<1 OR B%>10 OR B%+N%>R%THEN PRINT
    "[UP]";:GOTO 720
730 FOR R=1 TO B%:PRINT"[CLEAR]"
740 PRINT"[HOME,DOWN]KEY ";E$(1)
750 INPUT K$:IF(K$="")OR(K$=CHR$(160))THEN
     740
760 FOR K=1 TO N%+R-1:IF K$<>K$(K)THEN NEXT
    :GOTO 780
770 PRINT"[HOME]";K$;" IN USE":GOTO 740
780 F$(1)=K$:K$(N%+R)=K$
790 FOR J=2 TO F%
800 PRINT E$(J)
810 INPUT F$(J):IF F$(J)=""THEN PRINT"[UP]
    ";:GOTO 810
820 NEXT
830 K%=N%+R:GOSUB 200
840 NEXT
845 :
900 REM CLOSE HIRAM FILE
910 FF$=F$:F$=F$+"-NDX":FF%=F%:F%=1
    :PRINT"APPEND TO KEY FILE"
920 FOR K=N%+1 TO N%+B%
930 K%=K:F$(1)=K$(K)
940 GOSUB 200
950 NEXT
960 N%=N%+B%:F$=FF$:F%=FF%
970 RETURN
975 :
1100 REM SEARCH  FOR K$ IN KEY LIST
1110 FOR I=L TO N%
1120 ON S GOSUB 1150,1170
1130 NEXT
1140 RETURN
1150 IF K$<>K$(I)THEN E=1:RETURN
1160 E=0:K%=I:I=N%:RETURN
1170 IF K$<>LEFT$(K$(I),LEN(K$))THEN E=1
    :RETURN
1180 E=0:K%=I:I=N%:RETURN
1200 REM DISPLAY RECORD
1210 PRINT"[CLEAR]";:FOR I=1 TO F%
1220 PRINT E$(I):PRINT"[RIGHT2]";F$(I)
1230 NEXT
1240 RETURN
1245 :
1300 CLOSE 2:CLOSE 1:END
1500 REM CREATE FILE DESCRIPTION
1520 PRINT"[CLEAR]FILE DESCRIPTION"
1530 INPUT"FILE NAME";F$
1540 INPUT"RECORD SIZE (B)";L%
1550 INPUT"NO. OF FIELDS";F%
1560 INPUT"MAX. NO. RECS.";R%
1565 INPUT"KEY LENGTH";S%
1570 PRINT"[CLEAR]FIELD NAMES"
1580 FOR I=1 TO F%
1590 PRINT"FIELD";I;TAB(10);:INPUT E$(I)
1600 NEXT
1610 PRINT"[CLEAR]CREATE DATA FILE":PRINT
1615 PRINT" LONG WAIT  ! !":PRINT
1620 GOSUB 100:GOSUB 1630:GOTO 1700
1630 PRINT:PRINT"CREATE PARAM FILE"
1640 OPEN 2,8,2,"@:"+F$+"-PRM,S,W"
1650 PRINT#2,N%:PRINT#2,R%:PRINT#2,L%
    :PRINT#2,F%
1660 FOR I=1 TO F%
1670 PRINT#2,E$(I)
1680 NEXT
1690 CLOSE 2:RETURN
1695 :
1700 PRINT:PRINT"CREATE KEY FILE"
1710 F$=F$+"-NDX":L%=S%
1720 GOSUB 100
1730 CLR:GOTO 10
1735 :
1800 REM ENTER MORE DATA
1810 PRINT"[CLEAR]  HIRAM DATABASE":PRINT
1815 PRINT"  ENTER MORE DATA":PRINT
1820 INPUT"FILE NAME";F$
1830 GOSUB 500:IF A<>0 THEN RETURN
1840 GOSUB 700
1850 INPUT"CONTINUE (Y/N)";A$
1855 IF A$="Y"THEN 1840
1860 GOSUB 1630
1870 RETURN
1875 :
2000 REM EDIT & FIND
2010 A$="EDIT"
2020 PRINT"[CLEAR]    HIRAM DATABASE":PRINT
2030 PRINT A$;" RECORDS":PRINT
2040 INPUT"FILENAME";F$
2050 GOSUB 500
2060 PRINT"[CLEAR]";
2070 INPUT"KEY VALUE";K$:L=1
2080 S=0%-2:GOSUB 1100:IF(E=1)THEN PRINT K
    $;" NOT IN USE[HOME]";:GOTO 2070
2090 GOSUB 300:GOSUB 1200
2100 ON S GOTO 2110,2190
2105 :
2110 PRINT"[HOME,DOWN2]";:IF F%=1 THEN 2160
2120 FOR I=2 TO F%
2130 PRINT"[DOWN]";:INPUT F$(I)
2140 NEXT
2150 GOSUB 200
2160 INPUT"CONTINUE (Y/N)";A$
2170 IF A$="Y"THEN 2060
2180 RETURN
2185 :
2190 IF K%<N%THEN INPUT"CONTINUE (Y/N)";A$
    :IF A$="Y"THEN L=K%+1:GOTO 2080
2195 GOTO 2160
2200 A$="FIND":GOTO 2020
```



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Co-ordinates

J ROBSON-BROWN of Cookham Dean, Berkshire has written a game for four- to seven-year olds. It is intended to get children accustomed to the idea of Cartesian co-ordinates. The listing is for the MZ-700 running S-Basic.

Instructions are contained in Lines 520 to 530. The pictures defined in lines 400 to 450 are limited by the available screen space to 13 co-ordinate pairs. The numbers in lines 350 to 370 are in hex number pairs that are the ASCII numbers for the graphics characters making up the grid. You key in the characters themselves.

Return 700

Geoffrey T Childs of Winchcombe, Gloucestershire has discovered an odd feature of the MZ-700's S-Basic: the Return command can be used with a line number, as in Return 1000.

```
100 REM COORDS 1.19 PC          18/7/84
110 REM ******
120 REM (C) J Robson-Brown 1984
130 REM ***MAIN LOOP***
140 GOSUB 270:REM SETUP
150 GOSUB 470:REM INTRO
160 GOSUB 570:REM DIFF
170 GOSUB 630:REM CLS/BLUE
180 GOSUB 790:REM CHOOSE
190 GOSUB 860:REM GRID
200 GOSUB 1120:REM COORD LIST
210 GOSUB 1220:REM GET/MOVE
220 GOSUB 1610:REM OUTLINE
230 GOSUB 1810:REM MORE?
240 IF AN$="Y" THEN OSL=G0::GX=0:GY=0:GO
TO 170
250 END
260 REM
270 REM ***SETUP***
280 GT=2:GD=17:GL=5:GW=20
290 UP=18:DN=17:LFT=20:RIT=19:BP=62:SP=3
2:BLOB=107:XP=84:YP=85:LL=40:LH=1
300 SS=53248:SE=54247:WS=SS+GL+40*GT:WE=
WS+40*(GD-1)+GW-1:G0=WE-GW+1:OSL=G0
310 POKE $59,$F0:REM GET REPEATS
320 DEF FNY(Z)=GT+GD-1-INT((Z-SS)/LL):DE
F FNX(Z)=Z-SS-LL*INT((Z-SS)/LL)-GL
330 NP=5:DIM PC$(NP):RESTORE:FOR A=1 TO
NP:READ PC$(A):NEXT A
340 DIM X(12),Y(12),SX(2),SY(2)
350 TP$= "D0D2D2D2D2D2D2D2D2D2D2D2D2D2D2
D2D2D2D2CE"
360 CRO$="CB8181818181818181818181818181
8181818181D3"
370 BOT$="CDD1D1D1D181D1D1D1D181D1D1D1D1
81D1D1D1DD"
380 RETURN
390 REM
400 REM ***PICTURES***
410 DATA "0814051007100405080508020902090
9051305101012100915"
420 DATA "1908180504050108080809101210131
2141214101701019081"
430 DATA "0615061308100802140214071109080
7080204020410061 3"
440 DATA "1515131309110507020707020705110
91313"
450 DATA "0409040415041513141314111312071
204091509"
460 REM
470 REM ***INTRO***
480 CONSOLE:COLOR,,7,2:CLS
490 CONSOLE 1,23,1,38:COLOR,,7,6:CLS
500 CONSOLE 2,21,2,36:COLOR,,7,1:CLS
510 GOSUB 670:REM TITLE
520 CURSOR 2,5:PRINT "  In this game you
 must draw a":PRINT " picture by putting
 a series of":PRINT " blobs (*) on a gri
d at the correct"
530 PRINT " Cartesian coordinates. A lis
t of":PRINT " these is shown for each pi
cture.":PRINT "  The computer will then
 join up":PRINT " the blobs to complete
the picture."
540 GOSUB 710:REM CONT
550 RETURN
560 REM
570 REM ***DIFF***
580 PRINT "     Would you like it to
be":PRINT "     hard (H) or easy (E)?"
590 GET K$:IF (K$="H")+(K$="E")<>-1 THEN
 590
600 USR(BP):DFF=-(K$="H")
610 RETURN
620 REM
630 REM ***CLS/BLUE***
640 CONSOLE:COLOR,,7,1:CLS
650 RETURN
660 REM
670 REM ***TITLE***
680 PRINT "";TAB(14);"Coordinates":PRIN
T TAB(14);"-----------"
690 RETURN
700 REM
710 REM ***CONT***
720 B=0:XC=PEEK(XP):YC=PEEK(YP)
730 CURSOR 6,23:PRINT [7-7*-(B>3),B] " P
ress SPACE-BAR to continue ";
740 B=B+1:FOR DEL=1 TO 60:NEXT DEL:IF B>
7 THEN B=0
750 GET K$:IF ASC(K$)<>SP THEN 730
760 CURSOR 6,23:PRINT [6,6] SPC(29);:CUR
SOR XC,YC:USR(BP)

770 RETURN
780 REM
790 REM ***CHOOSE***
800 PC=INT(RND(1)*5)+1:PC$=PC$(PC):NC=LE
N(PC$)/4:IF (PC=O1)+(PC=O2) THEN 800
810 O2=O1:O1=PC:REM NOT=LAST 2
820 FOR CN=1 TO NC
830 C$=MID$(PC$,4*CN-3,4):X(CN)=VAL(LEFT
$(C$,2)):Y(CN)=VAL(RIGHT$(C$,2))
840 NEXT CN
850 RETURN
860 REM ***GRID***
870 GOSUB 670:REM TITLE
880 CONSOLE GT,GD,GL,GW:COLOR,,5,0:CLS:C
ONSOLE GT,GD+1,GL,GW
```

(continued on next page)

(continued from previous page)

```
890 PRINT TP$;:FOR A=1 TO GD-2:PRINT CRO
$;:NEXT A:PRINT BOT$;
900 REM
910 REM ---Y-AXIS---
920 CONSOLE GT+1,GD,GL-2,2:COLOR,,7,1:PR
INT "■";
930 FOR YA=15 TO 0 STEP -5
940 PRINT TAB(GL-2-(YA<10));STR$(YA);:IF
 YA THEN PRINT "■■■■";
950 NEXT YA
960 CONSOLE
970 CURSOR 1,GT+8:PRINT "Y■■axis"
980 REM
990 REM ---X-AXIS---
1000 CURSOR GL,GT+GD:PRINT "0    5    10
   15":PRINT TAB(12);"X axis"
1010 POKE OSL+$800,$7
1020 REM
1030 REM ---LEGEND---
1040 CONSOLE 2,8,27,11:COLOR,,0,6:CLS
1050 PRINT " Use the  "
1060 PRINT " CURSOR ";:PRINT [7,3] "↑"
1070 PRINT " keys  ";:PRINT [7,3] "←■→"
1080 PRINT " to     ";:PRINT [7,3] "↓"
1090 PRINT " move, and":PRINT " the SPAC
E":PRINT " BAR to   ":PRINT " blob (*)";
1100 CONSOLE:COLOR ,,7,1
1110 RETURN
1120 REM
1130 REM ***COORD LIST***
1140 CONSOLE 11,NC+1,29,7:COLOR,,7,4:CLS
1150 PRINT [7,0] "■■X■■Y"
1160 FOR CN=1 TO NC
1170 PRINT TAB(30+(X(CN)>9));X(CN);TAB(3
3+(Y(CN)>9));Y(CN);:IF CN<NC THEN PRINT
1180 NEXT CN
1190 CONSOLE:COLOR ,,7,1
1200 RETURN
1210 REM
1220 REM ***GET/MOVE***
1230 USR(BP)
1240 FOR CN=1 TO NC
1250 IF DFF=0 THEN CURSOR 2,22:PRINT [7,
3] "You are■■■■■■■now at:■";:PRINT [7,1
] GX;",";GY;" "
1260 IF CN>1 THEN FOR A=1 TO 7:COLOR 28+
A,10+CN,7,4:NEXT A
1270 FOR A=1 TO 7:COLOR 28+A,11+CN,7,2:N
EXT A
1280 REM ---GETKEY---
1290 GET K$:K=ASC(K$):IF (K<>SP)*((K<DN)
+(K>LFT)) THEN 1290
1300 REM
1310 REM ---MOVE---
1320 MOOV=-LL*-(K=UP)+LL*-(K=DN)-LH*-(K=
LFT)+LH*-(K=RIT):NSL=OSL+MOOV
1330 GY=FNY(NSL):GX=FNX(NSL):OK=(GY=>0)*
(GY<=GD-1)*(GX=>0)*(GX<=GW-1)
1340 SL=OSL+MOOV*OK:GY=FNY(SL):GX=FNX(SL
):HERE=(GX=X(CN))*(GY=Y(CN))
1350 P=PEEK(SL):IF K=SP THEN P=BLOB:IF H
ERE=0 GOSUB 1480:GOTO 1290
1360 FB=$50+$20*-(PEEK(OSL)=BLOB)
1370 IF DFF=0 THEN BX=1-(GX=X(CN)):BY=1-
(GY=Y(CN)):CURSOR 10,23:PRINT [7,BX] GX;
",";:PRINT [7,BY] GY;" ";:PRINT "  "
1380 POKE OSL+$800,FB:POKE OSL,PEEK(OSL)
1390 POKE SL+$800,$7-5*HERE*-(DFF=0):POK
E SL,P:IF HERE*-(DFF=0) USR(BP)
1400 OSL=SL:IF K<>SP GOTO 1290
1410 GOSUB 1550:REM OK!
1420 POKE SL+$800,$7
1430 REM
1440 NEXT CN
1450 POKE SL+$800,$70
1460 FOR A=1 TO 7:COLOR 28+A,10+CN,7,4:N
EXT A
1470 RETURN
1480 REM
1490 REM ***ERROR***
1500 CONSOLE 21,3,21,7:COLOR ,,7,2:CLS
1510 PRINT TAB(22) "■WRONG":TEMPO 6:MUSI
C "E0#DD#CC#CD#DE#DD#CC#CD#DE#DD#CC1"
1520 COLOR ,,7,1:CLS:CONSOLE
1530 RETURN
1540 REM
1550 REM ***RIGHT!***
1560 CONSOLE 21,3,21,7:COLOR ,,0,4:CLS
1570 PRINT TAB(22) "■RIGHT":TEMPO 3:MUSI
C "C0EG+CGECEG+CGECEG+CGEC1-G0C2"
1580 COLOR ,,7,1:CLS:CONSOLE
1590 RETURN
1600 REM
1610 REM ***OUTLINE***
1620 CONSOLE 21,3,1,38:COLOR,,7,5:CLS
1630 CURSOR 3,22:PRINT [7,2] " Now the b
lobs will be joined up! "
1640 FOR DEL=1 TO 2000:NEXT DEL
1650 FOR CN=1 TO NC-1
1660 TEMPO 6:MUSIC "C1DEFGAB+C":FC=CN+1
1670 SX(1)=2*(X(CN)+GL):SX(2)=2*(X(FC)+G
L):DX=SX(2)-SX(1):IF DX=0 THEN DX=.01:SX
(2)=SX(2)+.01
1680 SY(1)=2*(GT+GD-1-Y(CN)):SY(2)=2*(GT
+GD-1-Y(FC)):DY=SY(2)-SY(1):IF DY=0 THEN
 DY=.01
1690 GRD=DY/DX:STP=SGN(DX)/ABS(GRD):IF A
BS(STP)>1 THEN STP=SGN(STP)
1700 POKE 2618,1+NC-CN
1710 FOR X=SX(1) TO SX(2) STEP STP
1720 POKE 2617,6*ABS(SX(2)-X):USR(68)
1730 Y=SY(1)+GRD*(X-SX(1))
1740 SET X,Y
1750 NEXT X
1760 NEXT CN
1770 USR(71):COLOR,,7,1:CLS:CONSOLE
1780 GOSUB 710:REM CONT

1790 RETURN
1800 REM
1810 REM ***MORE?***
1820 CONSOLE 21,3,1,38:COLOR,,7,3:CLS
1830 CURSOR 3,22:PRINT [7,3] " Do you wa
nt to do another ";:PRINT [7-7*-(B>3),B]
 "(Y/N)?";
1840 B=B+1:FOR DEL=1 TO 60:NEXT DEL:IF B
>7 THEN B=0
1850 GET AN$:IF (AN$="Y")+(AN$="N")<>-1
THEN 1830
1860 COLOR,,7,1:CLS:CONSOLE
1870 RETURN
```

Extra memory

```
1 ON ERROR GOTO 100
10 FOR X=1 TO 1023 STEP 2
20 Y1=INT(X/256):Y2=X-(256*Y1) 'THIS
SPLITS EACH VALUE OF X INTO A HIGH &
LOW BYTE
30 POKE 15359+X,Y1:POKE 15359+X+1,Y2:'
THIS  POKES THE HIGH BYTEINTO THE
RELATIVE LOCATION AND THE LOW BYTE
INTO THE NEXT LOCATION.
40 NEXT
50 T=51 ' T= THE NUMBER TO BE FOUND.
AS WRITTEN IT WILL FIND THE 51ST
NUMBER ENTERED.
60 P=T*2-1' THIS CALCULATES THE
OFF-SET FROM ADDRESS 15359 WHICH IS
THE LOCATION IMMEDIATELY PRECEEDING
THE VDU MEMORY BLOCK
70 A=PEEK(15359+P):B=PEEK(15359+P+1)'
THIS READS THE HIGH AND LOW BYTES OF
THE DATA REQUIRED.
80 AB=A*256+B 'THIS CALCULATES THE
DECIMAL VALUE OF THE TWO BYTES
90 CLS:PRINT"NUMBER IS ";AB
95 END
```

WHERE MEMORY is very short and the circumstances are right, you can use the 1,024 bytes of memory used for the VDU. For example, you might have to read a number of values from a file which ordinarily would have to go into an array, perform some function with them and check or select certain values, after which memory can be used by Poking the values serially into this block.

Only values below 256 can be Poked directly. To Poke higher numbers, you have to split the numbers into single bytes which can then be Poked.

In the sample program, a loop is used to generate values but in practice these values would probably be read in from a file. They are all the odd numbers up to 1,023. As the higher numbers are over 255, two bytes will be required and so the loop is Step 2.

Having Poked in all the values the program will then select the 51st value in the series as in line 50. In lines 60 and 70 it Peeks the value, converts it to decimal and assigns the value to the variable AB. The required values must be assigned to variables before the screen is cleared or used.

Times addition

Ian Debenham of Lingfield has written a routine to add various times together.

The arrays can be eliminated by first making the two variables of the input in line 170 become H and M with suitable adjustments elsewhere. Lines 200 to 280 are deleted and replaced with

```
200  TH = TH + H:TM = TM + M:GOTO 170
230  MM = INT(TM/60)
240  TH = TH + MM:TM = TM – (MM * 60)
```

Genie code

It is amazing how the old Tandy series continues to maintain its popularity. Its graphics are very crude compared with the latest micros but still people come up with good action games. I bought my model 1 level 1 4K machine for £500 towards the end of 1978, and it is still going strong today, though now it has been expanded up to 48K, and has two disc drives plus other frills. Now Tandy has a range of models from 16-bit professional machines, colour and portables to cheap hobbyist models. Yet most of the programs that we receive from readers are still model 1 programs. Of course, I must include the Genie clan who support us very well.

A point worth mentioning here to those Genie users who send us programs for this column. Most of the Genie Basic coding is acceptable to Tandy machines but there is one form of syntax used by Genie which is

(continued on next page)

Times addition.

```
100 'hOURS & MINUTES ADDITION PROGRAM
110 'COPYRIGHT 1981 - A.I.S.DEBENHAM
130 DIMH(50),M(59)
140 A$="££,£££":B$="£££"
150 'LPRINT CHR$(27)CHR$(66)CHR$(30)
160 TH=0:TM=0:X=0:I=0:CLS
170 INPUT"ENTER HOURS, MINUTES (0,0) TO
 EXIT";H(X),M(X)
180 IF H(X)=0 AND M(X)=0 GOTO 230 ELSE 190
190 PRINT TAB(10)"";:PRINT USING A$;H(X);:
PRINT USING B$;M(X)
200 X=X+1
210 I=I+1
220 GOTO 170
230 FOR X= 0 TO I
240 NH=NH+H(X)
250 NM=NM+M(X)
260 NEXT
270 TH=TH+NH+INT(NM/60)
280 TM=TM+NM-INT(NM/60)*60
290 PRINT"TOTAL TIME";TH;TM
291 END
300 LPRINT CHR$(10),CHR$(10)
310 LPRINT "TOTAL TIME";:LPRINT USING A$;
TH;:LPRINTUSING B$;TM
320 RUN
```

(continued from previous page)

not common to TRS-80 machines. The Genie will accept

```
PRINT@470,"X";@534,"Y":
```

but for the TRS-80, it must be

```
PRINT@470, "X";:PRINT@534,"Y":
```

The Genie will accept the Tandy syntax, so any Genie programs sent to us on tape should have the Tandy syntax so that we can test them.

Square roots and cube roots

A W Sheppard of Cambridge has sent in two algorithms for obtaining square and cube roots in double precision.

The level II SQR function has the great disadvantage of only calculating square roots to single precision, regardless of the accuracy of the input value. Similarly, cube roots can only be evaluated to single precision and the machine is unable to cope with negative values.

The two routines calculate the square root and cube root of the double-precision value N£ which, for cube roots, may be a negative number. The result from each routine is stored in the variable Y£ and N£ remains unchanged. The variable X£ is used for temporary storage by both routines.

Framed

Tony Roberts of Prescot has sent in a routine for placing a frame round a heading or whatever. It can be very helpful in smartening up your presentation.

Disc directory

G S Dawson of Glasgow offers a routine for a Tandy model III which allows the user to read a number of disc directories without having to type CMD"D:X every time.

Roots.

```
1000 REM Y£=SQUARE ROOT (N£)
1010 Y£=SQR(N£): REM GET APROX. SOLUTION
1020 X£=Y£
1030 Y£=(X£+N£/X£)/2: REM GET REFINEMENT
 ALGORITHM
1040 IF Y£<>X£ THEN 1020: REM LOOP UNTIL
 REFINEMENT COMPLETE
1050 RETURN
1100 REM Y£=CUBE ROOT(N£)
1110 Y£=ABS(N£)[(1/3)*SGN(N£):REM GET
 APPROXIMATE SOLUTION
1120 X£=Y£
1130 Y£=(2*X£+N£/(X£*X£))/3 : REM
REFINEMENT ALGORITHM
1140 IF Y£<>X£ THEN 1120 : REM LOOP UNTIL
 REFINEMENT COMPLETE
1150 RETURN
```

Framed.

```
10 CLS:DEFINTA-Z:ON ERROR GOTO 60:INPUT"
ENTER A STRING < 61 CHARACTERS LONG";A$:
INPUT"ENTER PRINT @ POSITION";P:PRINT@
P,A$
20 P=P-65:A=INT(P/64):X=(P-(A*64))*2:Y=
A*3
30 X1=X+(LEN(A$)*2)+3:Y1=Y+7
40 FOR X2 = X TO X1:SET(X2,Y):SET(X2,Y1):
NEXT:FOR Y2=Y TO Y1:SET (X,Y2):SET(X1,
Y2):NEXT
50 A$=INKEY$:IF A$="" THEN 50 ELSE RUN
60 CLS:PRINT"SUBJECT OVERLAPS. TRY
INCREASING OR DECREASING VALUE FOR
 POSITION":FOR N= 0 TO 2000:NEXT:RUN
```

Disc directory.

```
1  ' DISK DIRECTORY PROGRAM
3  ' FOR TANDY MODEL III. BY G.S.DAWSON.
   OCT 83
4  CLS:  PRINT@393, "PRESS NUMBER ONE KEY
   TO SEE DRIVE <1> DIRECTORY."
5  PRINT@513,"PRESS ANY KEY EXCEPT <B> OR
   <T> TO SEE DRIVE <0> DIRECTORY"
6  A$=INKEY$:IF A$="" THEN 6
7  IF A$="1" THEN 11 ELSE IF A$ ="B" THEN
   14 ELSE IF A$="T" THEN 15 ELSE 8
8  CMD"D:0
9  PRINT@832,"TO RETURN  TO  BASIC  PRESS
   <B>  ..OR.. <T> TO RETURN TO TRSDOS"
10 GOTO 6
11 CMD"D:1'
12 GOTO 9
13 GOTO 6
14 POKE16409,1:END
15 POKE16409,1:CMD"S
```

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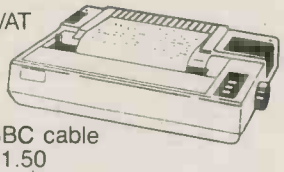

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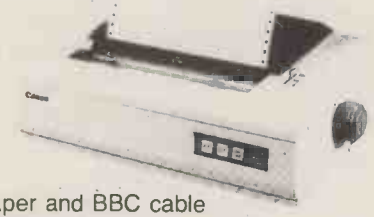

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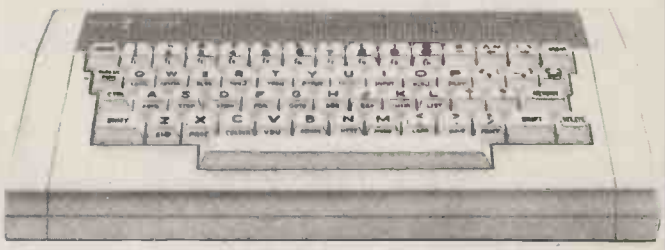

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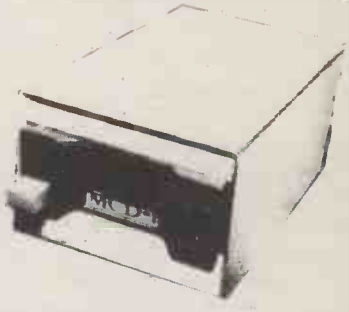

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Cat command

```
10 REM   CAT II    FOR THE AMSTRAD CPC464
20 REM              By P. Paton,  August 1984
30 REM
40 REM           VARIABLES AND CONTROLS
50 REM
60 REM       CHR$(24)   =  REVERSE FIELD ON/OFF TOGGLE
70 REM        CHR$(7)   =  BELL
80 REM          FIL$    =  FILENAME OF PROGRAM BEING READ
90 REM            BN    =  CURRENT BLOCK NUMBER
100 REM           BL    =  CURRENT BLOCK LENGTH
110 REM           PL    =  PROGRAM LENGTH
120 REM           LA    =  CURRENT BLOCK LOAD ADDRESS
130 REM         TYPE    =  FILE TYPE
140 REM          PLA    =  PROGRAM LOAD ADDRESS
150 REM       BLOCKS    =  TOTAL BLOCKS IN FILE
160 REM           PE    =  PROGRAM END ADDRESS
170 REM
180 ON BREAK GOSUB 260
190 R$=CHR$(24):MODE 1
200 LOCATE 3,1:PRINT R$;" INSERT TAPE IN CASSETTE DECK ";R$
210 LOCATE 2,6:PRINT"Press ";R$;" ESC ";R$;" ";R$;" ESC ";R$;
220 PRINT" When 'Ok' appears"
230 PRINT:PRINT
240 CAT
250 REM ---------- ON BREAK RUNS FROM HERE ON -----
260 MODE 2
270 LOCATE 20,2:PRINT R$;" CAT II  --  PROGRAM ANALYSIS ";R$
280 REM ------------ GET FILENAME -----------
290 FIL$="":FOR I=47244 TO 47259
300 FIL$=FIL$+CHR$(PEEK(I))
310 NEXT
320 REM ---------- GET BLOCK NUMBER ----------
330 BN=PEEK(47260)
340 REM ---------- GET BLOCK LENGTH ----------
350 BL=PEEK(47264)*256+PEEK(47263)
360 REM ---------- GET PROGRAM LENGTH --------
370 PL=PEEK(47269)*256+PEEK(47268)
380 REM ---------- GET BLOCK LOAD ADDRESS ---------
390 LA=PEEK(47266)*256+PEEK(47265)
400 REM ---------  GET FILE TYPE -------------
410 TYPE=PEEK(47262)
420 REM ---------- CALCULATE TOTAL BLOCKS ----------
430 BLOCKS=PL/2048
440 IF BLOCKS<>INT(BLOCKS) THEN BLOCKS=INT(BLOCKS)+1
450 REM ---------  CALCULATE PROGRAM LOAD ADDRESS ------
460 PLA=LA
470 IF BN>1 THEN PLA=PLA-2048:BN=BN-1:GOTO 470
480 REM --------   CALCULATE PROGRAM END ADDRESS ------
490 PE=PLA+PL
500 REM ---------  PRINT INFORMATION TO SCREEN -------
510 LOCATE 5,4:PRINT R$;" PROGRAM NAME              ";R$;
520 PRINT"      ";FIL$
530 LOCATE 5,6:PRINT R$;" PROGRAM TYPE              ";R$;
540 PRINT"      ";
550 IF TYPE=0 THEN PRINT"STANDARD BASIC"
560 IF TYPE=1 THEN PRINT"PROTECTED BASIC"
570 IF TYPE=2 THEN PRINT"MACHINE CODE"
580 IF TYPE=22 THEN PRINT"ASCII TEXT"
590 LOCATE 5,8:PRINT R$;" CURRENT BLOCK NUMBER    ";R$;
600 PRINT"      ";BN
610 LOCATE 5,10:PRINT R$;" TOTAL BLOCKS IN FILE   ";R$;
620 PRINT"      ";BLOCKS
630 LOCATE 5,12:PRINT R$;" BLOCK LOAD ADDRESS     ";R$;
640 PRINT"      ";LA
650 LOCATE 5,14:PRINT R$;" BLOCK LENGTH           ";R$;
660 PRINT"      ";BL;" Bytes"
670 LOCATE 5,16:PRINT R$;" PROGRAM LOAD ADDRESS   ";R$;
680 PRINT"      ";PLA
690 LOCATE 5,18:PRINT R$;" PROGRAM END ADDRESS    ";R$;
700 PRINT"      ";PE
710 LOCATE 5,20:PRINT R$;" PROGRAM LENGTH         ";R$;
720 PRINT"      ";PL;"Bytes"
730 PRINT"  ";STRING$(76,95)
740 REM ---------- RUN AGAIN YES OR NO ----------
750 LOCATE 10,23
760 PRINT"Do You Wish To Analyse Another Program";
770 PRINT" ( Y or N ) ";R$;"-";R$;CHR$(8);
780 K$=INKEY$:IF K$="" THEN 780
790 IF K$="Y" THEN RUN ELSE IF K$="N" THEN CLS:END
800 PRINT CHR$(7);:GOTO 750
```

UTILITY PROGRAMS are always in great demand as programmers get to work on a new machine. Peter Paton's Cat II goes a good deal further than the Amstrad's rather limited Cat command in giving you information about the files you have on cassette.

Cat II works by reading file header information from the cassette buffer used by Cat, which begins at 47244. This yields a wealth of information about each file, as can be seen from the sample screen shown here.

Page-by-page memory dump

Peter Paton's second utility allows you to display a page-by-page hex dump of the contents of memory. The program operates on 256-byte pages. You specify the start page by typing in a page number in the range 0 to 255.

Contributions wanted

Contributions to Amstrad Open File are very welcome. Just send a cassette and a description of the program, typed double-spaced if possible. A printed listing helps but is not essential. We are most interested in utility programs, short programs which show off interesting Amstrad commands, and generally useful routines and discoveries. Programs more than 100 to 150 lines long are unlikely to get in.

Sample screen output from Amstrad Cat II.

```
                    CAT II  --  PROGRAM ANALYSIS
PROGRAM NAME                    CAT II
PROGRAM TYPE                    STANDARD BASIC
CURRENT BLOCK NUMBER            1
TOTAL BLOCKS IN FILE            2
BLOCK LOAD ADDRESS              368
BLOCK LENGTH                    2048  Bytes
PROGRAM LOAD ADDRESS            368
PROGRAM END ADDRESS             3212
PROGRAM LENGTH                  2844 Bytes

------------------------------------------------------------------------
        Do You Wish To Analyse Another Program ( Y or N )
```

Sample screen page from Amstrad memory pager.

```
PAGE No.  1  STARTS AT  256  ENDS AT  511  DECIMAL

------------------------------------------------------------------------
 MEM     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F          ASCII
------------------------------------------------------------------------
&0100   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0110   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0120   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0130   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0140   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0150   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0160   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
&0170   32 00 0A 00 C5 20 2D 2D 2D 2D 2D 2D 2D 20 41 4D  2...E ------- AM
&0180   53 54 52 41 44 20 4D 45 4D 4F 52 59 20 50 41 47  STRAD MEMORY PAG
&0190   45 52 20 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D  ER ------------
&01A0   2D 00 34 00 14 00 C5 20 2D 2D 2D 2D 2D 2D 2D 20  -.4...E -------
&01B0   42 79 20 50 2E 20 50 61 74 6F 6E 2C 20 20 41 75  By P. Paton,  Au
&01C0   67 75 73 74 20 31 39 38 34 20 2D 2D 2D 2D 2D 2D  gust 1984 ------
&01D0   2D 2D 2D 2D 2D 00 28 00 1E 00 AD 20 10 01 8D 20  -----.(...- ..
&01E0   E4 0D 05 00 C3 28 0D 00 00 D4 29 EF 28 28 19 50  d...C(...T)o((.P
&01F0   F5 FF 0E 28 03 0B 00 D3 29 29 F7 10 29 00 3D 00  u.(...S))w.).=.
------------------------------------------------------------------------
 MEM     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F          ASCII
------------------------------------------------------------------------
   SPACE BAR TO ADVANCE 1 PAGE, 'J' TO JUMP OR ANY OTHER KEY TO QUIT
```

Memory pager.

```
10 REM ------- AMSTRAD MEMORY PAGER --------------
20 REM ------- By P. Paton,  August 1984 -----------
30 MODE 2:DEF FNC(T)=((80-LEN(S$))/2)
40 S$="AMSTRAD CPC464 MEMORY PAGER":PRINT:PRINT TAB(FNC(T))S$
50 L=LEN(S$):S$=STRING$(L,126):PRINT TAB(FNC(T))S$
60 S$="BY PETER PATON":PRINT:PRINT TAB(FNC(T))S$
70 S$="This program will allow you to examine the CPC464's memory contents"
80 PRINT:PRINT:PRINT TAB(FNC(T))S$
90 S$="In the form of a hexadecimal dump. Each screen holds one memory page"
100 PRINT:PRINT TAB(FNC(T))S$
110 S$="Which is 256 bytes.":PRINT:PRINT TAB(FNC(T))S$
120 S$="On running the program you will be prompted for a START AT PAGE NO."
130 PRINT:PRINT:PRINT TAB(FNC(T))S$
140 S$="This should be an integer in the range 0 - 255":PRINT:PRINT TAB(FNC(T))S
$
150 S$="Press "+CHR$(24)+" S P A C E   B A R "+CHR$(24)+" to run the program "
160 PRINT:PRINT:PRINT:PRINT TAB(FNC(T))S$;
170 K$=INKEY$:IF K$<>" " THEN 170
180 KEY 128,"BORDER 1:INK 0,1:INK 1,24"+CHR$(13)
190 MODE 2:INK 0,20:INK 1,0:BORDER 20
200 LOCATE 20,25:PRINT"AMSTRAD CPC464 MEMORY PAGER"
210 WINDOW #1,1,80,5,20
220 REM ------------ INPUT START PAGE NUMBER ----------
230 LOCATE 2,2
240 LOCATE 5,2:PRINT CHR$(24);" START AT PAGE No.  > ";CHR$(24);" ?";CHR$(8);
250 LINE INPUT S$:S=VAL(S$):PAGE=S
260 IF S<0 OR S>255 THEN LOCATE 5,2:PRINT CHR$(7);"OUT OF RANGE";CHR$(18); ELSE
GOTO 280
270 FOR I=1 TO 1000:NEXT:GOTO 240
280 REM ------------ PRINT HEXDUMP -----------
290 W$=CHR$(24)+"  MEM     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
    ASCII         "+CHR$(24):LOCATE 1,4:PRINT W$:LOCA
TE 1,21:PRINT W$
300 LOCATE 5,2:PRINT CHR$(18):LOCATE 5,2:PRINT"PAGE No. ";S;
310 PRINT"STARTS AT ";(S*256);" ENDS AT ";((S*256)+255);" DECIMAL"
320 LOCATE 1,5
330 S=S*256
340 LOCATE 1,5:FOR M=S TO 65535 STEP 16:I=I+1
350 REM ------ CONVERT TO HEX AND SET PRINT FORMAT ----
360 A$=HEX$(M)
370 IF LEN(A$)=1 THEN PRINT" &000";A$;"    ";
380 IF LEN(A$)=2 THEN PRINT" &00";A$;"    ";
390 IF LEN(A$)=3 THEN PRINT" &0";A$;"    ";
400 IF LEN(A$)=4 THEN PRINT" &";A$;"    ";
410 REM -------- SET TO PRINT 16 BYTES ON EACH ROW --------
420 FOR R=0 TO 15
430 REM ------------ GET CONTENTS OF MEMORY -------------
440 X$=HEX$(PEEK(M+R))
450 IF LEN(X$)=1 THEN PRINT"0";X$;" ";
460 IF LEN(X$)=2 THEN PRINT X$;" ";
470 NEXT R
480 REM ---------  PRINT ASCII REPRESENTATION OF MEMORY CONTENTS -----
490 PRINT"    ";:FOR C=0 TO 15
500 IF PEEK(M+C)>31 THEN PRINT CHR$(PEEK(M+C)); ELSE PRINT".";
510 NEXT C
520 PRINT
530 REM ------ IF 16 ROWS HAVE BEEN PRINTED THEN STOP -------
540 REM ----- AND WAIT FOR A KEY TO BE PRESSED  ------------
550 IF I/16=INT(I/16) THEN GOSUB 580
560 NEXT M
570 END
580 LOCATE 5,23:PRINT CHR$(24);" SPACE BAR ";CHR$(24);" TO ADVANCE 1 PAGE, OR "C
HR$(24);" J ";CHR$(24);" TO JUMP OR ANY OTHER KEY TO
 QUIT";
590 K$=INKEY$:IF K$="" THEN 590
600 IF K$<>" " AND K$<>"J" THEN LOCATE 5,23:PRINT"RUN TERMINATED";CHR$(18) ELSE
GOTO 630
610 LOCATE 20,25:PRINT"Press '0' On Keypad To Restore Screen Colours";CHR$(11);
620 END
630 IF K$=" " THEN CLS #1:LOCATE 1,23:PRINT CHR$(18) ELSE GOTO 690
640 REM ----------------  PRINT NEXT PAGE HEADER -------------
650 PAGE=PAGE+1
660 LOCATE 5,2:PRINT CHR$(18):LOCATE 5,2:PRINT"PAGE No. ";:PRINT PAGE;" ";
670 PRINT"STARTS AT ";:PRINT (PAGE*256);:PRINT" ENDS AT ";:PRINT ((PAGE*256)+255
);:PRINT" DECIMAL"
680 LOCATE 1,5:RETURN
690 LOCATE 5,23:PRINT CHR$(18):LOCATE 5,23:PRINT"Jump To Page  > ";
700 LINE INPUT K$
710 IF VAL(K$)>=0 AND VAL(K$)<256 THEN 720 ELSE PRINT CHR$(7);:GOTO 690
720 PAGE=VAL(K$):S=VAL(K$):CLS #1:GOTO 300
```

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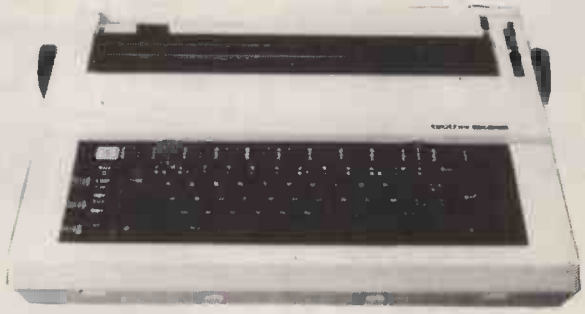

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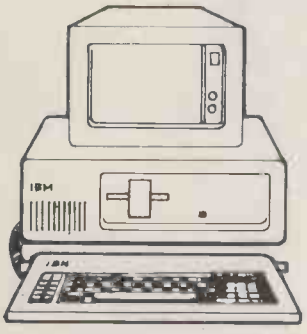

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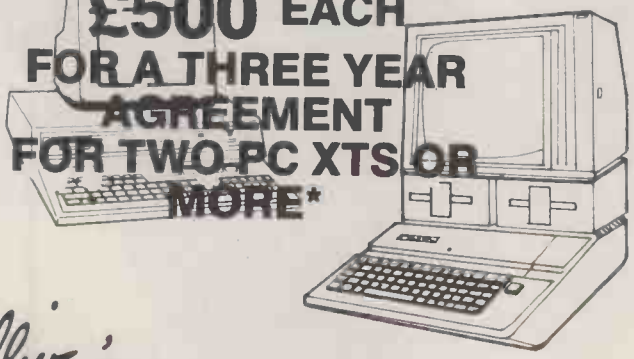

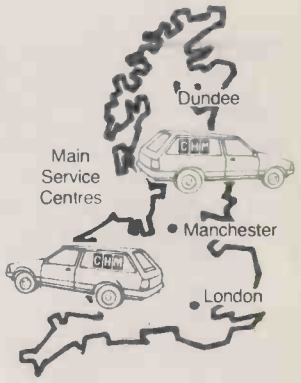

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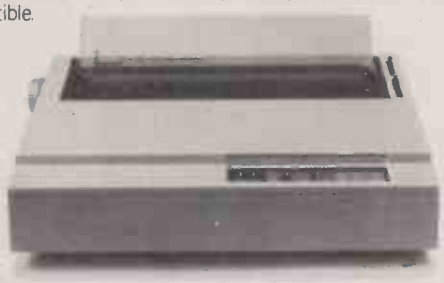

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QL crazy

Judging by the deluge of books published on the QL it is here to stay. Glyn Moody wades his way through some of those available.

JUDGING by the book publishers' reaction to it, the QL is a runaway success. Apart from old-timers like Granada and Sunshine, several new houses seem to have sprung up to service what they obviously feel is going to be the huge demand for books. In addition, some older established book publishers have taken this occasion to swallow their pride and join the micro stampede from which they have hitherto held themselves aloof.

The 20 or so books reviewed here are only the beginning: most of the publishing houses responsible promise that they have another five titles up their sleeves. If this continues, there could soon be more books on the QL than actual machines in use.

In such circumstances a book has got to be a little bit special to stand out from the pack. One such book likely to be of particular interest to hardened readers of *Practical Computing* is *The QL Advanced User Guide* by Adrian Dickens. It is designed to let you harness the full power of some of the QL's advanced features.

After a short rundown on the 68008, including information on registers, interrupts and the instruction set, there is a brief guide to Q-DOS. The rest of the book is devoted to its detailed exploration. Normally you would use an assembler to investigate Q-DOS's finer points. But very sensibly, Dickens assumes you lack this facility, and gives you a SuperBasic program to type in that will allow access to the main features of the system. This and other programs in the book are available on a Microdrive cartridge for £9.95 from the publishers. In particular it lets you generate the various traps which invoke operating system subroutines. The central section of the book describes these traps in some detail, and lets you try them out using the program.

The rest of the book gives information on the vectored utilities, and the detailed operation of SuperBasic. Useful appendices include the memory map of the QL, a summary of the 68008 instruction set, details of the external ROM, specification of the Microdrive format and information on the hardware expansion port. All in all, an invaluable reference work for the serious QL user.

For those interested more specifically in assembly language programming. Andrew Pennell's *Assembly Language Programming on the Sinclair QL* is an excellent introduction. It assumes no previous machine-code experience, and explains basic processor operation before moving on to details of the QL. Then gradually you are led through the various instruction codes, with short assembly language programs to type in throughout. After this guided tour, there is an A to Z of the instruction codes with fairly full comments.

The penultimate chapter is devoted to a SuperBasic listing of a disassembler. This is well written with plenty of Rems and staggered listings to indicate nestings. Many people may find that this program alone justifies the £7.95 price tag on the book. The final chapter talks around the 68000 family, and is written in the same eminently readable style as the rest of the book.

Colin Opie's *QL Assembly Language Programming* is rather drier, and seems intended more as a reference work. It offers information covered in both Dickens' and Pennell's books, with details of instruction sets and traps, as well as how to interface machine code to SuperBasic programs. It also contains several longer assembly language listings of various utilities. An editor and assembler package has been produced to complement the book. It is issued on Microdrive, and costs £29.95 from the publishers.

Predictably, the rest of the QL book deluge is aimed much more at the first-time user, though there are a few exceptions which stretch both the reader and the machine a little. For a general beginner's guide you could do worse than going to a man who at least has the right name. Ian Sinclair disclaims any connection with his namesake, but even if there were, his *QL Computing* would be worth getting for its clarity and gentle humour which never patronises. After a very basic guide to the hardware, there follows a fairly standard gentle romp through SuperBasic, with plenty of examples to try.

The title of Jeremy San, Fouad Katan and Simon Rockman's *Quantum Theory* sets the tone for this slightly jokey book. Like Ian Sinclair's book it begins with a short introduction to the QL, then proceeds through SuperBasic at a slightly higher level. One bonus is the inclusion of two classic games listings: Breakout — also known as Brick Out — and Snake.

An Introduction to Programming the Sinclair QL by R and J Penfold, is hamstrung by its tiny physical size of less than standard A5, so it is necessarily more selective. But if for any reason, you feel the need for a cheap, pocket-sized guide, this might fit the bill and the pocket.

Another idiosyncratic book, but this time because of its layout, is the *Sinclair QL User Guide*, a misleading title from Lionel Fleetwood. It is intended as a complete guide to the QL, SuperBasic and the Psion software. Its chapter numberings reflect this, but references to chapter QL5 or Ab3 - for Abacus, the spreadsheet - only confuse.

Things are not helped by a rather badly designed layout. There are far too many words on a line for easy legibility, which has the additional effect that paragraphs are often only two lines long. There are also very few subsidiary headings in each chapter, so it all looks very relentless. However, if you are prepared to negotiate all these unnecessary obstacles, the text is quite entertainingly written, and there are useful summaries and examples.

Introducing the Sinclair QL by Garry Marshall is part of the Sinclair QL Series from Hutchinson. As a wonderful example of overkill, there is a corner flash on the cover carrying a recommendation from *QL User* magazine, a foreword by Nigel Searle, managing director of Sinclair, an introduction by the editor of the series, Robin Bradbeer, and then a preface by Marshall.

The book deals with the QL fairly quickly, and spends most of its time discussing the Psion packages. It is nice to see so many screen shots to show you what is going on. Unfortunately, the section on SuperBasic is skimpy: after a short introduction, there is a long and boring list of keywords useless to the beginner.

From the same stable, and with the same introductory apparatus is *Desk-top Computing with the Sinclair QL* by Barry Miles, which is supposedly geared to the professions and business. In effect this means that the guide to the hardware is shorter than in the other volume and that the introduction to SuperBasic has disappeared completely, leaving only the even more inappropriate list of keywords.

The publisher's justification for this would probably be that it just happens to produce a rather fuller separate guide to SuperBasic: the *Introduction to SuperBasic on the Sinclair QL* by Dick

(continued on next page)

(continued from previous page)

Meadows. Once you have made it past the usual nonsense at the beginning, you find really rather a good general book on SuperBasic. It assumes nothing to begin with, but works up to quite impressive programs at the end.

One quibble I have is the use of typeset listings. They may look far neater on the page, and I may be very cynical, but I cannot believe that there are no typographical errors at all in them. It is far safer to use printouts. One big plus for this book is the inclusion of exercises throughout, together with answers, and the familiar list of SuperBasic keywords is justified here.

Roy Atherton's *Good Programming with QL SuperBasic* also has questions throughout, and is to be praised for its evangelical fervour on behalf of good — that is structured — programming. *QL SuperBasic* by A A Berk is more sedate, and lacks any particular virtues or vices. John Wilson's similarly titled book is intended for those who already have some acquaintance with Basic, and wish to learn about SuperBasic's differences and improvements. It contains a number of longer listings that again are sound rather than earth-shattering.

Developing Applications on the Sinclair QL is the rather grand title of Mike Grace's introduction to the Psion bundled software. Apart from a very approachable style, which some might find too easy-going, its main virtue is that it uses extended practical examples to explain the principles of the applications and the details of the Psion software.

Word processing with the Sinclair QL by Mike O'Reilly is the first of the Hutchinson books that will deal with the bundled software. It is also the best so far of the series. After short chapters on the QL and printers, it plunges into the nitty-gritty of word processing.

A very full text combines with clear screen shots to provide just about the most thorough guide to the subject imaginable. There is even a chapter called "Beyond Quill", which is in fact a polite way of discussing the features Quill has not got. There follows a short and rather pointless chapter on data communications, and then a splendidly provocative one on VDUs and health. A useful appendix summarises all the Quill commands. Worth getting just for its novelty value as an interesting book on word processing.

Two books from another projected series published by Century Communications are on Quill and Easel. *QL Quill* by Francesca Simon and Clare Spottiswoode, is a real idiot's guide to Quill and word processing. Whether this type of approach appeals, complete with cartoons and a mini-soap-opera story line that runs through all the volumes, depends on personal preferences. The books are well produced.

One criticism of the companion, *QL Easel* by Alison Spottiswoode, is that it succeeds in making a mountain out of a molehill. Easel is a fast and impressive program, but it is also quite limited. Whether it really deserves this kind of in-depth treatment is a moot point.

Advanced programming with the Sinclair QL is another Hutchinson book, this time by Martin Gandoff. The emphasis is rather different from other books. In its runthrough of SuperBasic it is geared very much with designing business applications in mind. A chapter headed "Programming Case Studies" gives listings of basic mathematical procedures, sorts, and simple records- and accounts-type programs. Unfortunately the listings are, once more, all typeset, which means that you may have to watch out for the odd misprint. But otherwise quite a good book with a novel approach.

Two other books are rehashes of previous volumes by the same authors, but nonetheless useful. Czes Kosniowski's *Mathematics on the Sinclair QL* offers a number of routines dealing with basic mathematical subjects like trigonometry, powers, primes, matrices and encryption.

The aptly-named father and son team of the Brains have rewritten their AI book for the QL as *Artificial Intelligence on the Sinclair QL*. It provides a handy practical introduction to the problems of expert systems and AI.

Finally, a book which probably should not be appearing in this review with such earnest tomes, *The QL Book of Games* by Richard Hurley and David Virgo. It contains nothing spectacular, just a range of games from a simple typing tutor, Type Attack, to extend listings of Backgammon and an adventure game, Nightmare Park. Games that utilise anything like the full potential of the QL will probably make use of multi-tasking, and that needs machine-code programming.

The QL Advanced User Guide by Adrian Dickens. Published by Adder Publishing, £12.95. ISBN 0 947929 00 2

Assembly Language Programming on the Sinclair QL by Andrew Pennell. Published by Sunshine Books, £7.95. ISBN 0 946408 42 4

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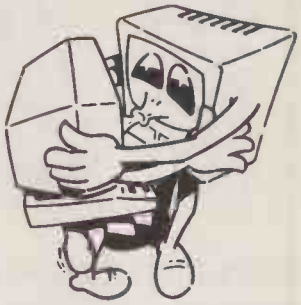

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Deaf aid

For most people the telephone is an indispensible part of everyday life — but it's not much use if you can't hear. David Myers explains how electronic mail could be changing all that.

IN AN AGE which regards space travel almost as nonchalantly as running a bath, I wonder how many people realise that use of the device which Alexander Graham Bell developed to help his deaf wife is, ironically, the cause of great frustration for the deaf. Even today, in this highly sophisticated electronic age, use of the telephone is virtually impossible for the profoundly deaf.

Although various devices exist which have been developed to help those with useful residual hearing, they are not helpful for those deaf people who need to see the speaker to know what has been said. These people need a deaf communicating terminal, which consists of a typewriter, modem and VDU; there is just one model available in the U.K. They can also use a micro with modem and a VDU. Of course the U.S. is fully supplied with equipment and for many years there have been several models of deaf communicating terminals available. Obviously they do not have to contend with BT to obtain approval of suitable devices, and use by the deaf is widespread. Why then is it that there is so little interest in helping the deaf in this country?

Advantages

For two years I have been using electronic mail, Email, and find it ideal for communications. But it would be better if there were more deaf users to communicate with. While I accept that the deaf want to be able to communicate on a direct, back-to-back basis, I would also like to see Email developed for use by the deaf. The advantgages of Email are many, not least the facility to prepare messages off-line, download and send at speed, and the facility of downloading incoming messages, reading at leisure — important if you are not a quick reader — and replying off-line in the first instance.

Use of Email may not be cheap and not all systems are easy to use, but it does enable you to make quick and cheap contact with anybody anywhere. It has been proved that it takes six or seven times longer to type a telephone conversation than to speak it, so a five-minute chat takes the deaf 30 minutes. Although this differential has been proved and accepted, no concessions are made to the deaf for it.

David Myers is an accountant; he is himself deaf.

Also, the deaf fraternity is close and widespread and long-distance messages by Email can be sent for the cost of a local call.

However, accessing Email is not a simple matter of installing a telephone and using it; expensive equipment is also needed. It is surprising that manufacturers are not more interested in supplying the deaf with a good and attractive package of a terminal, modem and mailbox on an Email system, at a price which deaf people, who frequently earn a lower wage than the hearing, can afford.

Ultimate benefit

If a manufacturer were to come forward and offer, say, 100 terminals, surely the benefit would ultimately be theirs? Even if the manufacturer only broke even on the initial supply of 100 units, there are an estimated four million people with varying degrees of hearing loss, so the potential order book must run to thousands. A dealer would need to be found who was prepared to give time initially to meeting the deaf but again they would benefit. Once something is started, the deaf who are familiar with the systems can help those experiencing difficulties, since where there's a will there's a way.

Email is the system of the future. Its widespread use by business already proves this to some extent. But why is use of Email kept so secret, and why is there no printed directory given to subscribers? For example, how many businesses with mailboxes publicise the fact on their stationery? Also we badly need some standardisation regarding compatibility. Different Email systems have no mutual link, and equipment is set to different communication parameters. There should be a universal agreed system to keep costs down.

I fervently hope that someone will heed this plea for help for the deaf and I am willing to help at any time. In a country with widespread unemployment, surely the possibility of filling an order book should attract someone, somewhere. BT would also benefit by having still more customers and perhaps still larger profits. The deaf are impatient for a chance to communicate by telephone, the market is there, please give us the goods.

Comments can be sent to David Myers via Telecom Gold at 81:BKU010, or to *Practical Computing* on 81:JET727.

David Myers uses an Olivetti M-10 and modem coupler, which are sold with a Telecom Gold mailbox.

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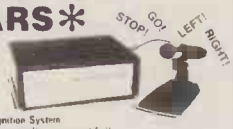

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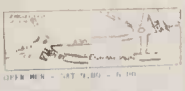

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