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BEYOND THE SPREADSHEET

Spreadsheets are one of the oldest business programs, and also one of the most popular. VisiCalc started it all: now Lotus dominates the market. But what lies beyond 1-2-3? After taking a look at spreadsheets past, present and future, *Glyn Moody* looks at Javelin on page 98, regarded by many as Lotus's heir presumptive. On page 100 *David Barlow* reviews Report Manager, a three-dimensional spreadsheet, and on page 102 there's an advanced product for the Mac. Finally, *Jerry Sanders* looks at What's Best, an add-on for Lotus which gives you advanced goal-seeking capabilities

97

INSIDE



Olivetti M-22 Portable, high-tech IBMulator — page 52.



AT compatibles The Ferranti PC-2860AT and Tandon's PCA-30 — page 58.

PRACTICAL COMPUTING

MAY 1986 CONTENTS

OLIVETTI M-22

Olivetti has finally added to its best-selling range of micros. *Glyn Moody* tries out the slim-line battery portable with a back-lit LCD

52

XEROX 6085 PCS

Xerox pioneered the Wimp techniques that are so fashionable today. *Ian Stobie* looks at its latest advanced desk-top machine

54

FERRANTI PC-2860AT TANDON PCA-30

Two AT compatibles from two very different manufacturers. *John Lee* and *Timothy Lee* compare and contrast them

58

NEC PAGEWRITER

Laser performance at a lower price: a full-page printer based on LED technology, reviewed by *Ian Stobie*

62

PARADOX

Mike Lewis completes his review of this exciting new database package with a look at PAL, the Paradox Application Language

64

BBC PAGE MAKERS

Personal publishing is all the rage; *Carol Hammond* tries out some programs for the BBC

68

MULTIMATEADVANTAGE

A new version of this popular word processor, reviewed by *Susan Curran*

72

dBASE COMPILERS

dBase is powerful, but it can be slow. *Mike Lewis* looks at a pair of add-on programs which speed it up

76

HACKER PROTECTION

Is your system safe? Hacker expert *Steve Gold* explains how to keep it that way

80

DEALING WITH DEALERS

What makes dealers tick? How can you get the best from them? *Jerry Sanders* offers advice on getting the best bargain

82

DATA PROTECTION UPDATE

Anne Staines asks whether the Data Protection Act has failed before it has even begun

85

TOP 10 NON-IBMULATORS

Steve Malone gives 10 good reasons for not joining the Big Blue bandwagon

91



Shopping around Get value for money when buying from dealers — page 82.

NEWS



Top of the Olivetti range: the M-28 AT compatible.

HARDWARE NEWS

Olivetti trio **12**

SOFTWARE NEWS

Natural commands on Q&A **14**

GENERAL NEWS

Zenith hits IRS jackpot **16**

OPEN FILE

CONTENTS

This month's programs **107**

LANGUAGES

What to write in which **108**

BUSINESS STATISTICS

Part 4: Essential statistics **110**

FILE TRANSFER

Kermit **114**

REGULARS

EDITORIAL

IBM v AT&T.....**5**

FEEDBACK

Your letters.....**7**

NEXT MONTH

What's in store.....**8**

SOFTWARE WORKSHOP

Security codes.....**23**

CHIP-CHAT

DIY logic.....**29**

COMMS LINK

Microlink.....**31**

ASK PC

You ask, we answer.....**38**

BOOKS

Serious business.....**49**

INTERVIEW

John Aris of the NCC.....**89**

LAST WORD

DOS chaos.....**117**

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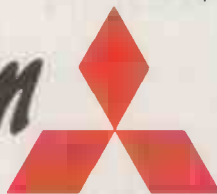
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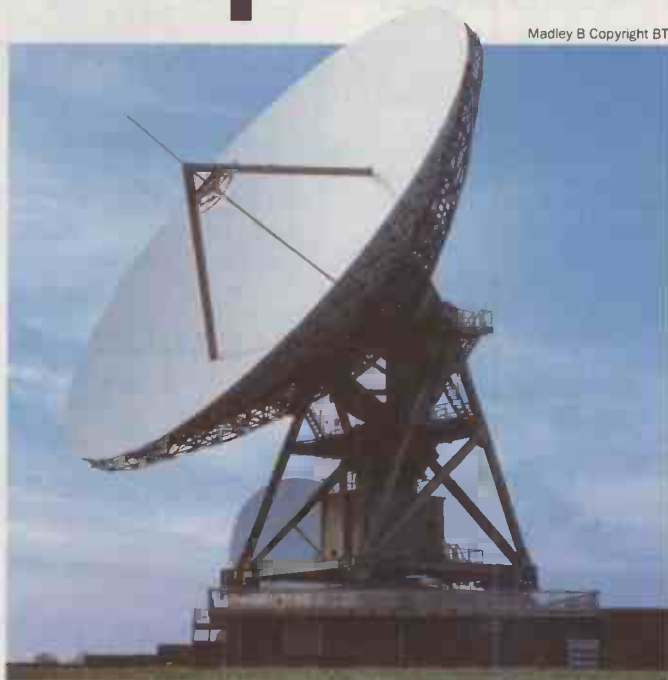


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WHO'S AFRAID OF AT&T?

The micro world was recently agog. Moles and pundits alike had predicted that IBM would announce a machine, a significant event by any standards. They also assured us that it would be the long-awaited Clamshell lap portable, also known as the Convertible. Sure enough, the Big Blue mountain shuddered — and brought forth the PC/RT.

Since then, the marketing waters have muddied considerably as conflicting reports regarding its intended end-market have circulated. Powerful graphics capabilities are an important feature of the new machine, and IBM has stated that it will be aimed at the scientific and engineering communities, along with CAD/CAM applications. However, IBM has also announced that a wide range of business programs will be available, and that the new system is intended for office automation.

There are two significant technical features of the machine. First, in addition to the new reduced instruction set chip, there will be a co-processor option which allows you to run AT software. Secondly, the main operating system and background environment in which PC tasks will run is a development of AT&T's Unix System V, Aix.

Aix is not just another flavour of Unix; it attempts to address one of the main impediments to Unix's widespread success, its user-unfriendliness. Also, IBM seems to be throwing a good deal more of its weight behind this implementation than any other that it has offered.

Consequently, the launch of the PC/RT could prove to be one of the most important of recent years, both for the future development of the micro market, and for the coming showdown between two U.S. giants, IBM and AT&T.

Since the break-up of the \$100 billion monolith into separate companies, AT&T has acted like a character in search of a play. It has long been touted as the only possible competitor to IBM which stands any serious chance of bridling IBM's aspirations to world dominance. Yet so far its showing has been dismal.

AT&T's first serious micro was based on Unix and was a complete flop. Then came the MS-DOS based PC-6300, and now AT&T has launched the PC-6300 Plus which offers AT compatibility as well as running Unix.

Both the PC-6300 Plus and the IBM PC/RT represent a kind of large-scale hedging of bets. Of course, IBM is in the stronger position in that PC-DOS is used more widely than Unix. However, IBM cannot take a chance on AT&T stealing a march on it, which Unix potentially allows it to do.

But IBM may be doing more than covering itself.

It could well be that it genuinely sees Unix, or a later development of it, as the way forward with multi-user micros for the 1990s. Evidence in support of this is the recent early validation of a version of Unix for Intel's 80386 chip, which is the successor to the 80286 found in the AT and expected to form the heart of the next generation of IBM PC machines.

There are some other pointers which suggest that the ugly duckling PC/RT may yet turn into a swan. There are rumours that the RT's keyboard will find its way on to all IBM PCs. Similarly, there are suggestions that other elements of the new micro will be carried across. For example, it is reported that 100,000 tape streamers of the kind used in the RT have been ordered, which is far more than could be used in RTs alone.

If the PC/RT does prove to be a dry run for the next generation of personal computers, and more importantly, if some form of Unix is at the heart of those machines, we are likely to see a lot of sparks flying. AT&T may have got off to a slow start, but there is no doubt that it will persevere until it gets going.

AT&T will be helped in this by the rapid growth in the importance of communications, an area in which it is the clear leader. IBM knows that time is against it and that unless it can colonise large tracts of AT&T's traditional territory soon, the whole business community will find itself swept into the waiting arms of AT&T.

So the PC/RT is a machine full of tantalising possibilities. It could certainly prove to be a good deal more exciting than was suggested by the politely stifled yawns which greeted its unexpected appearance. Never underestimate IBM — especially if you are AT&T.

5 YEARS AGO...

Acorn Computers has landed the job of building the new BBC microcomputer — and the projected BBC TV series *First Byte* will use an extended form of Atom Basic in its instructional material.

Acorn describes the new machine, which will retail for less than £200 and should be ready by the end of 1981, as "a condensed version of the forthcoming Proton".

Initially, the requirement was for a Z-80 processor, teletext capability and CP/M support, but intensive discussions throughout the industry showed that it was not possible to have a machine built in Britain within the time limit. The Z-80 requirement was scrapped but Acorn has been able to meet the others within the time limit. A new BBC Basic to be called ABC was to have been developed but this too was dropped for lack of time.

PC Volume 4 Issue 5



Cover feature: page 97

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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.

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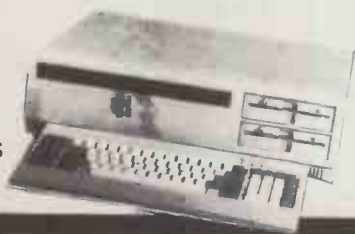
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Project Planners

I HAVE to admit growing disappointment with all the U.K. computer rags and *Practical Computing* is only a little better than the rest of the pack. Your recent two-month review of project-management systems was positively trivial! I know you do not have the resources to set up the same project on all the packages reviewed but you did not even attempt a comparison chart of the features, nor did you mention all the ones reviewed in your final summary box. Piffle!

I realise you have to aim at end-users — the developer/system house market is not large enough in the U.K. to justify a technical magazine — but with products like Gem and Windows you do very little to help the software writer choose which environment to develop for. Indeed, apart from the individual preferences opined by reviewers you seem to do little to encourage the sort of packages and user interfaces you believe should be produced. More co-ordination over reviews for user-friendly features could make the magazine a serious force for good development techniques.

JUSTIN SMITH,
London SW18.

Buy British

OH DEAR, Mr Cranshaw, you are not doing your homework. I refer to the letter "Open all hours" in the March Feedback column. There are lots of computer dealers selling highly successful British products at all hours. Unfortunately, there are an equal number of British buyers who are so IBM-orientated that they are not prepared to look beyond their own noses.

PBS Computers in Leamington is within 15 miles of Mr Cranshaw. We sell the all-British Ferranti PC, XT and AT which is the basis of one of the major success stories in the PC market in 1985/86. Our hours are 7.30 a.m. to 6.30 p.m. Monday to Friday and 7.30 a.m. to 1.30 p.m. on Saturday. All customers have access to the sales team through their home telephones outside these hours.

You are very wrong in your conclusion. It is not the manufacturers and dealers that need to get moving and be patriotic, it is the average buyer.

NEIL GREEN,
PBS Computers,
Leamington Spa.

FEEDBACK

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.

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PASSWORD PROTECTION

AS PART of your March review of Tandata's PA, a set-up screen for Prestel access appeared on page 54. This clearly shows the user's confidential identity code. It is a relatively short step from there for a would-be hacker to try an assortment of passwords and thus gain access to this account.

Please emphasise to all your staff — and if possible, your readers — that the Prestel ID should be kept secret! I would suggest that the owner of that account be advised of the situation so that they may consider asking Prestel for a change of ID.

HOWARD SPURR,
(via Telecom Gold).

THE EDITOR ADDS: Point taken. More security lapses occur because people have left passwords lying around than as a result of clever hacking by the intruder. However, in this case the legitimate user is still protected by the Prestel password, which is not displayed.

More money in selling mainframes?

AFTER reading Rod Butterworth's sensible letter in your February issue on the growing pains of the PC business can I suggest that there are plenty of salesmen with the experience and qualifications he rightly believes are needed? They are working on mainframes and quietly laughing at more and more PC salesmen chasing less and less money and ending up with 35 percent of sweet Fanny Adams.

ADRIAN WILSON,
Burton-on-Trent.

Underrated Edlin

I AM sure many will support Mike Lewis's comment in the March issue that WP packages are too sophisticated for the quick typing job. But for those who run MS-DOS, what about Edlin?

Consider: creating a file could hardly be easier, saving it only needs ^E, and it can be printed

with

COPY < > PRN

What about editing? Since when did a typist edit a letter. What about typos? Well, I am aware of most of my typos as soon as I hit the wrong key. I am aware of 99 percent of the rest before I leave the line. All these can be easily dealt with. And of the one percent that remain? If they are real bloomers, it is not such a big job to redo the line.

In my view Edlin is a much underrated facility.

W S HARVEY,
Glasgow.

Metatext

UNFORTUNATELY, in the excellent review of the Metatext print enhancer in your February issue you omitted the name of the U.K. distributor for Metatext, to whom all enquires should be directed. Metatext is distributed by KPG Hardware House, 578 Chiswick High Road, London W4 5RP. Telephone: 01-995 3573.

DAVE BERRIMAN,
Campbell Sadler Lohan,
London EC1.

Wang APC

WE HAVE been using the Wang APC now for a month and can certainly agree with your reviewer's comments in your March issue.

We have been using Autocad since September and have been impressed with it. Your Software Shorts mentions its availability for IBM compatibles and Apricots. We first used Autocad on a Wang PC and have now migrated to the APC with 80287 maths co-processor chip and 30Mbyte Winchester, using a virtual disc on a Wang VS-100 for backup purposes.

The 101-key keyboard is the same used on Wang's VS line of minicomputers, OIS line of word-processing equipment and regular PC. Their integrated word-processing application is similar to their other WP packages on the rest of their systems.

In your article on software copying you mention that Autocad is not copy protected. True. However, U.K. versions now require a hardware-protection device that does put restrictions on Autocad.

THOMAS GIVENS,
Information Processing Center,
American Embassy,
London W1.

Greek alphabet

I READ the letter from S Weatherhead in Ask PC, March, regarding word processing using the Greek alphabet with interest.

We can offer another solution which was developed here at BCA for our own use. It allows the Greek alphabet, line-drawing symbols and other special symbols resident in the DEC LN-03 laser printer to be accessed from WordStar using standard WordStar control commands. It takes the form of a small utility software package and is suitable for the IBM PC and the DEC Rainbow.

BRIAN S CRANK,
BCA Industrial Publicity,
Services,
Southborough,
Kent.

IN THE March 1986 issue of *Practical Computing*, S Weatherhead asked about word-processing packages for the IBM PC that allowed the full use of Greek characters as well as the normal ones. At least some of the packages you mentioned are

(continued on next page)

(continued from previous page)
quite reasonable, but readers might be interested in the only IBM package especially designed to do Greek/English, Russian/English, etc., called Academic Font. It is in use in many universities around the world, especially in the U.S. It is now becoming available in the U.K. as I have agreed to help University Microcomputers distribute it. It was originally written for Unix computers and bundled with AT&T minis. The word-processing power alone is good value at the current prices, and its multi-lingual capacities are unsurpassed.

Academic Font is primarily intended for those who need to do textual work in more than one alphabet. It is based on Wordix and Edix — text formatter and editor respectively — from Emerging Technology. The base version, for English/Romance/Germanic work, including Wordix and Edix, is £250. The Propack, which also includes a spelling checker, Spellix, and index creator, Indix, is £300. The Propack Plus also includes Offix, an integrated software package that combines filing, word processing, forms design and report generation. Its word processor is WYSIWYG, but can be patched to Wordix for more sophisticated formatting and combining with Edix files. The price for this package is £350.

Academic Font really comes into its own with the more expensive versions: £375, £425 and £475 for basic version, Propack and Propack Plus. They are designed to combine the English alphabet with either Greek, Greek and Logic, Russian/Eastern European, International Phonetic Alphabet, Portuguese or Old Scandinavian. It is available for the IBM PC, PC/XT, PC/AT, Compaq, Olivetti and Zenith.

DAVID OWEN,
Mansfield College,
Oxford.

Diskey

RE THE letter entitled "Data security add-on" in your March issue. We also have a data-security system for the IBM. Called Diskey, it password protects the hard disc of an IBM PC/XT or compatible computer from unauthorised access. The password can be up to 15 characters long. Upper case, lower case and control characters are accepted. On booting the system, you are prompted for the

password which unless entered correctly will necessitate the rebooting of the system. Once the password is correctly entered you can alter the password or elect to have the system boot normally.

The password is encrypted and does not reside in the DOS directory of the hard disc. Booting the system from a floppy disc will still not allow you access to the hard disc. If the password is forgotten, then this necessitates the hard formatting of the hard disc via the IBM advanced diagnostics for a chargeable visit by a member of our staff. Diskey 1.0 costs £39.50.

MIKE LANGENSIEPEN,
Audit Computer Systems,
27 Murray Street,
Llanelli,
Dyfed SA15 1AQ.


Hitachi business user group

FOLLOWING the recent promotion of the Hitachi PC in the High Street there is now a sizeable user base of this computer in the U.K. Support from the High Street for full business machines is non-existent and as far as Hitachi are concerned this product is a discontinued line, so there is an obvious need for information for users.

The Hitachi PC User Group has been established for the distribution of information, assistance, advice and Public Domain software for all Hitachi users. The membership includes computer suppliers, personnel agencies, county councils and members of political parties. There is also a commitment from Hitachi Sales (U.K.) themselves to join this organisation.

There is a bi-monthly newsletter with software/hardware offers, tips on using popular packages, such as WordStar, Multiplan, etc., on the Hitachi and a library of free software for the Hitachi available for all members.

We are trying to contact all users with further information, but if any are reading this and want more information please write to the address below. This is primarily a user group for Hitachi users but if users of other 16-bit 5.25in. disc format MS-DOS machines would like to join they would be very welcome.

COLIN MILLER,
Hitachi PC User Group,
39 Cranbury Road,
Eastleigh,
Hampshire SO5 5HB. 

NEXT MONTH

SPECIAL SECTION LOCAL AREA NETWORKS

More and more people are looking at the possibility of hooking up their micros with LANs. This is fine in theory, but what about the practice? In our special section we not only give the background to the latest developments, but also carry out detailed bench tests on setting up and running different networks.

HARDWARE

Following our review of the M-22 in this issue, we look at the remaining two new members of the Olivetti family, the top-end M-28 AT-alike and the low-cost M-19. There is also a review of the ultimate in portable computing: a micro and cellular-radio unit combined.

SOFTWARE

Boxes and Arrows is an innovative package with claims to be a "visual spreadsheet". We will also be looking at another product which straddles several categories: Recall combines features of a database with the ability to use free text.

FEATURES

The controversy over VDUs continues; we look at the issues and the evidence.

TOP 10 SURVEY BUDGET SYSTEMS

Purchasing a business micro no longer means breaking the bank. We point you towards the best buys.

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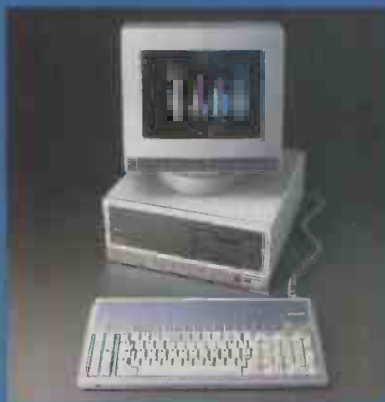
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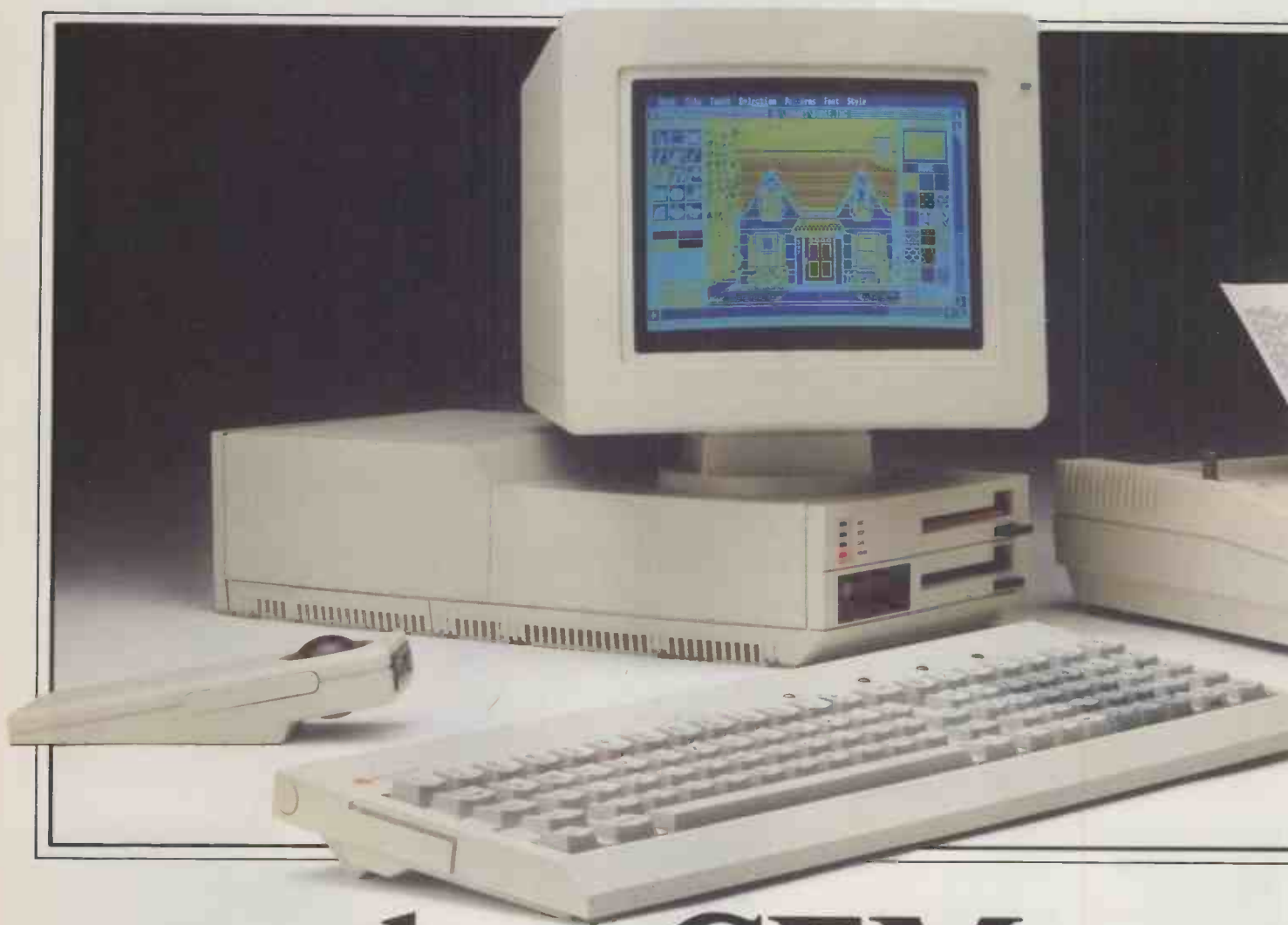


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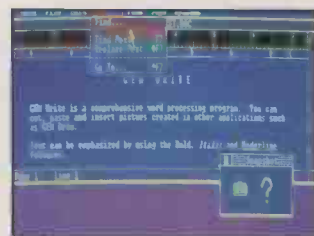
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 **GEM Applications**

Apricot upgrades Xen

IN A BID to make inroads into the mini and mainframe markets, Apricot has introduced a multi-user version of the Xen 80286-based microcomputer.

Known as the Xen Mainframe, the new system is claimed to be up to four times faster than the current Apricot Network system, and yet to be compatible with the full Apricot and IBM range. The Mainframe incorporates 2Mbyte of RAM, a 720K disc drive, a 20Mbyte tape cartridge back-up unit and a modem. A hard disc is also fitted as standard: you have the choice of 20Mbyte, 50Mbyte or 100Mbyte versions. Prices range from £4,999 to £7,999. Xen Mainframe is able to run under either Xenix or MS-DOS 3.2.

Further details from Apricot Computers, Apricot House, 17 Westbourne Road, Edgbaston, Birmingham B15 3TR. Telephone: 021-454 9091.

Burroughs multi-user

BURROUGHS MACHINES has introduced another model into its range of B-20 systems. The B-28 desk-top computer is intended as a master station in a multi-user system.

Based around the Intel 80286 processor, the base version of the B-28 comes with 1Mbyte of RAM and costs £3,100. For an extra £650 the computer comes fitted with a 80287 maths co-processor.

Contact Burroughs Machines Ltd, Heathrow House, Bath Road, Hounslow, Middlesex TW5 9QL. Telephone: 01-750 1291.

Quattro modem

A NEW universal V-22bis modem has been announced by DN Computer Services. The Quattro can be configured to the V-21, V-22 and V-23 protocols as well as offering auto log-on, autodial and synchronous/asynchronous transmission.

The Quattro is BABT approved and priced at £795. More details from DN Computer Services, Truedata House, Green Lane, Heywood, Manchester OL10 2DY. Telephone: (0706) 67567.

THREE FROM OLIVETTI

OLIVETTI has announced the launch of three machines to add to its range of IBM-compatible computers. The new models are the M-19 IBM PC compatible machine, the M-22 portable, and the M-28 PC/AT-compatible desk-top computer.

Weighing around 8kg., the portable M-22 is about the size of a briefcase. Folding back the screen reveals the full-size keyboard, and storage is provided by a single 5.25in. floppy-disc drive on the side. The display is provided by a back-lit LCD screen, which is much easier to read than conventional LCD displays.

The M-22 is fitted with two 80C88 CMOS processors, the second processor being dedicated to screen handling and manipulation of the Personal Windows software provided with the machine. Olivetti sees this machine as being aimed at the corporate market — salesmen and travelling executives, in particular. The M-22 is previewed by Glyn Moody on page 52 of this issue.

Based around the 80286 processor, the M-28 is equipped

with 512K of RAM, expandable to 7Mbyte if additional boards are fitted. In common with manufacturers such as Compaq, Olivetti has chosen a clock speed of 8MHz for its AT-compatible. This gives it a 30 percent edge over the IBM PC/AT, which runs at 6MHz. Mass storage is provided by a single 1.2Mbyte floppy disc and a 20Mbyte hard disc.

The M-19 is based around the 8088 CPU and is fitted with 256K of RAM and one or two 5.25in. floppy discs as standard. Also provided are Centronics and RS-232C ports, with two extra slots provided for additional expansion. Olivetti is aiming the M-19 at the educational and small-business markets, and also at the corporate market where relatively lowly computers are increasingly being used as work stations within a network.

No prices have yet been announced for any of the new models. They are expected go on sale between now and the autumn. Contact British Olivetti Ltd, PO Box 89, 86/88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.



The M-19 IBM PC compatible.



The Olivetti M-22 portable.



The M-28 PC/AT-compatible.



Amstrad adds RAM and second disc

AN UPGRADED version of the PCW-8256 machine has been introduced. Called the PCW-8512 it has an additional 256K of RAM and an extra disc drive. The new drive is double sided, and reads and writes at double density, providing a formatted capacity of 720K. Amstrad claims complete compatibility with existing PCW software.

A 512K version of the PCW has been on the cards ever since the first versions of the machine appeared with an empty row of RAM sockets. Similarly, Amstrad

has promised a dual-drive version of the machine to solve the problems of having to swap discs.

The PCW-8512 is priced at £499, just £100 more than the PCW-8256. Although Amstrad denies that the new model is a replacement, the pricing raises questions as to how long the PCW-8256 is likely to remain in production.

Further details from Amstrad Consumer Electronics, Brentwood House, 169 King's Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 228888.

OPD gets telex interface

THE ICL One Per Desk (OPD) can now be used as a telex terminal thanks to Telexbox 3 telex interface from Data Control and Equipment. The Telexbox 3 can be used with a modem. Alternatively it can be fitted directly to the printer port, where one OPD terminal can be used as a telex supervisor for the other members of the cluster.

ICL has been so impressed by the performance of the Telexbox 3 that it is now recommending it to telex users as a standard for telex communications for the OPD. DCE says that the Telexbox 3 should also be fully compatible with the British Telecom version of the OPD, the Tonto, though it is as yet untried with the BT machine.

The Telexbox 3 costs £1,450. Further details from Data Control Equipment, DCE House, Bessemer Crescent, Ralbands Lane, Aylesbury, Buckinghamshire HP19 3TM. Telephone: (0296) 32971.

New printer from Star

STAR MICRONICS is to replace its SG-10 and SG-10C printers with a new unit called the NB-15. This nine-pin dot-matrix printer is capable of 120cps in draft mode and 30cps at near letter quality.

Costing £278 for the parallel-interface version, or £318 with a serial interface, the NB-15 will have a number of cartridges available to enable it to interface to IBM, Apple and Commodore computers, as well as the usual Centronics and RS-232 ports. Further cartridges will become available to enable users to alter the fonts available.

For more information contact Star Micronics, Craven House, 40 Uxbridge Road, London W5 2BS. Telephone: 01-840 1800.

Epson LQ-1000

EPSON has now set the price of its letter quality dot-matrix printer, the LQ-1000, at £795. The printer is the 136-column version of the LQ-800 launched late last year.

The LQ-1000 is fitted with a newly designed 24-pin print head which enables it to print letter-quality characters and graphics. In draft mode the printer is capable of 180cps, while in letter-quality mode it runs at 60cps.

Another innovation on the LQ-1000 is a new cartridge which provides a wide range of fonts, including one for use with optical character readers. Epson claims that the cartridge is compatible with most common desk-top micros.

For details contact Epson U.K. Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892.



ATARI ADDS TO ST RANGE

TWO NEW versions of the Atari 520ST were launched at the Atari User Show held in March in London. The two new machines, the 520STM and the 1040STF represent an attempt to span a wider market than that currently covered by the standard 520ST.

The upmarket model, the 1040STF, is fitted with 1Mbyte of RAM and contains an integral 720K disc drive. It is available in two versions: with monochrome monitor priced at £799, or for £999 with a colour monitor.

The 520STM is a cut-down version of the standard 520ST. Retailing at £399, the computer is sold without a monitor and is

instead fitted with a UHF modulator to allow the computer to be connected to a standard TV set. The price of the 520STM does not include a disc drive either, even though the ST machines do not have a cassette port. A disc drive is therefore essential to enable you to load any software. Buying one separately will cost you £150.

Also available for the ST range is a CP/M emulator which will enable the computer to run CP/M software, although it will first have to be transferred to the Atari's 3.5in. disc format. Atari has also promised that the first deliveries of the long-awaited hard-disc drive will begin in May.

Xtech's Insider job

THE LATEST in the current rash of hard-disc upgrades for the IBM PC is the Insider from Xtech. Like many recent hard discs, this device has a capacity of 20Mbyte and can be installed by the user.

The Insider fits into one of the computer's free slots and takes its power directly from the host computer's power-supply

unit. Xtech claims that this arrangement, combined with a special aluminium chassis, will ensure reliability. The Insider is priced at £875.

Further details from Xtech, Court Farm Estate, Green Norton Road, Towcester, Northamptonshire NN12 8AN. Telephone: (0327) 53399.

HARDWARE SHORTS

● Ajwad has released a twin-drive IBM compatible. Prices start from £890. Details 01-788 1982.

● Victor has upgraded its VPC II PC compatible by replacing the 8088 with an 8086 processor and increasing the memory to 640K. It costs £899. Ring (0494) 450661.

● The NL-10 is a budget-priced printer from Datastar Systems. The NL-10 has cartridge interfaces to make it compatible with all makes of microcomputer. It is priced at £239, excluding the interface. Details on 01-482 1711.

● Image Buffer is a plug-in board which allows the Apple Imagewriter II to buffer up to 40 pages of text. Details from P&P on (0706) 217744.

● The Keytronic 3270/PC keyboard is designed for use with the company's Micro-to-Mainframe packages. It is plug compatible with the full IBM micro range. Details on (0420) 87500.

● The Facit D-2000 is an auto bi-directional daisywheel printer capable of operating at a speed of 24cps. The D-2000 is priced at £550. Details on (0634) 402080.

● Tallgrass now offers backup systems for the IBM PC range and Olivetti M-24 users. The TG-20251 fits into a full-height slot on the PC and contains a 25Mbyte hard disc and 20Mbyte tape storage unit. A similar unit, called the TG-14251 is available for the Olivetti M-24. Details on (0256) 460666.

● Rapid Terminals supplies the GLM-510, a stand-alone multiplexer for use with LANs fitted to micros or Gandalf PACX systems. For details contact (0494) 450111.

● Tandy has cut the price of the IBM-compatible 1000. Prices now range from £695 to £1,995. Details available on (0922) 648181.

● Pentagon Computers has developed a four-slot extender card for the Epson PC. Contact (0753) 32723.

● A telex facility has been introduced by Dateline Systems for use with IBM PCs. Details (04427) 74006.

● Gizmo from ICCT is a device which allows the PC/AT to access 2Mbyte of memory. For details phone 01-248 8895.



Thorn EMI goes for data comms

THORN-EMI DATAPHONE has entered the field of cellular radio data communications with the introduction of the Mobile Office system. The concept of the system is to combine the features of laptop word processors like the Liberator with the integrated communications facilities of ICL's One Per Desk.

The Mobile Office has been launched with two separate packa-

ges. The Textlite PX-1000 is a pocket-sized text processor with a fold-up single-line LCD screen and typewriter keyboard. Once the text has been completed it can be stored on a cassette machine or printed on a 40-column thermal printer supplied with the machine.

The other package in the Mobile Office range is the PM Magnum. Manufactured in Australia by Portable Micros, the Magnum is a

personal computer which Thorn-EMI claims is fully IBM compatible. The computer is fitted with a fold-up LCD screen and a full-sized typewriter keyboard. It has no integral disc drive; MS-DOS and applications software are held on cartridge.

Contact Thorn EMI Dataphone, Apex House, Twickenham Road, Feltham, Middlesex TW13 6JQ. Telephone: 01-894 5644.

Superkey: the secret is out

BORLAND SUPERKEY has officially arrived in the U.K. at last. The £69.95 IBM utility combines two main functions: it lets you set up keyboard macros and it allows you to encrypt data files. According to Superkey's U.K. distributor, Altor, it is the latter function which has caused the hold-up. Apparently the U.S. government took some time deciding whether inhabitants of the U.K. could be entrusted with a full Data Encryption Standard product before issuing an export licence.

Superkey runs on the IBM PC, PC/XT, PC/AT and compatibles. It is a RAM-resident utility, so you can use it alongside other applications. For instance, you could set up Lotus commands as single keystrokes or create a glossary of terms for use in your normal WP. Superkey also offers other security features, such as quick keyboard locking and screen blanking.

For further details contact Altor Computers, 11A Anderston Centre, Glasgow G2 7PH. Telephone: 041-226 4211.

Laser printing improved

PRINTWORKS for Lasers is designed to help you get the most from your existing software when using a laser printer. Running on the IBM PC, the £67.15 utility is memory-resident, so you can use it at the same time as an application program such as Lotus 1-2-3 or WordStar.

It lets you select type size, weight, pitch and spacing, and choose between fonts. It will also print graphics, and lets you merge text with graphics.

Printworks for Lasers works with the Hewlett-Packard Laserjet and Canon LBP printers, and other compatible laser printers.

Applications do not have to be specially configured for use with a laser printer; Printworks can work with anything designed for conventional matrix printers like the Epson MX-80 or IBM Graphics printers.

For further details contact First Software, Intec 1, Basingstoke, Hampshire RG23 0NE. Telephone: (0256) 463344.

Q&A TAKES COMMAND THE NATURAL WAY

PRODUCTS claiming to respond to natural English-like commands are usually a disappointment but Q&A looks like being the first real exception.

Q&A is a database and word-processing package aimed at people who need to manage a collection of records, make on-line queries and produce reports. It costs £250 and runs on IBM PCs and compatibles with at least 512K of memory.

You can use Q&A in a conventional way, controlling everything through a set of menus; its menu structure is said to be similar to that of the PFS and IBM

Assistant series. The distinctive feature of the package is its natural-language interface, called Intelligent Assistant.

Intelligent Assistant does not restrict you to a formal and precise set of commands. Instead you can train Q&A to recognise the terms which make most sense to you. You can type in ad hoc commands like "Find me all the companies that make dustbin lids and list them by area." Q&A comes with a built-in vocabulary of 450 words and you can teach it other words as you go along.

Q&A has been on sale in the U.S. since September 1985, but is

only becoming available in the U.K. now. It has attracted favourable comment in the U.S. press, not only because the natural-language interface appears to work, but also because the WP and database applications are in themselves quite powerful.

Other useful features of the package are the ability to import data from Lotus 1-2-3 and dBase III, and its easy installation — it is not copy protected.

Details from Paradigm, Southampton House, 192-206 York Road, London SW11 3SA. Telephone: 01-228 5008 or (0800) 289 202.

Faster Multiplan is Lotus compatible

MICROSOFT has released a new version of Multiplan which can read Lotus 1-2-3 files and cope with larger worksheets. It costs £245 and will run on most IBM-compatible and MS-DOS machines. Multiplan 2.0 is going on sale at once. Existing Multiplan users will be able to upgrade for £50.

Multiplan came on the market over three years ago, and rapidly established itself as one of the classic business-spreadsheet packages. The new version is designed to keep it competitive with more modern products. Among the new features are keyboard macros, improved consolidation of data between worksheets and the ability to use the

package with an optional mouse or maths co-processor chip.

Multiplan still lacks built-in graphics, but you can now transfer a worksheet directly to Chart, Microsoft's business-graphics package. You can set up a link between the two applications so that your charts change automatically when you alter data in the spreadsheet.

Multiplan can now read and write complete Lotus 1-2-3 models, including values and formulae, according to Microsoft. It will also work with Syk format packages such as Microsoft Project and Word.

Microsoft is continuing with plans to release its high-performance Macintosh spreadsheet,



Excel, for the IBM PC. Excel will be targeted upmarket at heavy users of spreadsheets, with Multiplan positioned below it as a cheaper product aimed at the general business user. Multiplan is the less memory-hungry product; it only requires 128K to run and one double-sided disc drive. It will also run on a broader range of machines.

For further information contact Microsoft Ltd, Excel House, 49 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741.

Hard-disc security

CLAM is designed to make personal computers, especially hard-disc systems, more secure. The £98 software utility for the IBM PC, PC/XT and PC/AT and compatibles replaces the usual MS-DOS prompts with a set of menus. Users log on with a password and can then see the menu options for the tasks and applications for which they have authority.

Security is a problem with hard-disc systems because they can store a great deal of information but the hard disc is more difficult to remove physically and lock away than floppy discs.

Once Clam is installed you can

only use the system by going through the Clam menus. Users who are authorised to use DOS can still be locked out of particular sub-directories on the hard disc by Clam.

Clam discs are not copy protected, but have an individual serial number on them which forms part of the security mechanism. A networked version of Clam is promised for later in the year.

More details from Microft Technology Ltd, The Old Powerhouse, Kew Gardens Station, Kew, Surrey TW9 3PS. Telephone: 01-948 8255.

Moneywise is back

ONE well-regarded program laid low by financial trouble is back on the market. Called Moneywise, it is more orientated to modelling and producing printed reports than a conventional spreadsheet.

Moneywise will be marketed and distributed by a new company, Moneywise Ltd. The package costs £395 and it is available for the IBM PC, PC/XT and compatibles, and MS-DOS machines such as the Apricot.

Contact Moneywise Ltd, 699 London Road, North Cheam, Surrey SM3 9DL. Telephone: 01-337 0663.

Foreign-language WP

VUWRITER Language Master helps you to write letters or produce documentation in foreign languages. It is a specialised word-processing package designed to handle the unusual character sets found in many foreign languages.

Language Master support all the major European languages, including Greek and those which use the Cyrillic alphabet. It does not handle languages which are written from right to left. Running on the IBM PC or compatibles, it comes in two versions, depending on the sort of printer you intend to use. Language Master for matrix printers costs £295, while the laser-printer version costs £595.

Details from Vuman Computer Systems Ltd, Enterprise House, Manchester Science Park, Lloyd Street North, Manchester ME14 4EN. Telephone: 061-226 8311.

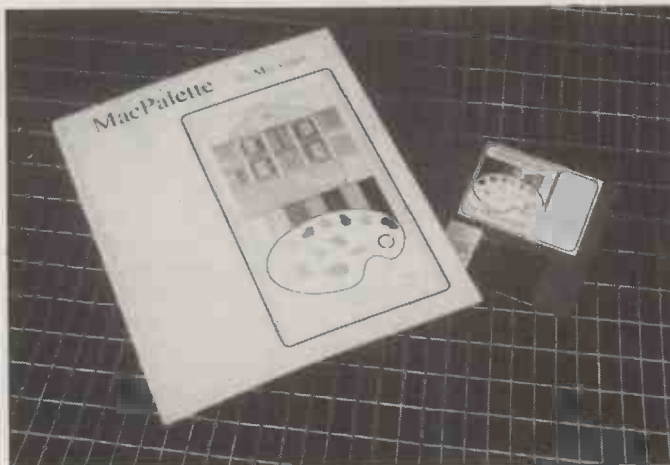
Paradox freed from copy protection

ANSA SOFTWARE has joined the growing number of companies removing copy protection from their products. The new 1.1 version of Paradox, the powerful database-management package reviewed in this and last month's issues is no longer copy protected. This will allow you to install Paradox more easily on hard-disc systems, and let you take backup copies of the program.

Paradox also comes with a separate run-time system. This is a cut-down version of the full Paradox system which lets you run applications written in Paradox, but not create or alter them. Run-time is aimed at encouraging the growth of a dBase III style market in third-party applications written in Paradox.

The price is £550. Existing users can upgrade to the new version at no extra charge.

Contact P&P Micro Distributors Ltd, 1 Gleneagle Road, London SW16 6AY. Telephone: 01-677 7631. Softsel Computer Products Ltd, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD. Telephone: 01-568 8866.



Colour printouts of Mac graphics

TWO PACKAGES are now available to let you get coloured pictures out of a Macintosh equipped with an Imagewriter II printer. Both work with existing software.

Macpalette works with programs that use object-orientated graphics, such as Macdraw, Jazz, Excel and Macproject. You assign colours or coloured patterns to replace the original monochrome lines, text or patterns.

Colormate also works with Macpaint format images — in fact anything you can transfer to the clipboard. With a Macpaint image you set up filters to select

particular grey tones within the picture, which you can then replace with any selected colour pattern.

Macpalette costs £49 and is available from P&P. Colormate costs £41.40 from First Software. You can also get Colormate Art, a library of over 100 pre-coloured images for use with Colormate, for £41.85.

Contact P&P Micro Distributors Ltd, 1 Gleneagle Road London SW16 6AY. Telephone: 01-677 7631. First Software, Intec 1, Basingstoke, Hampshire RG23 0NE. Telephone: (0256) 463344.

Improved Multimate

ASHTON-TATE, which now owns Multimate, has released a new version of the Multimate Advantage word processor.

Multimate Advantage 3.60 has a 40,000-word thesaurus and can read and write documents in IBM's DCA format. It can handle newspaper-style columns where text flows from the bottom of one column to the top of the next. In addition to its existing 110,000-word built-in anglicised

spelling checker, Advantage has two specialised dictionaries of medical and legal terms.

Ashton-Tate acquired Multimate at the end of 1985. The new release confirms Ashton-Tate's statements that it will continue to develop the Multimate product line.

Contact Ashton-Tate (U.K.) Ltd, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123.

Autopoll

AUTOPOLL lets you automatically transfer files down the phone system between two or more computers at a predetermined time. You need an autodial modem on at least one system and auto-answer on the others.

The Autopoll software costs £250 for a set of discs for three systems. Details from Format PC Ltd, Goods Wharf, Goods Road, Belper, Derbyshire DE5 1UU. Telephone: (0773) 820011.



SOFTWARE SHORTS

● Microsoft Word is available in a networked version for the Apricot Xen. It is bundled with email and other software in an office automation package which costs £1,499 for five users. Details on (0734) 500741.

● Scratchpad Plus is a spreadsheet for the Amstrad PCW-8256 and CPC-6128 machines. Claimed advantages are large worksheet size and multiple windows. Price is £69.99 including VAT. Contact Caxton Software Ltd on 01-379 6502.


● PC Paint Plus is the new version of the popular PC Paint drawing package for the IBM PC and compatibles. You can use it to enhance graphs or data taken from popular application packages such as Lotus 1-2-3, dBase or WordStar. PC Paint costs £99; with a mouse and extra software it costs £186. Contact Data Design Techniques Ltd on (0291) 423781.

● Apricot Computers is bundling Gem across its range of computer systems. So all Apricot machines will have Digital Research's Mac-like front end to MS-DOS, and will be able to run applications written specifically for Gem. Apricot is also bundling Microsoft's rival product Windows on its top-end multi-user Xen system. Details on 021-454 9091.

● Ashton-Tate has announced record financial results. The company which boasts dBase III, Framework and Multimate in its product portfolio, reported revenues of \$121.6 million for the year ended 31 January 1986.

Speedy Microcache

MICROCACHE speeds up the IBM PC and XT as well as MS-DOS machines such as the Apricot, by providing automatic disc caching, print spooling and a RAM disc. The latest version allows you to use up to 4Mbyte of RAM on an IBM PC. Microcache costs £195.

Contact Microcosm Research Ltd, 26 Danbury Street, London N1 8JU. Tel: 01-226 9092. 

Apple in the High Street

APPLE COMPUTER has staked a place in the High Street with the opening of the first two Apple Centres in Knightsbridge and Swiss Cottage in London. These two centres are intended to be the first of 50 which Apple intends to open throughout the country over the next two years.

Jointly owned by Apple and its dealers, the Apple Centres will provide training and consultancy for customers. Naturally they will also supply Apple products. Apple claims that the centres will provide a 24-hour customer-support service and hold a supply of commonly needed spare parts.

Atari Show at Novotel

THE FIRST Atari User Show, was held at the Novotel Hotel in London on 7 to 9 March. Sam Tramiel, the President of Atari and son of Chairman Jack, was present to launch two new machines in the ST range, the 1Mbyte 1040STF and the 520STM budget computer. Full details of these machines are reported on page 13 of this issue.

Tramiel also revealed that the company became profitable in 1985 and that it requires no further loans from the banks. Atari was firmly established in the U.S., Canada, U.K., France, Germany and the Benelux countries, he said. Following changes in the exchange rate Atari is now planning to make an assault on the Japanese market.

Turning to the future he announced emulator packages for the ST range which will enable these machines to run CP/M and IBM software.

Atari demonstrated a prototype model of the IBM emulator at the show. The concept is similar to that of the Mac Charlie package for the Macintosh. An 8088 processor, the BIOS ROM and 512K of RAM are housed in a separate box that connects to the ST.

Tramiel then revealed another surprise. Atari has noted the success of the Amstrad PCW-8256 and is planning to launch a similar all-in system this summer. Finally, the assembled company was told that Atari is working on a Unix machine to provide an upgrade path from the STs.

IRS CHOOSES ZENITH Z-171

ZENITH DATA SYSTEMS, the manufacturer of IBM PC compatibles, has landed two valuable U.S. government contracts. The first is an order to supply portable micros to the U.S. Internal Revenue Service. The contract to supply 15,000 briefcase sized Z-171s is worth an estimated \$30 million. The order was won in the face of fierce competition from IBM, which was widely rumoured to have brought forward production of its own lap portable in order to win the contract.

The Z-171 has an 80-by-25 back-lit LCD screen and a full-size

fold-down typewriter keyboard. The model sold to the IRS will have twin 5.25in. disc drives and is fully IBM compatible. A built-in modem will enable the auditors to communicate directly with IRS central computers.

A separate contract to supply PC/AT compatibles to the U.S. Department of Defense is claimed by Zenith to be the biggest ever awarded by the U.S. government. Zenith is expecting to supply around 90,000 of the computers, known as the Z-200, over the next three years. The estimated value of the contract is \$240 million.



The Z-200 PC/AT compatible won Zenith a \$240 million contract.

Data Protection Register available

ANYONE who wants to discover who has got data hidden away on a computer about them can now examine the Data Protection Register. At present the register is only available at the Office of the Data Protection Registrar in Wilmslow, Cheshire. The intention is that eventually the register will be available at all main public libraries.

The Data Protection Registrar has reported that of the 150,000 registration packs that have been

distributed, only 10,000 have so far been returned. As the final date for registration is 11 May, it looks as though a large number of users will be in breach of the law. Anne Staines discusses this and related matters on page 85 of this issue.

For further information contact the Office of the Data Protection Registrar, Springfield House, Water Lane, Wilmslow, Cheshire SK9 5AX. Telephone: (0625) 535777.

No more inky fingers?

A NEW DEVICE from U.S.-based company Fingermatrix Inc. is claimed to abolish the time-honoured practice of taking fingerprints with ink and rollers. The Z Card can scan fingerprints and reproduce a perfect copy of the print within seconds, eliminating both inky fingers and the possibility of smudged or distorted prints.

Fingermatrix produces a security device based around the same technology. The Ridge Reader scans a person's fingerprint and compares it with a file held in memory. Thus the device can be used to restrict access to sensitive areas by restricting entry to authorised personnel, identified by their fingerprints.

SHORTS

- Buyers of the Hayes Smartmodem 1200 or Smartcom II software can now obtain a free Telecom Gold mailbox. The modems can only be obtained from authorised Hayes dealers. Details on 01-847 4471.

- The British Standards Institution has issued three new documents outlining the standards for OSI/LAN. Aimed at developers the Drafts for Development are DD99 part 2, and DD136 parts 1 and 2. Phone 01-629 9000.

- A+G Computerware has introduced 8088- and 8086-compatible chips which the company claims will increase processing speed by 70 percent on clock speeds of 5MHz or less. For details contact 061-428 2014.


- The Department of Trade and Industry has earmarked a million pounds with the aim of providing every secondary and middle school in the country with a modem. The models endorsed by the scheme are the Tandata 512 and the Dacom DSL-2123AD.

- Hermann Hauser, a director of Acorn Computers and a major shareholder prior to the company's takeover by Olivetti last year, has been made director of Advanced Research and Development in the Olivetti group.

- The British Technology Group has a low-cost speech-recognition module available for OEM evaluation. For details phone 01-403 6666.

Mac users gang up

USERS of the Apple Macintosh are now able to join the independent Mac User Group. For an annual subscription of £25 the group hopes to be able to offer a regular newsletter, public-domain software and discounts on hardware and software. The group also hopes to be able to cater for special interests, such as home use, business and education.

As an added incentive, the first 500 members will receive a free disc of public-domain software. Further details from the Mac User Group U.K., 55 Linkside Avenue, Oxford OX2 8JE. Telephone: (0865) 58027. 

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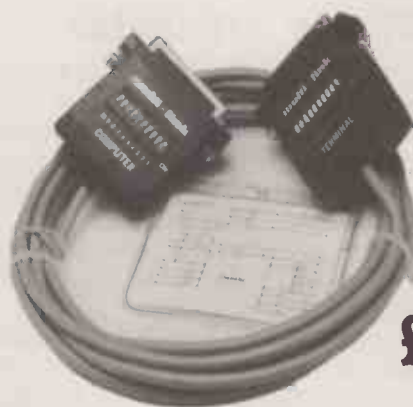
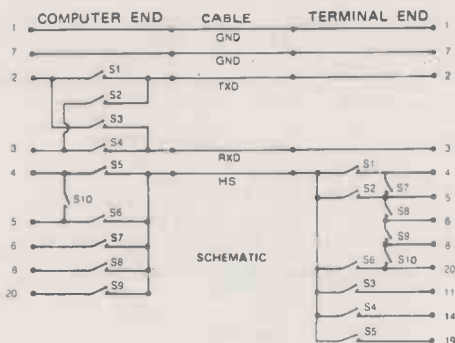
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BY MIKE LEWIS

HOW TO KEEP A SECRET

A simple program to encode and decode your confidential files;

programmer to know how to use it.

One safeguard is provided by the fact that in many applications data is stored as a series of binary fields. For example, in a payroll the salary, tax and overtime details might well be held on file in a variety of numeric formats, including integers, binary-coded decimal, floating-point and even bit strings. Typing this sort of file usually produces a meaningless screen display.

Even to decipher a hex dump, the would-be eavesdropper has to know which bytes are used for which fields and needs fairly precise information about the numeric formats that have been used. Knowing that an amount is held in floating-point does not necessarily help to determine what the amount is. Is it single- or double-precision? Is it the standard IEEE variety of floating-point, the widely used Microsoft format, or perhaps even the 48-bit format favoured by certain other languages?

But if binary data files are safe from the casual viewer, text files are not. After all, ASCII text can be read from the screen as easily as from the printed page. It is not only word-processed documents that are vulnerable in this way. A database program might record, say, the names of non-credit-worthy customers in ASCII, even though other fields in the database might be stored differently. If you were to Type a dBase II file the chances are that you would recognise most of the data.

Fortunately, there are many well-established techniques for keeping information secret. In fact, the development of cryptography — the study of codes and ciphers — is closely connected with

(continued on next page)

VIGENERE ENCRYPTION PROGRAM

```

program crypt;
  (Program to demonstrate the Vigenere method of encrypting a file,
  using exclusive or. The same program will both encrypt and decrypt.
  It takes two parameters: the filename and the key (or password).

  This version is in Turbo Pascal ver. 3 under MS-DOS. To implement
  under CP/M, you must use untyped files with block reads and writes,
  otherwise Turbo will interpret the first four bytes to be the record
  size and number of records. In earlier versions of Turbo Pascal, the
  paracount and parastr functions are not available, so get the user
  to enter the filename and passwords into the program.)

var
  infilename, workfilename: string[14];
  password: string[9];           (password after making it exactly 9 chars)
  keytable: array[1..8] of integer; (password converted to 8 integers)
  infile, workfile: file of integer; (input and work files)
  current, j: integer;

begin
  (sign on and check parameters)
  writeln('FILE ENCRYPTION/DECRYPT(ON)'); writeln;
  if paracount < 2 then
    begin
      writeln('To encrypt or decrypt a file, type:');
      writeln('  crypt ffff pppp');
      writeln('where ffff is the filename and');
      writeln('pppp is a password of 4 to 9 characters');
      halt;
    end;

  if (length(parastr(2)) < 4) or (length(parastr(2)) > 9) then
    begin
      writeln('The password must be between 4 and 9 characters');
      halt;
    end;

  (open input file)
  infilename := parastr(1);
  assign(infile, infilename);
  ($[- switch on error handling)
  reset(infile);
  ($!+ make error handling automatic again)
  if not (ioresult = 0) then
    begin
      writeln('Cannot find ', infilename);
      halt;
    end;

  (form work file name and open file for output)
  j := pos('.', infilename);
  if j = 0 then
    workfilename := infilename + '.*'
  else
    workfilename := copy(infilename, 1, j) + '.*';
  assign(workfile, workfilename);
  rewrite(workfile);

  (build the key table; this is done by converting successive pairs
  of chars. in the password to integers, then multiplying by 1,2,..,8;
  other methods are possible)

  password := copy(parastr(2) + parastr(2) + parastr(2), 1, 9);
                (make password exactly 9 characters)
  for j := 1 to 8 do
    keytable[j] := (ord(password[j]) * 256 + ord(password[j+1])) * j mod maxint;

  (now xor the input file with successive entries in the key table, writing
  the results to the work file)

  writeln('In progress');
  j := 0;           (this is a pointer for the key table)
  repeat
    read(infile, current);
    current := current xor keytable[j+1];
    write(workfile, current);
    j := (j+1) mod 8;
  until eof(infile);

  (close files, delete the input file and rename the work file, and sign off)
  close(infile); close(workfile);
  erase(infile);
  rename(workfile, infilename);
  writeln('Finished');

end.

```

Privacy is an issue that concerns many micro users. As computer applications expand, so more confidential information is finding its way into disc files. As long as these files are held on removable media like floppy discs they can be locked away from prying eyes as easily as

their paper counterparts. But the moment you start using fixed discs or networks more sophisticated security procedures must be brought into use.

Few off-the-shelf products offer much help. With application packages such as accounting systems, any security devices are

usually aimed at preventing access to the software rather than to the data. Essential as these are, they cannot stop an intruder from viewing a file from outside the package. After all, virtually every micro has the equivalent of the CP/M or MS-DOS Type command and you do not have to be an expert

(continued from previous page)
that of computers and programming. The first electronic computers were used chiefly as dedicated code-breaking machines during the Second World War.

However, secret codes have been in use a lot longer than that. The Romans used the earliest known cryptosystem and their technique could not have been simpler. It involved adding some pre-agreed integer to the ordinal value of every character in the text. Assuming that the character set in use consists of the 26 capital letters followed by a space, the word:

PRACTICAL COMPUTING

when coded with a key of 10, would become:

ZALMCSMLVJYWZDCSXQ

The Romans must have relied on a singular lack of numerical and logical skills among their enemies, because you can crack this code just by trying each of the 27 possible key values in turn.

A tougher code to break is one that uses an arbitrary look-up value for each of the characters in the set. Thus L might be substituted for A, X for B, F for C, and so on. Although there is no easy mechanical method of breaking this type of cipher, it will present few problems to anyone with a knowledge of letter frequencies and

word formation. Codes of this kind often appear as entertaining puzzles in magazines.

STRING KEY

The next step up in complexity is a code called the Vigenere cipher. This is like the Roman system except that instead of adding a single integer to each letter you use a small string of integers. The string is obtained from the ordinal values of the characters in a key word or phrase, applied repeatedly.

For example, if the key word was "ACE", you would have:

PRACTICAL COMPUTING

plus

ACEACEACEACEACEACE

gives

QUFDWNDDQAFNTSZULSH

With this code, the degree of security is in direct proportion to the length of the key. An extreme case would be to use a key which is as long as the text to be encoded. This is the principle of a system called the Vernam cipher, also known as the one-time pad, which is used in certain military and banking applications. Although it offers exceptionally good security, it is not practical for anything other than very short messages.

Of course any cryptosystem is only as good as the method that is

used for transmitting the key. Consequently, most recent research has concentrated on systems which use public keys. The idea is that a public key is available for encoding the text, but only a private key can be used to decode it. The public key can easily be derived from the private key, but not vice versa. So there is no need to keep the public key secret, and the person sending the message does not need to know the recipient's private key.

If keeping your files safe from prying eyes is a problem that concerns you, the program shown on the previous page might help. I offer it without guarantees; its intention is merely to demonstrate a technique. If you must use it for your vital data, make sure that you have tested it to your own satisfaction first.


The program uses the Vigenere method, but with one important difference. Instead of the key and the plain text being added together, they are combined by means of an Exclusive Or operation. The Exclusive Or, or XOR, is a logical operator that produces 0 from two bits that are the same or 1 from two that are different. The point is that it is reversible: if A XOR B is C, then A XOR C is B. This means that the

same program can be used for both encoding and decoding, as long as an identical key is provided each time.

The user specifies the key and the name of the file as a command-line parameter. Although the key, or password, is entered as a character string, the program converts it to an array of eight integers. The method used for this conversion is fairly arbitrary. Its aim is to produce eight integers — 16 bytes — that are as different from each other as possible.

LANGUAGES

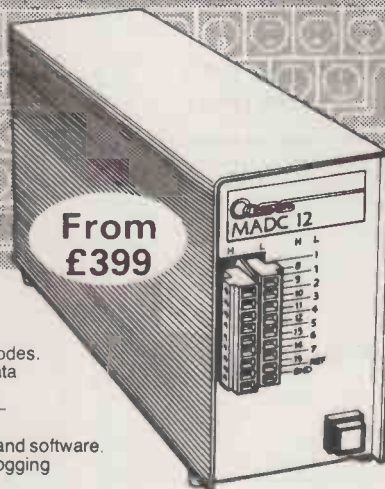
I used Turbo Pascal for this example because it provides easy access to the DOS command line. If you prefer Basic, Microsoft's Quick Basic compiler offers the same facility, as do most common versions of C. All the popular high-level languages support the XOR operator.

The program will not keep out the determined code breaker. If unauthorised access really worries you, buy a commercial encrypting program. Finally, whatever solution you adopt, do not leave the program itself on your hard disc. A malicious employee can wreak enormous havoc by encoding all your important data and then forgetting the password. 

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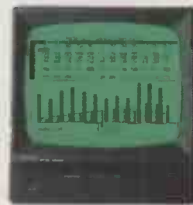
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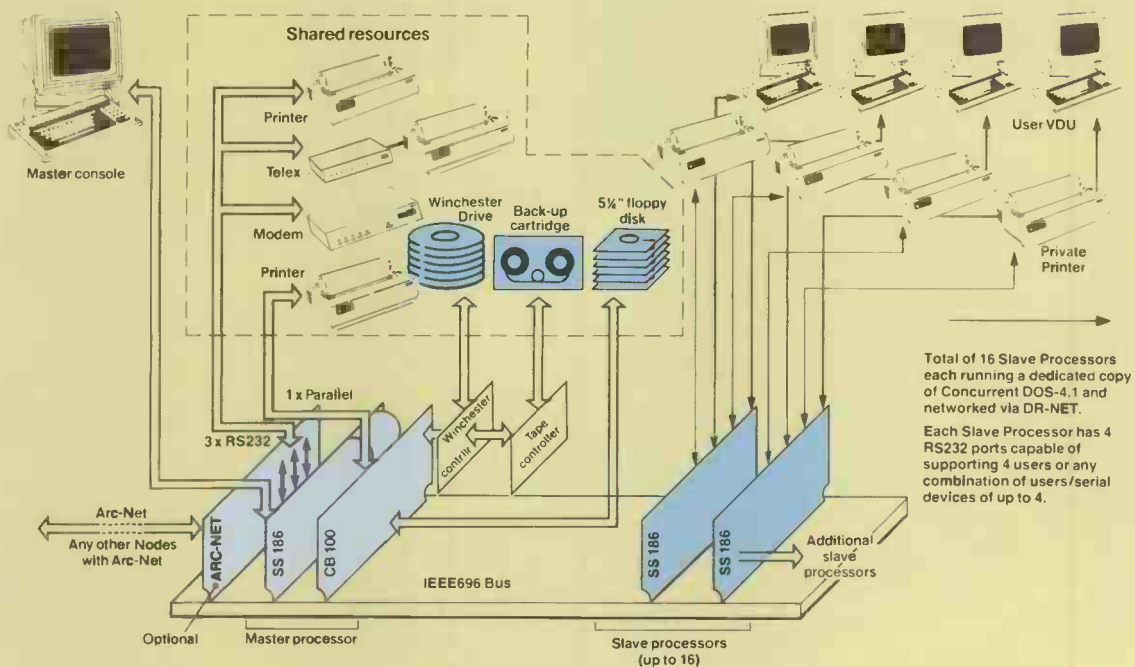
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SECOND CHANCE

Unlike fusible link devices, If the EP-600 does not do what you expect when you first program it, you can erase all the links using ultraviolet light, correct your mistakes and start all over again.

To help you avoid mistakes in the first place, Altera offers the A-Plus development software package. It runs on the IBM PC and allows designs to be entered as a circuit schematic or as logic equations. Once the design is entered, the Altera PLDS-2 development system linked to your PC can program a device in minutes.

The EP-600 family comes in small 24-pin so-called skinny-DIP packages, runs off 5V supplies, and can operate at clock rates of up to 40MHz. If the EP-600 is not big enough for you, there is also an EP-1200 family. To give the final seal of approval, Intel is second-sourcing the whole range. 

Logic gates are the raw material from which microprocessors and most of their associated support circuitry are made. In theory at least, no matter how complicated the device, it could all be implemented by wiring together large numbers of simple two-input inverting logic gates using the Nand or Nor format.

Since standard two-input gates are normally supplied four at a time in a 16-pin DIL package, and the latest microprocessors need a total of 50,000 or so, the resulting circuit board for a homebrew 68020 emulation would cause quite a stir with the neighbours. Moreover, if bipolar TTL logic were to be used, this laboriously assembled monster would have a dramatic impact on the quarterly electricity bill.

Most disappointing of all would be the level of performance. The several kilometres of inter-connecting wire needed, and the cumbersome use of multiple two-input gates to emulate shift registers, RAM arrays and ROMs, would conspire to slow things down to such an extent that the Motorola share price would hardly waver.

Standard products like microprocessors and memory chips are usually designed at the individual transistor level, one step down from gates. The creation of a perfect memory cell design can be the life's work of some chip designers, and they tinker with the size, type and orientation of individual transistors until they have combined the maximum possible performance with the minimum possible chip area. Not for them the wasteful simplicity of two-input gate Lego bricks.

FULL CUSTOM

If you are rich enough, you too can have a chip designed for you in this way. The process is called "full-custom"; it costs an arm and a leg, and you usually need to order several thousand parts of the same type for the economics to work. This approach does offer the highest-performance solution, but for the average equipment designer it remains just as impracticable as the use of a room full of quad two-input gate packages.

The microprocessor itself can be used to bridge the gap. Although we tend to think of these devices as number crunchers or text processors, they can also be used to implement any sequential logic function under the control of a suitable program. In fact, more microprocessors spend their working lives performing in this role than are ever used in personal computers.

It is tempting to think that in the microprocessor you now have the complete answer to all your logic design problems. After all, a black box with N inputs and N outputs containing a microprocessor and memory can implement any operation you care to dream up, provided that you can create an appropriate program.

Unfortunately, there is a flaw, since the sequential nature of the microprocessor can make it much too slow for some tasks. Even when the task is so simple that a microprocessor can perform fast enough, the overhead of RAM, ROM, I/O chips and a crystal does make it seem a sledgehammer solution.

ULA

Semiconductor manufacturers have been aware for some time of this gap in the market between full-custom chip designs and the stored program microprocessor, and they have done their best to fill it with a variety of semi-custom solutions. In this they have achieved varying degrees of success. One of the first firms to spot the need was the British Ferranti company back in the mid-seventies. Ferranti introduced an innovative device called an uncommitted logic array (ULA), which consisted of a standard array of simple gates that could be wired up using a final layer of metallisation to produce a custom logic circuit.

The great advantage of this approach is that 90 percent of the chip fabrication can be identical for all applications, only the final metal layer being specific to each customer. As a result, design and manufacture is quicker and cheaper than can be achieved with a full-custom layout, and it became economically viable to produce specials in hundreds rather than in thousands.

Ferranti did very well with this technology for a number of years, but it has now been eclipsed by bigger and better gate arrays from competitors in the U.S.A. and Japan. Today the leading gate-array technology uses 1.5 micron CMOS and two layers of metal interconnection to provide custom circuits with up to 20,000 gates — enough to build a simple microprocessor.

The market for gate arrays, or application-specific integrated circuits (ASICs) as they are now often called, is growing rapidly with more and more engineers being attracted by their benefits. Computer Aided Engineering (CAE) work stations, often based on IBM or compatible PCs, are also helping to provide individual

engineers with the capability to create and simulate gate-array designs on their own desks without the need for prototype breadboards. A major use for complex gate arrays like these is in providing the glue logic which handles the interface and control function in microprocessor-based systems. Most inexpensive microcomputers rely on the use of such devices to keep costs to a minimum.

All this is fine, but it still cannot help the engineer who wants to produce small numbers of systems, who does not have access to a CAE work station, and who cannot afford to wait six weeks or more for a completed gate-array design. Fortunately help is on the way.

An analysis of logic designs shows that there are certain configurations of gates which are used repeatedly, with only the detailed interconnections differing from job to job. Taking advantage of this common structure, semiconductor manufacturers have produced simple field programmable logic arrays (FPLAs), also called PLAs and PALs, which provide a generalisation of the common configuration.

SIZE RESTRICTED

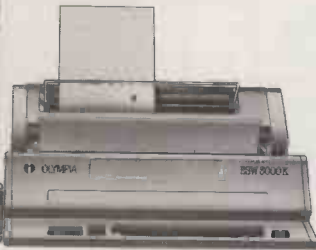
To use these devices designers have merely to decide which inputs and outputs should be connected to which gates. Then they program these interconnections using a simple unit similar to a PROM programmer to blow tiny fuse links incorporated on the surface of the chip during fabrication. The resulting devices, individually tailored on the designer's own bench, can replace many discrete logic chips. But, unfortunately, the limitations of the bipolar fusible link technology have placed restrictions on the size and use of these arrays.

Now new versions of these programmable chips are becoming available. For the first time it appears that the gap between standard logic and full-custom has been completely plugged. For a start, most of the new devices use high-speed CMOS rather than power-hungry bipolar technology. Better still, devices are available which are erasable and re-programmable, and the number of equivalent gates is increasing to the point where they overlap the lower end of the metallisation-programmed families.

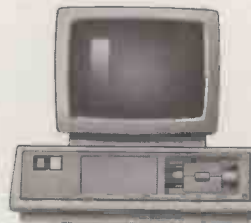
Typical of the new erasable programmable logic devices (EPLDs) is the EP-600 from the Altera Corporation, based in Santa Clara California. The EP-600 contains the equivalent of more than 600 gates, and has a particularly



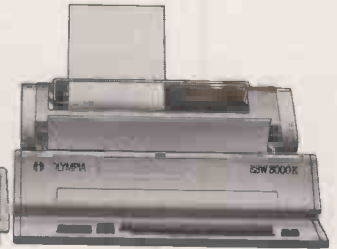
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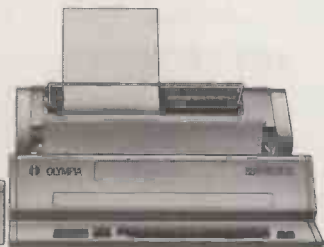


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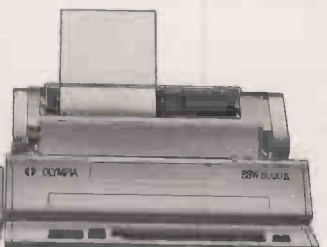
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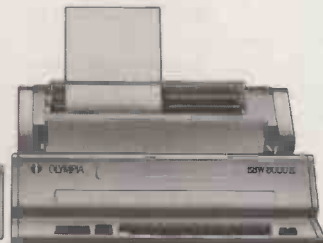
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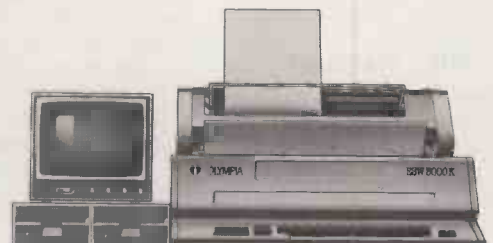
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For those people yearning to use U.S. information services such as Compuserve and The Source but deterred by the high charges, it is worth taking a look at Microlink.

Microlink is an extension to Telecom Gold, the electronic mail system owned by British Telecom. It is run by Database Publications. As well as offering all the usual mail facilities of Telecom Gold, Microlink provides a number of additional services.

Logging on to your Microlink mailbox is carried out in exactly the same way as you log on to a normal Telecom Gold mailbox. After a short welcome message, which gives details of any new services or updates to the existing ones, you are presented with the familiar Gold prompt >. Here you may type in any of the usual Gold commands such as Mail, IDB, etc., or enter MM to get the Microlink main menu which comprises the entries detailed below.

Another feature which is currently under development is a CB-style conferencing system, where Microlink members will be able to chat to many users in real-time. Further details of this are available by typing Confer at the > prompt.

Microlink is quick and fairly straightforward to use. Unfortunately, the user guide supplied when you first join is not very clear. The system provides many useful features for business and home users alike, turning a somewhat mundane mailing service into the nucleus of a proper information utility.

Charges for Microlink are as follows: £5 for initial registration, then a standing charge of £3 per month. On-line charges are the same as Telecom Gold: 3.5 pence per minute between 7 p.m. and 8 a.m. and 11 pence per minute during office hours. If you access the system through PSS, there is an extra charge of 2.5 pence per minute.

MAIN MENU

BB — Microboard Enters Telecom Gold's interactive bulletin board, Noticebd. Notices may be posted or read under a variety of headings such as Chatter, Comms, Lap-holds, For Sale and Wanted.
BR — British Rail Provides access to train timetables for trains between London and 20 other major British cities. users with credit cards may also book rail tickets and make seat reservations.
EE — Electronic mail Same as Telecom Gold's Mail command.

MICROLINK LOG-ON SEQUENCE

```
Welcome to Telecom Gold's System 72
Please Sign On
>ID MAG95279
Password:
```

```
TELECOM GOLD Automated Office Services 18 4R(72)
On At 22:24 02/03/86 GMT
Last On At 18:46 02/03/86 GMT
```

```
Mail call (4 Read, 1 Unread)
```

```
*****
```

```
MicroLink
```

```
*****
```

```
(c) Database Publications
```

```
Welcome! You are
now connected to the
MicroLink mainframe
at TELECOM GOLD
```

```
Type MM for the Microlink Menu HELPLINE - 061 456 8836
```

```
Make Mother's Day a day to remember...
send her flowers via your micro: Key FL
```

```
See our new 'NewsBytes' feature: Key NB
```

```
Many extra sections for MemoPad: Key PP
```

EG — Exhibition guide Lists dates, locations and contact addresses for all major computer and computer-related shows.

FL — Floralink If you have a credit card, you can use this service to order flowers and have them delivered to any address in Britain by Interflora. Soon it will be possible to have flowers delivered in other countries.

GG — Telecom Gold Passes you back to the Gold system.

LL — Bulletin board list Displays a regularly updated list of all the bulletin board systems currently operating in the U.K.

MM — Microlink menu Displays the main menu.

NB — Newsbytes A weekly rundown of the current computer news written by Steve Gold and based on his U.K. news column which appears on The Source.

NL — Newsletter Details of the latest additions and improvements to the Microlink service.

NN — Micro news A regularly updated database of computer news. Stories are kept on-line for up to a month.

OL — Orderlink If you use the Microsearch database —

see **SS** — to look up computer hardware and software, you can order featured products through Orderlink.

PP — Memopad Microlink's own version of Telecom Gold's interactive bulletin board, Noticebd. Subjects covered are predominantly biased towards micros.

SS — Microsearch Computer product locator database. Provides descriptions, prices and source details of computer hardware and software.

Keyword searching is provided so you can locate a particular product as quickly as possible.

TL — Theatrelink Provides an up-to-date guide to the London theatre scene and allows you to book tickets at the same time.

TM — Telemesssage Telemesssages are the replacement of the old telegram. Using this option on Microlink, you can send messages anywhere in the U.K. or to the U.S. If you use the First Class option which is only available for U.K. letters, delivery is guaranteed for the next day as long as you send the messages before 8p.m.

TT — Telex Accesses the standard telex system interface provided by Telecom Gold.



BY BEN KNOX

MICROLINK

Telecom Gold looks set to become more than an email systems with the addition of this on-line information service.

UU — Users Guide An on-line version of the users guide which is supplied when you first join Microlink. Using the UU option you can keep up to date with features which were not available when you received your copy of the printed guide.

WL — Weatherlink This is a database of weather maps transmitted by orbiting weather satellites. Programs are available in this area which enable BBC Micros, IBMs and Apples to display the maps in colour. It takes about seven to 10 minutes to download all the map data for one picture at 1,200 baud. Obviously this time will be four times longer for 300 baud.

WW — Who's Who An on-line version of the *Who's Who in Computing* encyclopedia. Keyword searching is provided, so you can locate people and the companies they work for fairly quickly.

XX — Telesoftware A database of about 70 free programs. Currently only the Amstrad, Apple, Atari and BBC Micro are catered for. There are no error-free transfer protocols available, so if you live on the end of a rather noisy line, it would probably not be worthwhile attempting downloads.

For further information, contact Microlink, Database Publications Limited, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY. Telephone: 061-456 8383.

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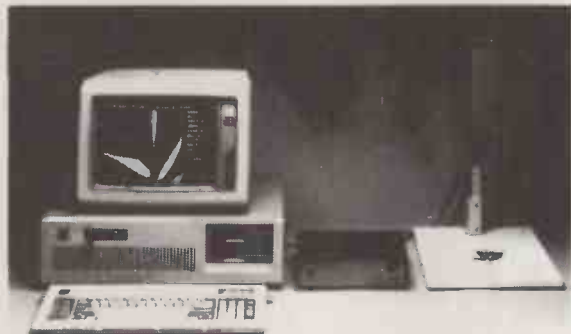
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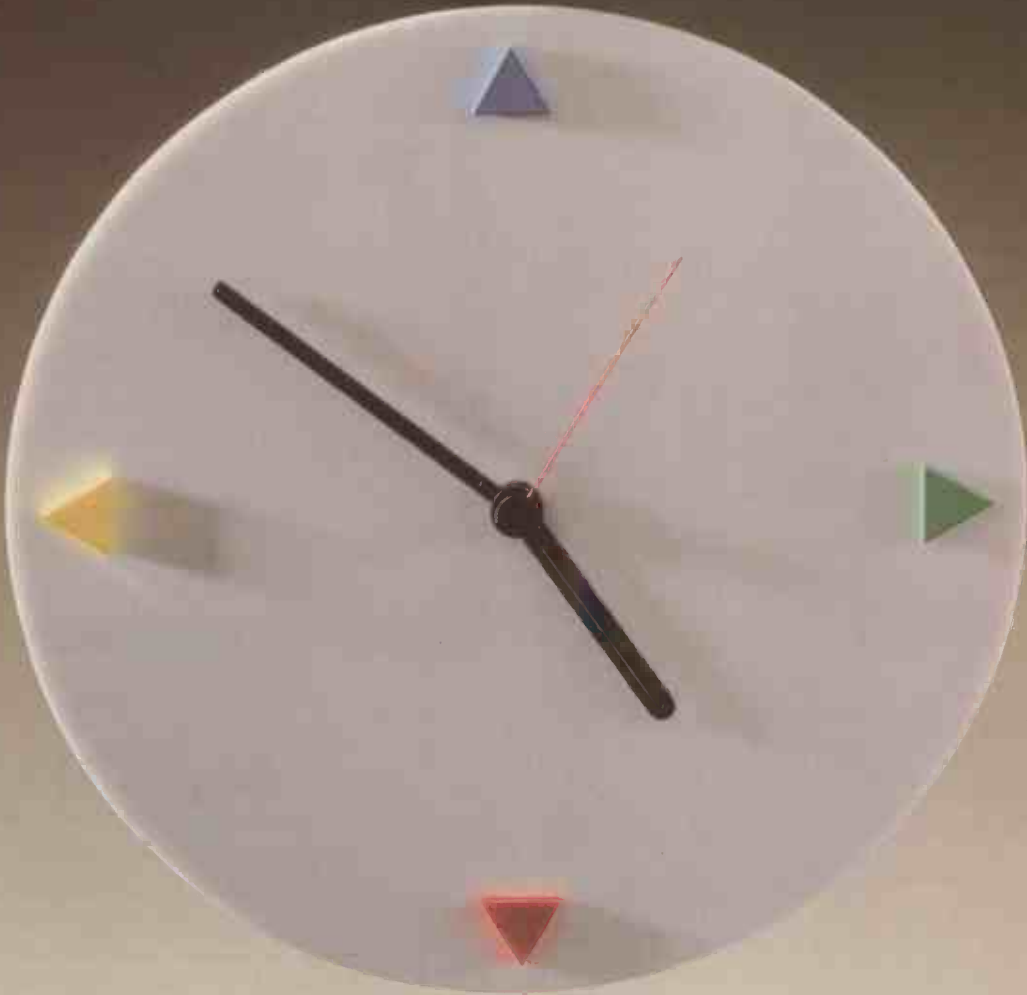
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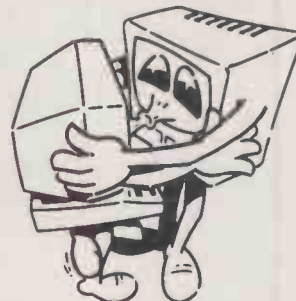
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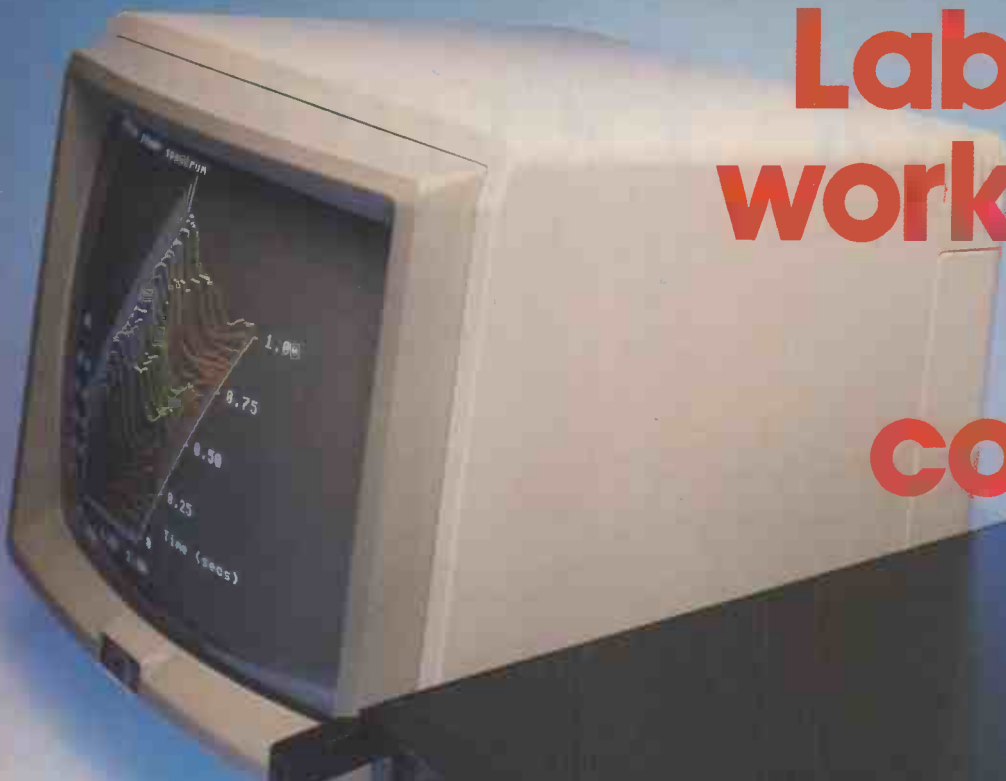
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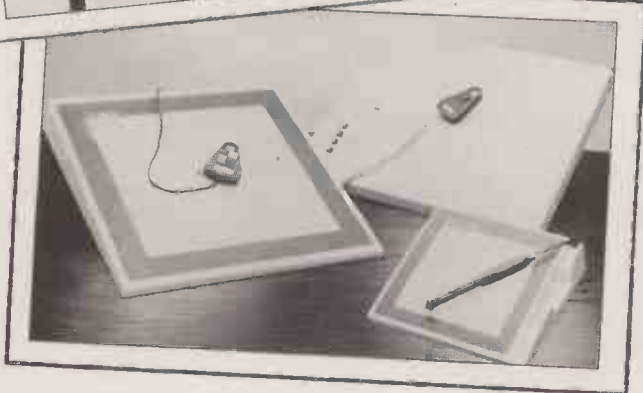
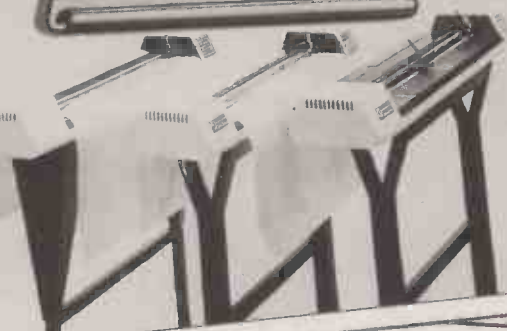
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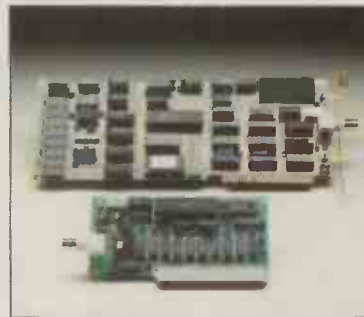


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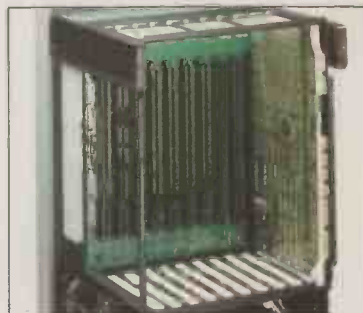


You can even network stand-alones into the Minstrel System, using Minstrel ARC net cards.

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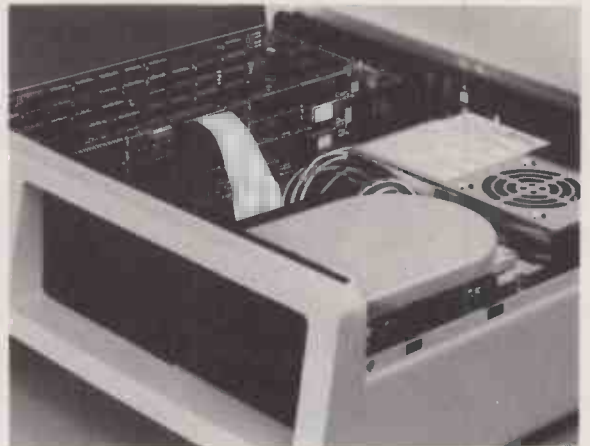


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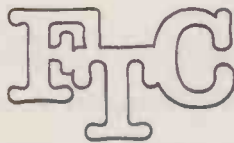
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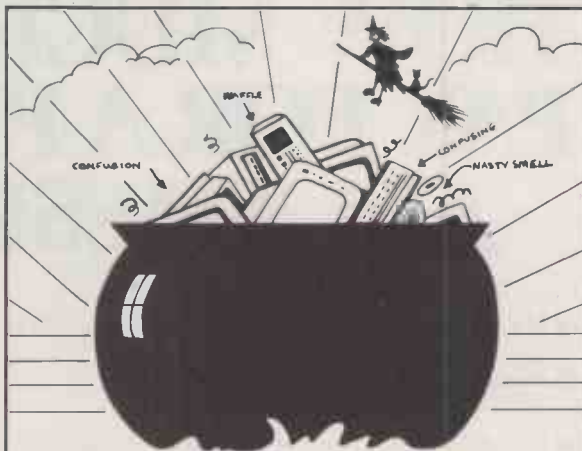
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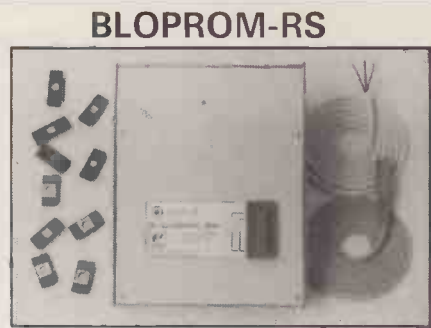
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ANYONE thinking of buying a computer for business use is beset by a host of problems. It is not just a matter of deciding which machine to buy and what software to run. People with little or no experience in computing do not realise the impact a computer can have on a business, beneficial or otherwise. Left alone with their new computer there are a number of other sources they can turn to for help: magazines, dealers, advice centres, other users — and books.

One book to help first-time users is Frank Blewett's *Beginner's Guide to Microcomputers in Business*. It is intended for people running a business who are thinking of buying a micro, and for executives in larger companies who need to use one. The author visited local businesses, providing guidance on behalf of the Polytechnic of North London's micro advice centre, and this first-hand experience as an agony uncle is apparent; his book is full of sound, easy to understand advice.

It is cheap, compact and clearly written with a chapter on each of the most popular applications for business micros. To help explain an application Blewett concentrates on one or two well-known software packages. Illustrations are in the form of screen shots and sample output. For example, in the section on word processing he cites WordStar to help describe facilities such as wordwrap, and Microsoft Word to introduce the concept of windows. Similarly, he uses Multiplan as an example of a spreadsheet.

But Blewett places such applications in a larger context too. He points out that word processing can have its disadvantages, such as the noise generated by a daisywheel printer. He explains that a spreadsheet has only a limited set of functions and cannot cope with large models, and that in such instances it is reasonable to opt for a financial-modelling package. He also gives advice on how to go about buying hardware and software, together with a rough guide to prices.

Blewett not only tackles the problem of the kit you buy, he also realises that people are involved in any business and that they too present a dilemma. He points out that by installing a new system you may have to deal with staff who do not like the changes made; you may lose control if your staff understand the system and you don't, and there is a need to make a concerted effort to get to grips with computing to get the best out of it. If you want a book to advise you on why you need a micro, what is best to choose, how it works and



DOWN TO BUSINESS

Running a business but troubled by techno-fear? **Carol Hammond** looks at some new books which will set you right.

when to upgrade, together with a useful glossary of computer terms and suggestions for further reading, this fits the bill.

Henry Horenstein and Eliot Tarlin's *The Business Computer Guide* is also intended for those choosing a personal computer for business use. This book came about because one of the authors wanted to buy a personal computer but could not find a book that told him everything he needed to know about one. This guide is his answer to the problem.

The book was originally published in the U.S. but I did not find its Americanisms particularly intrusive. It is divided into two parts: the first five chapters are explanatory, and the sixth is a catalogue of products. The authors explain the main application areas of a micro, with worked examples in each case. For example, they show how to use a word processor to amend a CV. They describe what various pieces of hardware are, how they work and how they should be looked after. They also give extensive guidelines on how to select a personal computer, even taking into account how best to benefit tax-wise, and where to position your micro best for your health once you have bought it.

The catalogue of products is somewhat out of date, as you would expect, but it is still useful. It gives the specification of a product, comments on its advantages and disadvantages, gives a price guide, and places

a product within a particular category. Each section is prefaced by advice on what to consider when buying that type of product.

The book is illustrated with line drawings, screen shots and sample output. It is clearly laid out, easy to read and offers useful appendices on further reading, programming languages and information services such as Telecom Gold, complete with addresses. It is worth buying if you are a beginner.

Andrew Leigh's *Understanding Management Software* also falls into two parts. The first gives advice on how to understand and select management software while the second reviews 30 software packages, giving a management verdict similar to our own PC Verdict for each package.

Leigh's book is aimed at managers who are trying to make the transition to turning the office micro into a useful personal tool, rather than using it as part of a large office system. As a working manager himself, Leigh sympathises with the problems of the harassed manager. He attempts to sweep aside the idea that a manager should waste his or her time getting to know about the hardware. He says: "Surrounded by other incomprehensible gadgetry, the CPU lives inside the main heavy box that you usually think of as the computer. In fact the CPU is not much bigger than a couple of large postage stamps and is thinner than a folded copy of *The Times*. To be fair to the

BOOK REVIEWS

computer fanatics, all that internal mish-mash could be made comprehensible. But there are not enough hours in the day, so why bother?" In his jokey way, Leigh makes a valid point, but if I were a busy manager I would find it tiresome and unnecessarily time-consuming to read this sort of advice.

This book is less attractive in appearance than any of the others mentioned so far, and has few illustrations. The review section is quite useful, though such information can go out of date very quickly.

Kathy and Terry Lang have produced two books for business people who are planning to buy or are already using micros. The books are identical in all but the micros they deal with. *Managing your Business with the IBM PC* and *Managing your Business with the Apricot* are very clearly laid out and well organised. The authors concentrate on explaining how you can learn to get the best out of your machine. They explain how to carry out everyday tasks efficiently, and provide checklists to measure packages against to see which is the best candidate for your requirements.

There are sections on PC-DOS and MS-DOS, where appropriate, with advice on how to use your operating system to help you, and how to protect yourself against common mistakes. The authors also give a rundown on assessing and buying supplies and training, when to opt for add-ons like clocks, calendars and extra memory, and how to use email to communicate with other users.

Unlike the other books mentioned so far, the Langs' offerings enter the field of programming, giving a simple program in Basic and suggesting which programming language to use for what purpose. They proffer advice on when to have a program written for you rather than using an off-the-shelf package.

Both books are illustrated with screen shots, photographs and line

(continued on next page)

BOOK REVIEWS

(continued from previous page)

drawings. They are more advanced in their subject matter than the other books mentioned, and are probably best suited for someone who already owns a machine but could be made more aware of its full potential.

Myles E Walsh's *Understanding Computers* also attempts a crash course in programming in Basic. It is divided into three sections: hardware, data processing and system software, and applications. It covers a wide range, attempting to explain CAD/CAM and email while providing an application development story to show how a small computer application develops.

It is very thick and very

American. I found its tenor too American for my taste and phrases like "What the heck" jarring. It is probably most useful as a reference book rather than something to read from cover to cover. If you do plough through to the end you will be rewarded with a section which examines what philosophers and sociologists have to say about computers and their effect on society.

There is even one bizarre piece on films which mentions *ET*: "Computer technology was not mentioned specifically, but technicians were certainly given a pretty good ribbing." What I was most surprised to discover was that there were two computers on the Starship Enterprise of *Star Trek* fame, one of which was the half-human, half-Vulcan Mr Spock. I wonder that Mr Walsh hasn't been beamed up for expressing such sentiments.

Gary Simon's *Choosing Accounting Software for your Microcomputer* moves into a specialist area. A chartered accountant, Simon aims to help you go about choosing accounting software. He explains how you should work out your accounting requirements and then what you want from the software.

There is a large section of

checklists which you can use when you come to buy a package. This is followed by reference sections on nominal, purchase and sales ledgers which detail what each computerised ledger is, the processes involved and the facilities they offer. It is a slim, well-organised book, complete with diagrams, which should appeal to accountants.

Another book for a specialist area is Stephen Morris's *Business Computing on the Merlin Tonto*, which was produced in association with British Telecom Business Systems. It explains in great detail

how the Xchange programs work, and provides examples of applications that can be run on the Tonto. These include stock control, invoicing, accounting, analysis and forecasting, planning and scheduling. For example, in the chapter on accounts it relates how you can do a VAT return using Abacus.

There are plenty of illustrations, including screen shots and sample output, plus appendices of ASCII codes and a glossary of terms. For Tonto users this makes an invaluable companion to the user guide. **PC**

DOWN TO BUSINESS

Beginner's Guide to Microcomputers in Business by Frank Blewett. Published by Newnes Technical Books, 160 pages, £4.95. ISBN 0 408 01527 6

The Business Computer Guide by Henry Horenstein and Eliot Tarlin. Published by Sunshine Books, 196 pages, £8.95. ISBN 0 7181 2486 3

Understanding Management Software by Andrew Leigh. Published by Macmillan, 286 pages, £11.50. ISBN 0 333 40946 9

Understanding Computers by Myles E Walsh. Published by John Wiley, 434 pages, £29.15. ISBN 0 471 80476 2

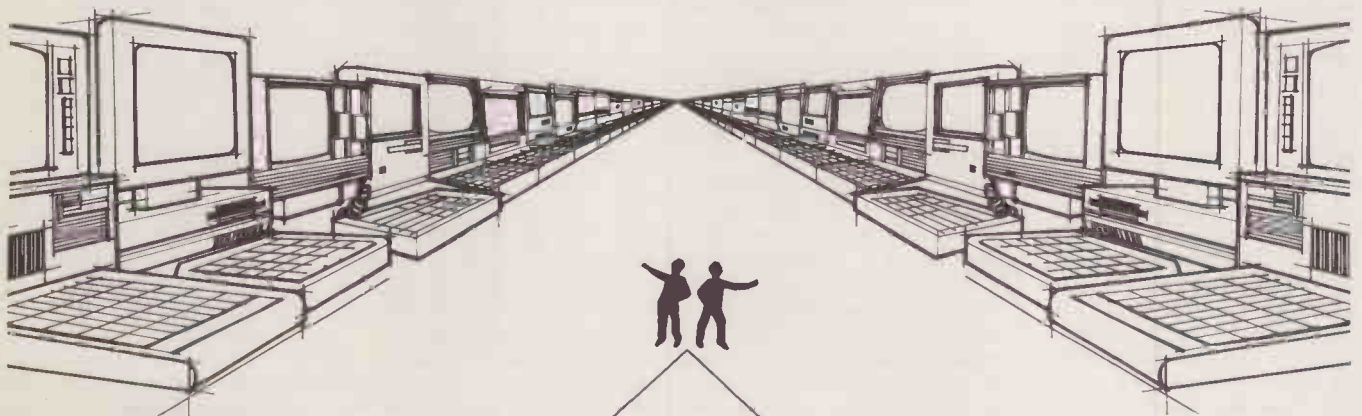
Managing your Business with the Apricot by Kathy and Terry Lang. Published by Holt, Rinehart and Winston, 142 pages, £8.95. ISBN 0 03 910662 4

Managing your Business with the IBM PC by Kathy and Terry Lang. Published by Holt, Rinehart and Winston, 142 pages, £8.95. ISBN 0 03 910661 6

Choosing Accounting Software for your Microcomputer by Gary Simon. Published by Collins, 130 pages, £7.95. ISBN 0 00 383006 3

Business Computing on the Merlin Tonto by Stephen Morris. Published by Century, 192 pages, £12.95. ISBN 0 09 161671 9

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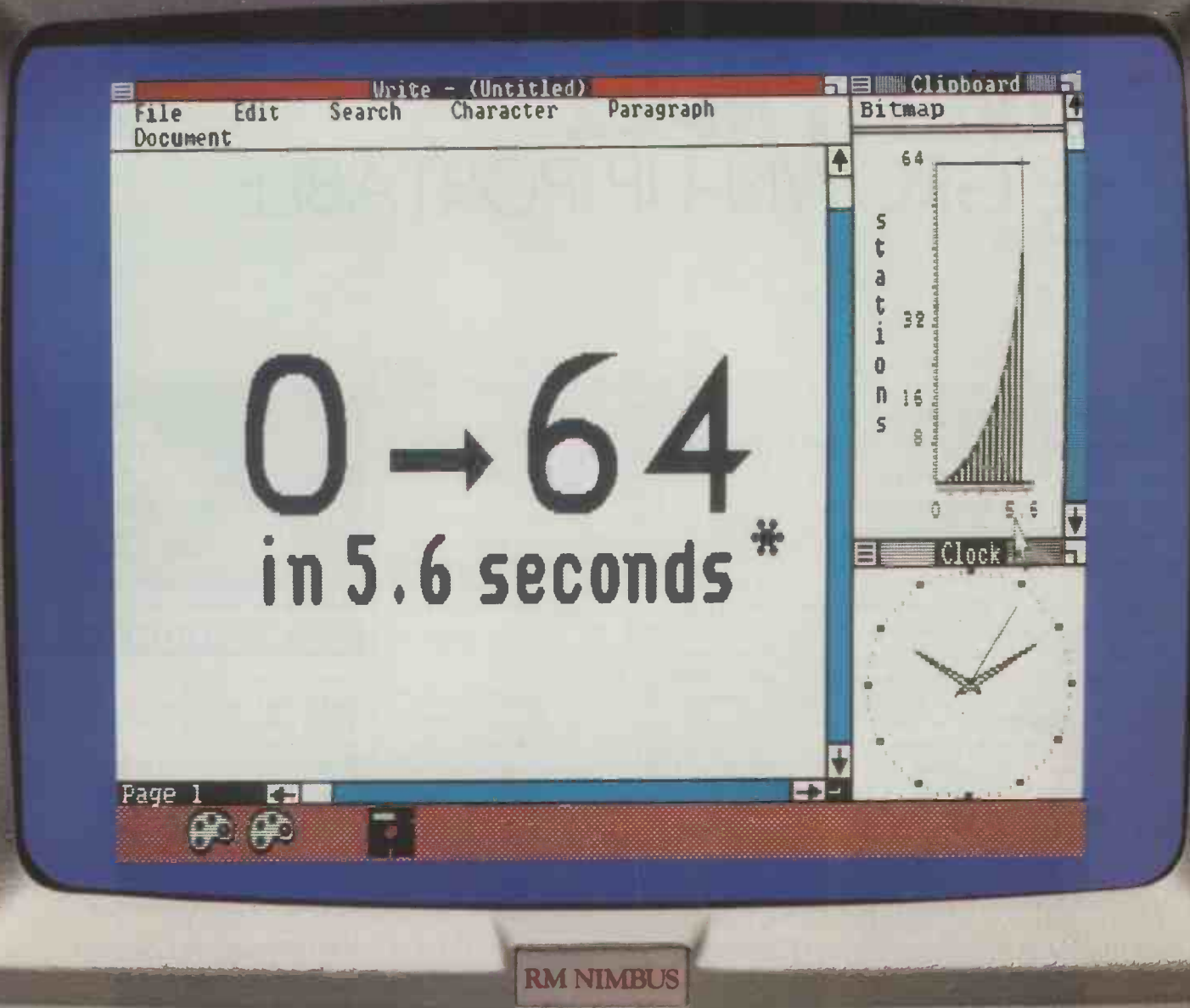
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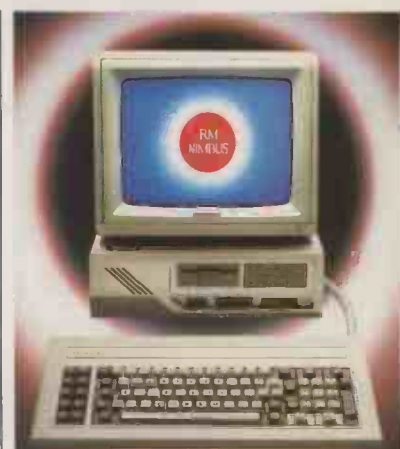
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*Time taken to send 700 word report to 64 stations on the Nimbus Network



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OLIVETTI M-22

THE GROWN-UP PORTABLE

By Glyn Moody

Display and processor technologies have been developed to the point where portable IBMulators are a genuinely usable proposition. Olivetti's machine promises all this and more.

At *Practical Computing* we have always considered Olivetti's M-24 to be the best of the value-added IBM clones. Understandably, the company has been content to reap the maximum benefit from this product, and has held back from further launches. Olivetti has produced just one minor upgrade, the M-24SP reviewed in the January issue.

But the market has moved on. Recognising this, Olivetti has finally launched three new machines: the M-19, a low-end IBMulator; the M-28, an AT clone; and the M-22 portable reviewed here.

It is probably no coincidence that the portable has made its appearance at the time that the major U.S. Internal Revenue Service contract for just such a machine was out to tender. As it turned out, the contract went to Zenith, but it seems likely that the M-22 was a candidate, entered under the aegis of Olivetti's American partner and part owner, AT&T.

It is also likely that AT&T will market the portable in the U.S. at some stage. Olivetti reckons that AT&T sold some 200,000 of its M-24s in 1985 — half of the total sales. Any machine with this kind of backing would be

interesting, but the M-22 has enough virtues of its own to merit attention.

It is a battery portable with a back-lit LCD, one 5.25in. floppy, and a basic 256K of RAM. Memory can be expanded to 1Mbyte, up to 360K of which can be configured as a silicon disc. Other expansion options include a 10Mbyte Winchester, up to two proprietary cards and one full-length eight-bit IBM expansion card. There are two 80C88 processor chips, one of which handles the screen and the built-in Personal Windows desk utilities. Prices are likely to start at under £1,800.

Although the unit is not small, it is slim and easily manoeuvrable: It weighs 7.5kg. The casing is built in the fashionable flip-top style, where the screen closes over the keyboard. The disc drive is on the right-hand side. In the base of the unit there is the handle which swings out of its recess.

10MBYTE WINCHESTER

The M-22 will run on Nicad batteries also housed in the base of the unit. They provide around 12 hours of normal use. Olivetti supplies a mains unit with the machine, which can be used to provide power direct and to recharge the batteries. With the batteries removed, it is possible to install a removable 10Mbyte Winchester.

At the top of the machine towards the back there is a full-size IBM expansion cavity. The outputs from the card emerge to the left. A hinged flap at the back of the machine folds down to provide support for the main unit and the correct angling for the keyboard. Behind it there are serial and par-



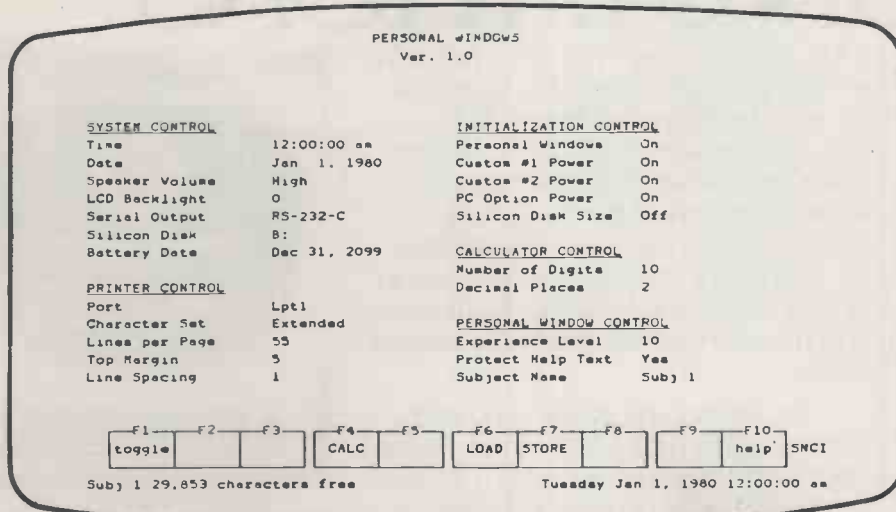
SPECIFICATION

CPU: 80C88 running at 4.77MHz
RAM: 256K, expandable to 1Mbyte
ROM: 96K, including BIOS, diagnostics and Personal Windows
Dimensions: 410mm. (16.1in.) x 91mm. (3.6in.) x 344mm. (13.5in.)
Weight: 7.5kg. (16.5lb.) without batteries
Display: green back-lit LCD; 80 by 25 text, 640 by 200 graphics, four shades of grey
Keyboard: QWERTY with dual numeric pad/cursor block
Mass storage: one 5.25in. 360K floppy; optional 10Mbyte hard disc; 360K silicon disc can be configured from RAM
Interfaces: RS-232, Centronics, two Olivetti interfaces, one full-length IBM eight-bit card slot
Software in price: MS-DOS 2.11; Personal Windows
Price: likely to be under £1,800
Manufacturer: made in Hong Kong for Olivetti
U.K. distributor: British Olivetti, Olivetti House, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.
Available: autumn 1986

allel ports, an Olivetti mouse port and the power socket.

The screen is a back-lit LCD of advanced design. Its overall surface area is very close to that of a conventional VDU. The characters are well formed and very legible. My only complaint is that there seems to be a slight persistence as text scrolls. The back-lighting unit has to be replaced from time to time, but this can be done by the user. The main processors and memory are housed in the screen unit, not in the main box. A slightly noisy cooling fan is fitted to the main box, presumably to cool add-ons.

The keyboard is a new design from Olivetti. Its feel is lighter and more ratty than the ideal, but not unacceptably so. What is less forgivable is the tiny right-hand Shift key. It is so close to the far larger



Personal Windows' main setup window where you can assign a drive to the silicon disc.



Two plus points of the Olivetti M-22 are its clear back-lit LCD screen and its ability to use a hard disc.

Return key that I found myself constantly entering Carriage Returns by mistake. As well as a numeric pad doubling as cursor controls, there are 10 function keys, grouped rather curiously in threes and twos — apparently another legacy of the AT&T connection — and an additional Personal Windows key.

Personal Windows is a proprietary desk-top utility which is resident in ROM. It is available at any point, whether you have booted up or not, just by pressing the special key. Personal Windows has two main uses. First it provides you with a range of simple desk-top functions. These include a memo pad, a To Do scheduler, a diary, an expenses ledger, an address book, notepad, calendar and calculator. All of them are rudimentary. For example there is no check on whether times are valid for the scheduler, the address book does not automatically sort for you, and the ledger has no £ sign.

A novel option available from Personal Windows is called View. It allows you to transfer non-graphic data from outside Personal Windows — say from DOS, or an application — into one of its memories. Perhaps the most important function of Personal Windows is that it allows you to configure most aspects of the M-22. You do this from the so-called Values option, which presents you with a menu of some 25 options. They include things like setting up the printer, the level of LCD backlighting, time and date. You can also specify whether power is to be supplied to add-on cards.

Perhaps the most interesting option is that of specifying the silicon disc. Anything from 63K to 360K of available RAM can be set up in this way. This silicon disc can be designated A: or B:, and the physical drive then defaults to the other assignment. By judiciously changing the internal drive, various loading operations can be speeded up enormously. There is a special Load command available from Personal Windows

which accomplishes transfers from physical to virtual disc automatically.

Personal Windows is available at any time from within any program thanks to the second processor which is dedicated to it and the screen handling alone. This arrangement allows images to be switched with impressive rapidity. Personal Windows requires 64K of RAM for storing files it generates but they must be saved to a physical floppy before powering down. A protection device sustains the silicon-disc files for 15 seconds after you have powered down. The unit beeps to warn you and the silicon disc indicator flashes. The same indicator flashes whenever the silicon disc is accessed, and even makes half-realistic grinding noises. There are also indicators for the floppy and hard discs, and a low-battery warning.

BENCHMARKS

When you power-up the machine it runs a diagnostic routine which includes a full memory check. The Basic Benchmarks show the M-22 to be no more than 10 percent faster than the IBM PC. As far as disc performance is concerned, the Bagshaw Benchmarks put the M-22's floppy drive approximately on a par with the IBM. What is more surprising, running the Bagshaw Benchmarks on the silicon disc gave a result slower than many hard discs, and eight times slower than the silicon disc on the Compaq Deskpro 286.

The M-22 ran all the usual IBM compatibility tests: Lotus 1-2-3, Flight Simulator, Javelin and Sidekick. Personal Windows takes precedence over Sidekick: after the Personal Windows key has been pressed, Sidekick is unable to intercept the standard double Shift command. On the prototype machine which I saw there was a slight problem with programs like 1-2-3 and Framework which use cursor highlighting. The M-22 has four levels of grey available on


the LCD and has a colour-compatible graphics board, but the mapping across from VDU to LCD was not totally successful in its use of the grey shades to represent colour and cursor reversing.

All in all, the Olivetti emerges as a machine which goes well beyond the run-of-the-mill portables. Its excellent LCD will overcome many people's traditional objection to that technology. Its fully configurable silicon disc provides all the advantages of two floppies without the disadvantages.

On the down side, the M-22's less than stunning performance is a disappointment. The processor speed is less worrying in this respect than the disc performance, which is pedestrian at best. I am also unhappy about the design of the keyboard.

The world of portables is moving rapidly. Two months ago we looked at and were impressed by the new machine from Panasonic, which uses a large and legible plasma display and is generally well designed. The M-22 has the advantage of true battery-powered portability, and a markedly lower weight. It is also far more flexible and comes with Personal Windows as an extra. If a portable IBMulator is what you are looking for, Olivetti's stylish new machine is probably now the leader in the field.

CONCLUSIONS

- The Olivetti M-22 is a compact battery or mains-powered portable IBMulator with an outstanding back-lit LCD screen.
- Its ability to configure part of RAM as a silicon disc is a powerful plus.
- The performance of both the processor and disc is a little disappointing, especially when compared to the M-24.
- The M-22 forms part of a complete range of business micros, fitting in below the M-24 and M-28 machines, and providing a useful complement to them.
- The keyboard is flawed by an ill-judged design of the right-hand Shift key. 

XEROX 6085 PCS

THE ROUTE FROM PARC

By Ian Stobie

Xerox has often left other manufacturers to put its own ideas into practice. This may change with its new graphics-orientated system, but it does not come cheap.

Although Xerox invented the windows-icons-mouse interface, it has been other companies that have really exploited it in successful products and put it into the hands of users. Apple's Macintosh, Atari's ST and Microsoft's Windows all use ideas originally developed by Xerox at the company's famous Palo Alto Research Center (Parc).

Xerox's own Wimps-based computer offerings have generally been pitched too far upmarket to make much of an impact. For instance, the Xerox Star work station has been admired as a sort of super-Macintosh, but it has sold only in relatively small numbers. But now Xerox has come up with the 6085 Professional Computer System, which costs less than half the price of the Star while running much the same software. Starting at about £4,700 for a hard-disc system, it falls into the same bracket as the IBM PC/AT, and with the addition of a PC emulation board the 6085 PCS is capable of running IBM PC software.

However, the machine is not an attempt by Xerox to join in the cutthroat competition in the mainstream PC market. The 6085 PCS is not another IBM clone, but still very much a product in the Xerox image. It is intended more for specialist application areas where a high-performance graphics work station can command a premium price.

The most promising such area for Xerox is probably technical and foreign-language word processing, and the in-house production of documents which would otherwise require professional typesetting. A typical single-user 6085 PCS configuration suitable for this task, with Xerox laser printer and software, works out at around £14,000.

Xerox has a strong reputation in the copier and laser-printer market already, which should help it sell the 6085 PCS as a document-processing machine. Its other useful area of expertise is in local and long-distance networking: Xerox invented Ethernet. The 6085 PCS comes equipped with an Ethernet interface, and can be sold to larger users as part of a network-based document-processing system.

Physically everything about the new

Xerox machine tends to be big. The 6085's system box weighs 50lb., and you stand it upright on the floor rather than keep it on your desk. Inside the box is a 10Mbyte hard disc, although you can opt for anything up to 80Mbyte built-in. Also accommodated is at least 1Mbyte of RAM and a fast 16-bit processor designed by Xerox.

The display units are also built to Xerox's own design. They are enormous: you get a choice of a 15in. or 19in. display. The larger version does not just show the same image bigger; both units are mapped at the same resolution of 80 dots per inch so there are more dots on the larger screen, allowing it to display more material. Two upright A4 pages can be displayed actual size on the 19in. screen, as opposed to one A4 page sideways on the 15in.

CONCESSION TO IBM

By comparison the keyboard looks fairly conventional. As an apparent concession to IBM compatibility it has two sets of 10 function keys, one set running along the top of the keyboard, the other at the side in the usual IBM position. You also get a two-button mouse.

When you turn on the system a picture of a keyboard appears on-screen, which is meant to suggest to you that you hit a key. When you oblige, a small form is displayed, into which you type your name and password, and some other details. You can boot the system from either hard disc or floppy drive, or from any other disc on the network if your machine is wired up on Ethernet.

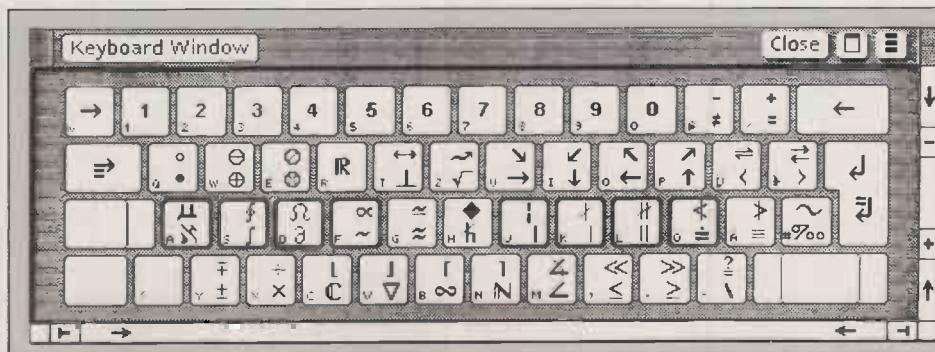
The screen then comes up with a display of the desk top. Superficially this looks very similar to a Macintosh screen, only bigger. You open windows and start applications by clicking on icons in the Mac way. One consequence of the big display is that you tend to leave many more icons lying around the desk top, as there is plenty of room for them

SPECIFICATION

CPU: Xerox Mesa 16-bit processor running at 8MHz
RAM: 1.1Mbyte standard, expandable on board to 3.7Mbyte
Keyboard: QWERTY with numeric pad and two sets of 10 function keys
Mouse: two-button optical mouse standard
Discs: built-in 10Mbyte hard disc is standard; optional 20Mbyte, 40Mbyte or 80Mbyte units and external 5.25in. 360K floppy-disc unit
Display: 15in. monochrome 697 by 880 pixels; 19in. monochrome 925 by 1,184 pixels
Interfaces: two serial ports configured for comms and local printer, Ethernet local area network port
Dimensions: system box 546mm. (21.5in.) x 318mm. (12.5in.) x 241mm. (9.5in.); weighs 22.7kg. (50lb.)
Software in price: none; Xerox Viewpoint operating environment and VP Document Editor package cost £704
Price: £4,685 for system with 1Mbyte RAM, 10Mbyte hard disc, one 360K 5.25in. floppy, 15in. monitor, keyboard and mouse
Manufacturer: Xerox Corporation of Palo Alto, California; made in U.S.A.
U.K. supplier: Rank Xerox (U.K.) Ltd, Bridge House, Oxford Road, Uxbridge, Middlesex UB8 1HS. Telephone: (0895) 51133
Available: now

alongside the window in which you are working.

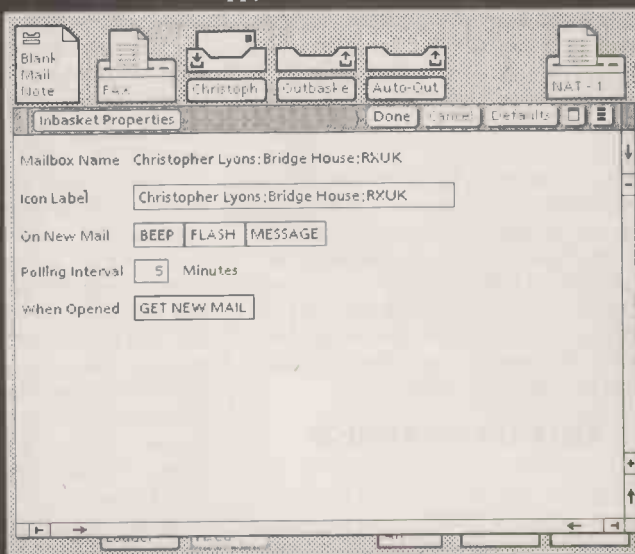
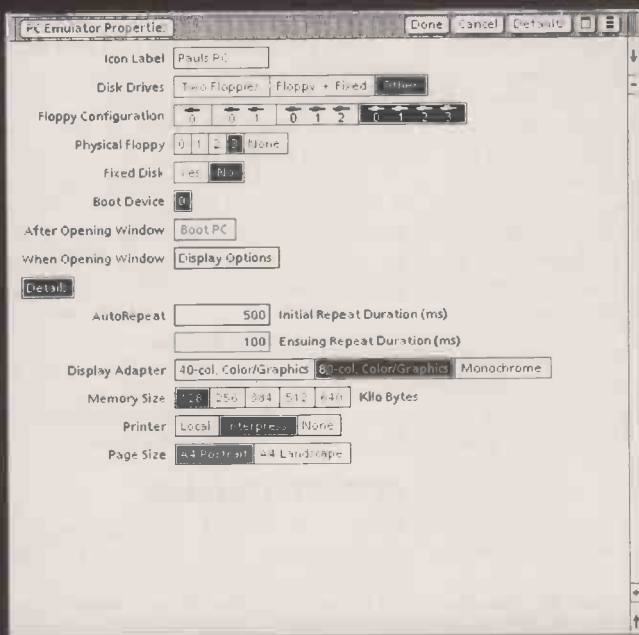
Generally, the display is very clear but occasionally I noticed scintillation of small horizontal sections of it. The refresh rate is only 38 times a second, probably because the display is so large — most systems refresh 50 or 60 times a second. So while the size of the display is luxurious and helpful, the screen surface itself is not as restful to look at as, say, that on the Vienna PC or the Mac.



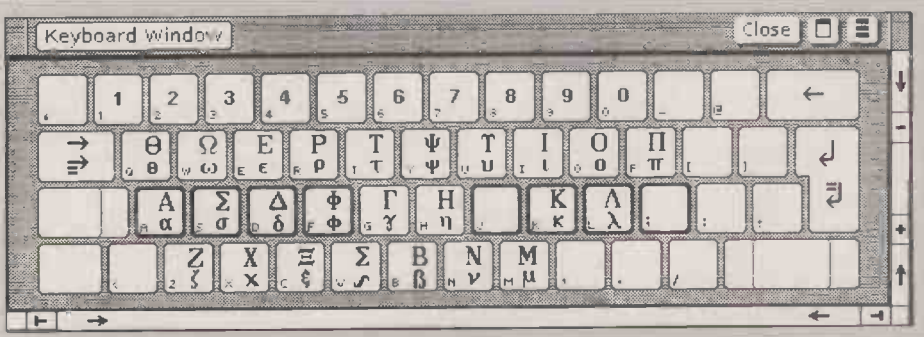
(continued on page 56)



Left: The 6085 PCS emulating an IBM PC with four floppy discs and an 80-column colour display; in reality we had a hard disc and one floppy.



Above: With the system connected to the network you can set the email software on your 6085 PCS to flash, beep or display a message when mail arrives.



Left: Document Editor supports technical and foreign-language founts. You can display a picture of the keyboard in a separate window to help you remember the key assignments.

(continued from previous page)

Xerox's own software for the 6085 PCS is a development of that for the Star. The disc-operating system is called Pilot, the windowing environment that sits on top of it, Viewpoint. At present there are about 20 Viewpoint packages available from Xerox, including a spreadsheet, list-management and drawing packages, plus various communications and file-conversion utilities. Xerox Development Environment, a development system based on Smalltalk, will be available for people who want to write their own applications. None of this is included in the system price. To get equipped for text processing you would need to spend at least another £526, which would get you the VP Document Editor package, Viewpoint, Pilot and a variety of type fonts.

All of the Viewpoint software packages integrate together easily. You can give VP Document Editor the capability to handle equations, Japanese or Chinese by buying the appropriate modules. Simple tinting and painting facilities are already built into VP Document Editor, but you can improve them by adding the VP Data Drive Graphics package, which also works with the VP Spreadsheet. The basic VP Document Editor on its own is a pretty impressive piece of software, more like a page make-up package than a conventional word processor. All fonts are displayed exactly as they print on-screen, and you can have text in any number of columns.

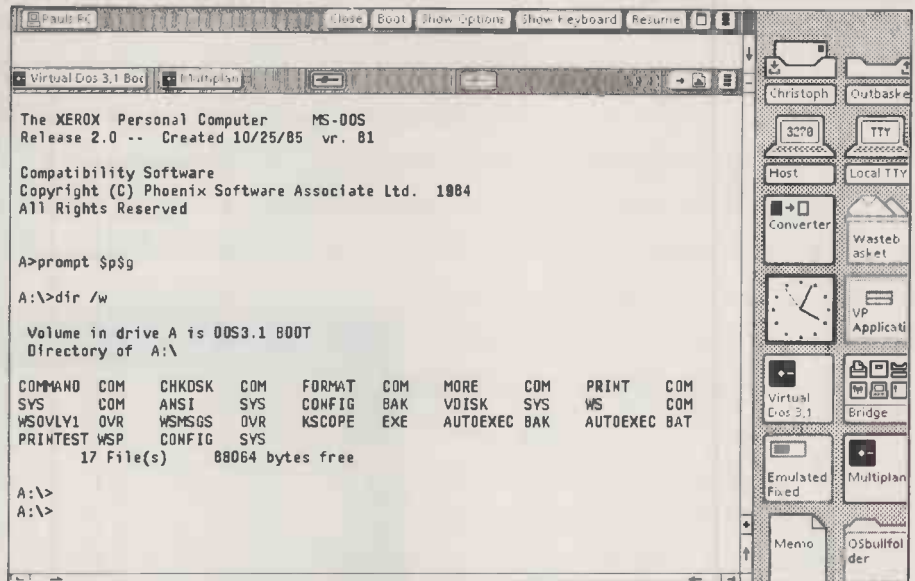
Most of the time you work at actual printing size on the 6085's big screen, although you can change the scale if you like. You can import special technical symbols, spreadsheet data or charts from other packages into the middle of text. VP Document Editor is able to flow passages of text around pictures, across columns and over page breaks.

IBM PC compatibility takes the form of an optional 80186-based hardware card which you fit inside the machine. You also need the Viewpoint PC emulation software and a set of different IBM-style display fonts which brings the total price to £794. You cannot add IBM-compatible hardware cards to the system; it is software compatibility only that is on offer.

COLOUR GRAPHICS

But the software compatibility is well implemented. MS-DOS or PC-DOS comes up as a full-size 25-line by 80-column window on the Viewpoint desk top. Unlike some IBM emulators it lets you run packages which use colour or monochrome graphics as well as text-based ones, although the colour takes the form of monochrome grey scales. The software also runs at a reasonable speed.

Flight Simulator does not run on the machine but Xerox says that most well-behaved IBM packages will. The company is systematically testing PC products and adding the ones that run to a certified list. At present this has over 25 packages on it, including word processors like WordStar, Word, Word Perfect and Displaywrite. Spreadsheets available include Multiplan,



MS-DOS comes up as a full-size 25-line by 80-column display inside a separate window on the large Xerox 6085 screen when you are emulating the IBM PC.

Lotus 1-2-3, Symphony and Supercalc, and for data handling there are Framework, Cornerstone and dBase. The graphics program Execuvision, and utilities such as Sidekick, Sideways and Prokey also run.

DATA TRANSFER

However, the real point of the IBM option is not turn the 6085 PCS into an expensive PC clone. It is more to provide a very flexible and convenient way of getting data organised on IBM PCs into the Viewpoint document-editing environment. If all you want to do is transfer text from an IBM to a page make-up package there are far simpler ways of doing it. But if you want to transfer spreadsheet, project-planning or graphics data from specific IBM packages into an elaborate and powerful word-processing environment, then the Xerox way makes some sense.

In fact the two environments, Viewpoint and IBM, are running concurrently. So you can take bit-mapped graphics out of the PC window and copy it directly into a Viewpoint document. You can also run data files from many popular packages into Viewpoint format. Xerox offers cheap utilities for Lotus, DIF, WordStar and other commonly used formats.

Xerox's strategy in a world of increasingly cheap IBM clones seems to be to avoid getting directly involved in what is becoming almost a commodity market. The 6085 PCS is not going to be sold as a straightforward PC but as a specialist text-processing system from Xerox the photocopier people. It also happens to have the ability to run IBM software should you want to move data from IBM packages into your Xerox-produced documents.

The 6085 PCS comes with a full IEEE-specification Ethernet interface capable of transferring data at 10Mbit per second. This is quick enough for you to use remote hard discs without noticing the difference. You

need some additional system software to use the network, but once on it you have access to printers and hard discs anywhere on the system, as well as email between network users.

Xerox has installed several thousand networks worldwide. Ethernet allows you both to network locally and to join networks together. The networks can be located anywhere, provided you have the comms lines. For big corporate buyers who need to shunt data around buildings and across national boundaries this experience gives Xerox an extra edge.

But the system is not cheap. Once you add on the extras, especially the printers on offer from Xerox, the cost mounts up. There is still something of the minicomputer world about the 6085 PCS. It is being sold by Xerox's own sales force, not through dealers. If you are prepared to struggle with the usual problems of the micro world you could get by with something a good deal cheaper, perhaps based on an IBM clone combined with suitable peripherals and one of the standard software packages. What you get from Xerox is a very complete and well worked-out solution, but the commitment you make both in monetary terms and to the Xerox way of doing things is deep.

CONCLUSIONS

■The 6085 PCS is a high-performance graphics-based work station which makes most sense in specific markets that really need the features it offers. It is not Xerox's attempt to break into the mass PC market, or even the PC/AT clone market.

■Document processing, especially scientific and foreign-language word processing and in-house publishing, is likely to be the major niche. The 6085 PCS, with its Viewpoint software, can mix text and graphics in complicated layouts and import text and graphics from IBM PC applications with the PC-emulation option fitted.

■Xerox has plenty of experience of networking, and it is likely that most 6085 PCSs will go to major corporate buyers who want a multi-user solution.

■Once you add on the extras, especially the printers on offer for the system, the Xerox solution does not come cheap.

SPECIFICATIONS

TANDON PCA-30

CPU: Intel 80286 running at 8MHz
RAM: 512K, expandable to 1Mbyte on the motherboard

Mass storage: one 5.25in. 1.2Mbyte floppy, one 30Mbyte hard disc

Interfaces: none built-in

Display: monochrome board and monitors supplied as standard, colour alternative also available

Software in prices: MS-DOS 3.10, GWBasic

Price: £3,095

Manufacturer: Tandon, made in the U.S.

U.K. supplier: Tandon Computer, Unit 19, Hunt End, Dunlop Road, Redditch, Worcestershire B97 5XP. Telephone: (0527) 46800

Available: now

FERRANTI 2860AT

CPU: Intel 80286 running at 8MHz, switchable to 6MHz

RAM: 640K

Mass storage: one 5.25in. 1.2Mbyte floppy, one 20Mbyte hard disc

Interfaces: one RS-232 serial and one Centronics parallel built-in, one Centronics parallel on video card

Display: choice of monochrome or colour boards for text and graphics
Software in price: MS-DOS 3.10, GWBasic, Perfect Writer, Perfect Speller, Perfect Filer

Price: £3,898, not including monitor and video board

Manufacturer: Ferranti Computer Systems, Derker Street, Oldham, Lancashire OL1 3XF. Telephone: 061-624 9552

Available: now

FERRANTI PC-2860AT TANDON PCA-30

TWO OF A KIND?

By John Lee and Timothy Lee



The choice of AT-emulators is widening, and two of the latest entrants to the race both offer increased performance at a lower price.

Since IBM launched the PC/AT in August 1984 the manufacturers of compatible micros have been anxious to get in on the act. Ferranti and Tandon are two recent arrivals on the AT scene, and as has often been the case their offerings out-perform the original in a number of respects. At £2,795 the Tandon PCA-20 is one of the cheapest AT clones so far. Ferranti's PC-2860AT, which has a 20Mbyte hard disc, costs around £1,000 more than a similarly specified Tandon machine, but scores in a number of other areas, such as its dual-speed processor.

Alongside the Ferranti we looked at the Tandon PCA-30, which is fitted with a 30Mbyte hard disc. Both machines have 1.2Mbyte floppy drives in addition to the Winchester. The standard memory on the Ferranti is 640K, while the Tandon is supplied with only 512K fitted.

Both machines are similar in size to the IBM PC/AT. The Tandon is the larger of the two by about half an inch all round, and this slight difference somehow contrives to make it look a great deal more bulky. Some other look-alikes are appreciably smaller and occupy less desk space. The Ferranti is quite heavy, weighing in at around 33lb., but with a floppy drive and a full-height hard disc this is no more than might be expected. The Tandon is heavier still. It weighs a massive 44lb., and you need to be quite strong to lift it.

DETACHABLE KEYBOARDS

Both machines have detachable keyboards connected by a coiled cable. They plug into the back of the computer using a five-pin DIN plug like the IBM itself. It is a pity not to have the keyboard plug on the front of the system box, as on the earlier Ferranti PC-860, since this arrangement reduces the tangle of cables around the back of the machine. The Ferranti's cable is particularly long and extendable, so you could run it under the desk if you wish.

The Ferranti's 84-key keyboard looks well made, and the keys have a good positive feel. It has basically the same layout as the IBM PC/AT, with some minor rearrangements. There is a large, L-shaped Enter key, which is very well placed, and two large Shift keys. LED indicators are built into the tops of the Caps Lock, Scroll Lock and Num Lock keys. We prefer this to the separate battery of indicators found on the IBM keyboard. The Tandon keyboard has the same arrangement of keys, but it has a much cheaper look and feel.

Both keyboards adopt the English layout, with the five characters ', £, @, ~ and # repositioned. You have to run Keybuk after

BASIC BENCHMARKS

Both the Ferranti and the Tandon were only marginally behind the speedy Compaq Deskpro 286. Even when the processor speed was reduced to 6MHz the Ferranti still outpaced the IBM PC/AT by about 15 percent. The Benchmark routines are published on page 102 of the January 1984 issue of *Practical Computing*. Timings are in seconds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Ferranti PC-2860AT — 80286, 8MHz	0.3	1.3	2.9	2.9	3.2	5.8	9.2	9.3	4.4
Ferranti PC-2860AT — 80286, 6MHz	0.4	1.7	3.9	4.0	4.4	8.0	12.5	12.6	5.9
Tandon PCA-30 — 80286, 8MHz	0.3	1.3	2.9	3.0	3.2	5.9	9.3	9.5	4.4
Compaq Deskpro 286 — 80286, 8MHz	0.3	1.2	2.8	2.9	3.2	5.7	9.1	9.2	4.3
IBM PC/AT — 80286, 6MHz	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8

switching on the computer, otherwise the American layout is assumed. Different versions of Keybuk are provided for the PC and the PC/AT — it is the AT version that you need for these machines.

Tandon and Ferranti supplied identical monitors with their test machines — a 14in. monochrome model made in Taiwan by Advanced Datum Information Corp. The unit is housed in a small, modern-looking case mounted on a swivel base which allows you to adjust the screen angle. The screen is squarer than many, and has a matt front that reduces reflections considerably. The use of a high-performance green phosphor eliminates any flicker, even when scrolling. There was no snow effect at any time and the characters were easy to read, indicating good video boards in both computers. The

which is 7.7 times as powerful as the IBM PC. This figure takes into account information about the memory present and the operating system as well as raw processing speed. On the same basis, the Ferranti at 6MHz and the IBM PC/AT itself are 5.7 times as powerful as the PC. The Ferranti machine has been run experimentally at 10MHz, so there is still some power in reserve for future development.

At power-up each machine does a number of checks to ensure that it is fully functional. The old steam-age IBM PC may take up to two minutes to do this if a lot of memory is fitted. If you switch the machine off and on several times a day this can add up to a lot of wasted time. The Ferranti 2860 with 640K of RAM on board takes only 17 seconds to complete these checks, and the Tandon beats 20 seconds with 512K of RAM. Both machines display a message while this process is taking place, giving a running indication of how much memory has been checked so far. The IBM PC/AT takes 24 seconds for the start-up sequence.

Both machines use MS-DOS version 3.1 as the operating system. It includes a number of useful features such as Vdisk, a built-in RAM disc program. Entering your international dialling code after the Country = command adjusts a number of features, such as the way the date is shown, to accord with local custom. Thus entering 44, the U.K. code, gives you the British dd-mm-yy date format instead of the America mm-dd-yy.

The Ferranti has a Setup command which can be used to set the date and time, or other features such as keyboard layout, the number of discs, the amount of memory and whether a colour, monochrome or graphics video card is fitted. A similar system setup command on the Tandon can be invoked by holding down the Escape key during power-up. You can also invoke a Screen Save feature which turns off the screen display if there has been no keyboard activity for 10 minutes. A built-in battery-backed clock holds the date and time. Neither the Tandon nor the Ferranti has a Reset button.

Both machines normally boot from the hard disc unless a disc is present in the floppy drive, in which case they boot from that. There is a very high degree of IBM compatibility. We successfully ran the Ferranti using PC-DOS 3.1 from an IBM PC/AT and used the Ferranti's MS-DOS

FERRANTI PC-2860AT				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> Faster and cheaper than an IBM — we were sorry to part with it.				

Tandon monitor has its own mains plug, while the power cable for the Ferranti monitor plugs into the back of the system box.

Both machines use the Intel 80286 central processor chip running at 8MHz. The Ferranti can be run at 6MHz, if necessary, to retain compatibility with software designed for slower machines. Comms packages are particularly likely to be sensitive in this respect. The higher speed is obviously the one to use whenever possible. To change from one speed to the other you simply type Ctrl-Alt-8 for 8MHz or Ctrl-Alt-6 for 6MHz. Anyone used to the leisurely pace of the IBM PC will find the speed of the AT-alikes exhilarating.

The Norton Utilities Sysinfo program rates the Tandon and Ferranti at 8MHz,

(continued on next page)

BAGSHAW DISC BENCHMARKS

The disc performance of the Ferranti is up with the best, leaving the Tandon among the stragglers. The Bagshaw Benchmarks are described on page 99 of the July 1985 edition of *Practical Computing*. Timings are in seconds.

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	Total
Ferranti PC-2860AT — 20Mbyte hard	5.9	1.8	2.3	2.8	1.7	2.9	1.0	2.9	1.0	1.3	2.2	11.5	10.4	3.0	50.7
Tandon PCA-30 — 30Mbyte hard	6.0	2.2	2.5	4.9	1.4	9.6	2.7	10.3	3.4	1.4	2.1	30.8	18.1	13.9	109.3
Compaq Deskpro 286 — 30Mbyte hard	6.2	1.8	2.5	2.3	2.8	3.6	1.2	3.8	1.1	0.8	1.6	11.0	5.9	3.2	47.8
IBM PC/AT — 20Mbyte hard	7.0	2.8	6.4	3.7	2.9	2.8	0.8	3.3	0.9	1.1	2.0	15.8	7.9	2.9	60.3
Ferranti PC-2860AT — 1.2Mbyte floppy	9.3	3.3	3.6	8.1	8.5	18.5	4.4	19.1	4.5	7.5	15.1	56.6	37.8	7.2	203.5
Tandon PCA-30 — 1.2Mbyte floppy	10.2	3.3	4.4	13.1	13.4	37.4	13.1	33.9	14.6	8.6	15.6	303.9	150.7	34.7	656.9
Compaq Deskpro 286 — 1.2Mbyte floppy	10.5	4.0	4.0	12.5	15.0	16.4	5.0	17.5	5.3	8.0	13.4	75.0	45.5	18.2	250.3
IBM PC/AT — 1.2Mbyte floppy	10.9	22.8	23.9	23.2	21.9	17.6	4.2	18.4	3.6	6.1	14.3	73.8	36.4	7.7	284.8
IBM PC — 360K floppy	21	10	21	21	20	30	8	65	17	7	15	311	145	51	742

(continued from previous page)

3.10 to run both the IBM and the Tandon. The 1.2Mbyte floppy drives can read not only 1.2Mbyte discs but also 360K discs from IBM PCs, thus ensuring access to programs and data from many sources.

We ran a number of standard DOS 2.2 applications packages, including WordStar, Microsoft Word 2, Volkswriter, Lotus 1-2-3 and Ryan-McFarland's Professional Fortran. They appeared to load and run satisfactorily, though we did not test them out thoroughly enough to be able to say categorically that they are perfectly compatible. The only program which gave us problems was Sidekick, which would not run on the Ferranti. We are not sure what was going wrong; it may just have been an idiosyncrasy of our particular version of the program.

The Ferranti has the usual Centronics parallel port with a 25-pin D plug for a printer provided at the back, and there is a second parallel port on the monochrome video card. A serial port with a nine-pin D plug, as on the IBM, is also provided at the back. The Tandon comes without any ports at all so you will have to buy an expansion board even to attach a printer. Tandon makes a board which provides both a serial and a parallel port, and another with four serial ports. Presumably third-party boards would work too.

The Ferranti has six expansion slots. Two are for eight-bit PC-type cards; the other four take 16-bit PC/AT-style cards. On the standard machine one eight-bit slot is occupied by the disc-controller card and one 16-bit slot by the video card. The Tandon also has two eight bit slots, but has six 16-bit slots, two more than the Ferranti. One eight-bit slot is used for the video board and one 16-bit slot for the disc controller. You will have to use at least one more slot to provide serial and parallel ports, but that still leaves plenty of room for expansion. On both machines you can reach the expansion slots simply by removing a panel on the outer casing, which makes it particularly easy to add or remove add-on cards.

You will hardly ever have to remove the whole case — which is fortunate as on the Ferranti it is not a particularly easy job.

Inside there is a large power supply with a 300W rated output. It should be more than adequate to power any boards, discs or tape drives you may want to add to the basic machine. The full-height 20Mbyte hard disc is manufactured by Seagate, and the half-height floppy drive by Panasonic. There is room above the floppy for a second drive or a tape streamer. Cables for a second floppy are already in place.

The Tandon case unscrews and slides off in the same way as on an IBM PC. The power supply is rated at 190W — again, enough to cope with future expansion. On our machine a lot of makeshift wiring had been added to the motherboard, which suggests

TANDON PCA-30

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

A powerful machine at a good price, but the cost-cutting shows.

that there had been a number of last-minute design changes. A battery-backed clock is also provided.

There are four rows of sockets for memory chips. On the review machine two were populated by 256K chips, giving 512K in total. Adding two rows of 64K chips would bring this up to 640K, or you could plug in more 256K chips to make 1Mbyte. Tandon sells a plug-in board to add a further 2Mbyte.

On the Tandon machine both the full-height 30Mbyte Winchester and the half-height 1.2Mbyte floppy are Tandon's own units. There is room for two more half-height drives, and once again cables for a second floppy have been provided by the manufacturer. On our machine the hard disc made a dreadful whining noise that reminded us of a vacuum cleaner.

The documentation for both the Ferranti and the Tandon machines covers all the necessary ground quite effectively. The Tandon also comes with a really excellent technical manual; most manufacturers make you pay extra for documentation of this kind. On-site maintenance is included in the price of both machines. It lasts for a year in the case of the Ferranti and six months for the Tandon.

We enjoyed using the Ferranti. Though the casing is slightly larger than on some comparable machines, and the fan was unusually noisy, it left us with the feeling that it is a top-quality computer. Ferranti says that it has had no other complaints about the fan, so maybe ours had been damaged in some way. The only feature we would have liked to see added is a Reset button to allow you to restart the computer after a crash.

The Tandon's basic processor performance matches that of the Ferranti, and it is a great deal cheaper too. Like the Ferranti it lacks a Reset button, but it does have a lock and key on the front; this feature is present on the IBM PC/AT but not on the Ferranti. However, its disc performance leaves a lot to be desired and we did not find it as pleasant to use as the Ferranti. At first we had trouble with cooling fan which stuck, and the hard disc on our machine was noisy. The keyboard was very rattly and generally did not seem to us to be of the quality you would expect in a business machine of this price. The Tandon has potential, but it still has some rough edges.

CONCLUSIONS

■ Both the Ferranti 2860AT and the Tandon PCA-30 provide the high performance of the IBM PC/AT and more, at a lower price.

■ The Ferranti is a well-engineered, top-quality micro. For the Tandon, the main attraction is its price.

■ Both machines ran most IBM PC software without difficulty. The Tandon may turn out to be a little better than the Ferranti in this respect.

■ While the Ferranti's disc performance is above average, that of the Tandon was disappointing. This might be an important drawback for some applications. PC

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CS03/140/125

NEC PAGEWRITER LASERS MEET THEIR MATCH

By Ian Stobie

A second generation of page printers based on LED technology looks set to undercut lasers.

Since they arrived in the personal-computer market in 1984 laser printers have been remarkably successful. They have rapidly established themselves as quick, quiet alternatives to the noisy, slow daisywheel in traditional word-processing applications and are a crucial element in the expanding personal-publishing market.

The only problem with these highly desirable machines is the price, which seems to have got stuck just below the £3,000 mark. Now NEC has introduced a new printing mechanism working on slightly different principles. This may herald the price breakthrough everyone has been waiting for.

The NEC Pagewriter is going on sale in the U.K. at a price of around £2,500. It is not a laser printer, but uses a similar page-printing technique based on light-emitting diodes (LEDs). The LED technique involves fewer moving parts and is potentially cheaper to manufacture.

As well as using this technology in its own printer NEC is selling the LED printing mechanism to other manufacturers to incorporate in their machines. Already Datasouth has announced a machine built around the NEC printing engine. It offers

more features than NEC's machine at a slightly higher price.

LED printers work in almost the same way as laser printers — they are basically photocopiers, working from the image of a page held in a memory buffer rather than from a physical original. The difference lies in how the printer gets the page image from the buffer on to the photocopier-style drum. Both use a fluctuating light source to paint it on to the rotating photo-sensitive drum. Laser printers use a moving beam of light from a small semiconductor or gas laser, while LED printers use a wide slit of light from an array of LEDs.

ROD LENSES

NEC's mechanism has 2,432 LEDs arranged in a single row about 8in. long. This gives the printer a horizontal resolution of 300 dots per inch, as each LED is responsible for one tiny dot on the finished image. The light from the LEDs is guided the short distance to the surface of the photo-sensitive drum by a matching set of rod lenses. The LED array and the rod lenses are manufactured as a single assembly.

In a laser printer, by contrast, there is a single light source, a small gas or semiconductor laser. The beam from the laser is chopped up into dots and scanned across the drum by a rotating polygonal mirror. Proponents of the LED approach say this makes laser printers more difficult to manufacture and less reliable.

With either system, once the light arrives

at the surface of the photo-sensitive drum things proceed in much the same way. The drum is initially electrostatically charged, and rotates steadily past the LED or laser head so that the surface is progressively scanned by successive waves of light. Where the light strikes the surface the electrostatic charge is destroyed. A dark, plastic-based toner of opposite charge is then released on to the surface of the drum; it sticks to some parts and not to others, depending on the charge present, and so forms an image. The image is then rolled on to a piece of paper and fused to it by hot rollers. This part of the process is almost identical to that used in many office photocopiers.

Printer output samples produced by LED and laser printers are practically indistinguishable. The popular Canon LBP-CX laser engine is used in many laser printers, including the HP Laserjet. The NEC LED mechanism gives the same resolution, 300 dots to the inch both horizontally and vertically, and runs at the same speed of eight pages per minute.

If there is no difference in quality, users are likely to decide on the basis of factors that have nothing to do with the printing mechanism itself. These include the range of founts and interfaces available, the cleverness of the controlling software, the paper handling, and so on. NEC's own new offering has rather good paper handling but a fairly limited range of founts at present. Compared to a laser printer, the machine looks less like a photocopier and more like a conventional daisywheel printer because the paper handling dominates its appearance.

There is a large 250-sheet input hopper at the back of machine and immediately in front of it is the 250-sheet output stacker. Pages are collated in the same order that you print them. The paper handling is very quiet. Since the LED printing process also makes very little noise the machine is exceptionally quiet.

PRINT OPTIONS

On the front of the machine is a small liquid-crystal display and four touch-sensitive switches. You use these to choose various printing options, including the fount you want to print in, assuming this is not overridden by the software you are running on your computer. The machine comes with four different variations of Courier already installed; 10 and 12 pitch, italic and Courier special symbols. Courier is a popular typewriter and daisywheel fount, suggesting the initial market NEC is looking

TECHNOLOGIES COMPARED

The LED technique involves fewer moving parts than laser printers, and so is potentially cheaper and more reliable. At the moment most manufacturers have more experience with laser-based systems. Second-generation laser printers with improved features are coming on to the market at the same time as the first LED printers.

What is likely to happen in the near future is that LED printers will take over the lower-cost end of the high-quality print market. Given the complexity of the photocopier parts of the system it is unlikely that either LED or laser printers will cost less than £1,500. The multi-pin matrix printer with an 18- or 24-pin matrix head provides generally acceptable but slightly inferior print quality and in this area it will rule supreme. Daisywheels may survive, competing on price at the very bottom of the quality print market.

	Technology	Speed	Price
Dataproducts LZR-1200	laser	12	£3,100
Qume Laser 10	laser	10	£2,880
Datasouth Pagewriter 8	LED	8	£2,950
Xerox 4045	laser	10	£4,045
Document Technology DL-20	LED	12	£6,500
NEC Pagewriter	LED	8	£2,500



SPECIFICATION

Speed: eight pages a minute
Founts: Courier 10 and 12 pitch, Italic and Symbol resident; two cartridge slots for additional founts
Resolution: 300 dots per inch horizontally and vertically
Graphics: full page at 75 dots per inch, one-eighth page at 300 by 300; optional 1.3Mbyte graphics board allows full-page graphics at full resolution
Paper handling: 250-sheet input and output trays standard; optional additional input tray
Interfaces: Centronics parallel and RS-232 serial ports standard
Consumables: separate toner and photo-sensitive drum cartridges; toner lasts a claimed 2,500 pages and costs £12 to replace, drum lasts 5,000 pages and costs £75
Price: around £2,500 for standard machine, optional 1.3Mbyte graphics buffer about £500, additional paper input tray £230
Manufacturer: made in Japan by NEC
Supplier: NEC Business Systems (Europe) Ltd, 35 Oval Road, London NW1 7EA. Telephone: 01-267 7000
Availability: late summer 1986

for is daisywheel replacement. You can buy additional founts in cartridges which plug into two slots below the front control panel. Altogether you can have up to 12 founts and fount variations available at one time. You can choose these either from the front panel or under software control and mix founts on the same page.

GRAPHICS COMMANDS

The standard NEC Pagewriter has limited graphic capabilities compared to, say, the HP Laserjet Plus or Canon LPB-8 A2. You can put tints over areas of text or draw boxes around things, but that is about the limit of it. To do more you need the 1.3Mbyte memory board, which costs £550. This gives you graphics in 300- by 300-dot resolution over the whole page area, and responds to commands in HPGL, a common graphics language used by software designed to work with Hewlett-Packard plotters.

All page printers, whether LED- or laser-based, require large quantities of memory before they can cope with detailed graphics at full resolution. This is a fundamental consequence of the fact that the image is first built up on a charged surface and not directly on paper. The photo-sensitive drum rotates at a fixed and even speed, and cannot wait for light to arrive. Data has to be immediately to hand to drive the light source.

When handling text in a known fount a small buffer is adequate. The data to drive the light source can readily be worked out from the information in the fount cartridge and text buffer. But working out graphics from some encoded description would take too long, so graphics have to be present inside the printer in full bit-image form to get to the surface of the drum in time.

printed

Enlarged sample of the Pagewriter's Courier 10 fount. Print quality is on a par with cheaper laser printers.

The speed of the printing process is ultimately governed by the physics of the drum surface and the intensity of the LED or laser light. They are carefully chosen during the design process and determine the speed the drum can realistically be made to rotate, and this in turn determines how fast a page is printed.

In practice, before a page containing graphics is actually printed, there can be considerable delay while the full bit image is prepared in the page buffer from the data arriving at the printer interface. We were unable to try out the NEC with its graphic option installed, but with any LED or laser printer it is well worth finding out how long this delay is likely to be. Once you have printed one copy of a page, any subsequent copies you print will probably come out at the speed quoted in the manufacturer's literature — eight pages a minute in the NEC print engine's case.


NEC appears to be aiming its appeal initially at word-processing users rather than at the more ambitious graphics or personal-publishing market. A daisywheel printer in the £1,000 to £1,500 range will go at perhaps 55 characters a second, which makes it a good deal slower than a page printer. You will probably need to buy a sheet paper feeder for it if you want to use ordinary stationery, and an acoustic hood is advisable if you intend using a daisywheel in an ordinary office. These extras considerably reduce the capital cost advantage of the daisywheel printer.

Ribbons are the main running cost of a daisywheel, so your consumable cost will vary a great deal depending on the sort of printing you are doing. A £5 carbon ribbon might last 300,000 characters. If your typical letter has, say, 30 lines of 70 characters you would need a new ribbon every 150 or so pages. This gives you a ribbon cost of 3.5p a page.

NEC has separate cartridges for the Pagewriter's main consumables, the toner and the drum. The toner lasts for a claimed 2,500 copies and costs £12 to replace, while you have to replace the drum after 5,000 copies at a cost of £75. The machine will not let you use the drum for more than 5,000 copies. Pagewriter consumables therefore cost about 2p a page.

Impact printers like the daisywheel still enjoy one advantage over laser and LED printers — they allow you to print on multi-part stationery or use carbon paper for simultaneous copies. But the NEC can handle a good variety of different paper stocks, just like a photocopier. Using the manual feed you can print on envelopes, and the machine prints on most types of overhead-projector film.

CONCLUSIONS

- LED printers will join laser printers as a plausible choice for anyone requiring a high-performance office printer. The performance of the NEC unit is on a par with that of the cheaper laser printers.
- Only price prevents the wider use of page printers. As production of LED units gets under way, costs may drop far enough to enable LED printers to undercut the cheaper laser machines.
- The NEC Pagewriter is very quiet and has good paper-handling facilities, making it attractive for heavy word-processing use. 

PARADOX THE LANGUAGE

By Mike Lewis

A full applications language forms part of Ansa's ambitious database.

Paradox is a heavyweight among database managers. In the first part of this review in last month's *Practical Computing*, page 66, I reported on how some of its highly sophisticated features can be put to work by the non-technical user. But there is another side to this remarkable product: the Paradox Application Language, or PAL. This is a true programming language which has a great deal to offer programmers and application developers.

At heart, PAL is an interpreter, in the same mould as dBase or Basic. At the same time, it is tightly integrated in the Paradox environment. It has its own Paradox-style top-line menu, which can be accessed from almost any point in the main system, and PAL programs can be freely mixed with normal Paradox working. Alternatively, a program can be invoked from the DOS command line, thus allowing a programmer to shield users from the underlying mechanism.

However, you do not need to be a programmer in order to use some of PAL's more elementary features. A PAL program — Ansa calls them scripts — need contain nothing more than the sequence of keystrokes required to perform some often-repeated task. An ordinary Paradox user can record, and subsequently play back, the script using normal menu commands, without recourse to PAL.

There are two ways to run a script. The normal Play command, which can be invoked from within either Paradox or PAL, simply executes a program and displays the final results. By contrast, Showplay performs each step separately, showing every recorded keystroke in turn. This is a very handy aid to debugging small scripts.

INSTANT SCRIPT

One drawback of playing scripts is that, because each script is held as a separate text file, you have to specify its name whenever you want to use it. Although this is an easy enough task, it does represent something of an overhead for short scripts which consist of just a few keystrokes. To overcome this, you can set up a file called an instant script, which can be put in motion just by pressing a function key. Unfortunately, only one instant script can exist at a time.

An alternative approach is to use a feature called the mini script. This is rather like the immediate mode in Basic: you type in a command, and it is executed straight away without being saved. PAL is superior to Basic in that you can enter a whole string of commands in this way, including conditional statements and small loops.

Mini scripts come into their own when used in conjunction with a Setkey statement. This is a normal PAL command, which assigns a further string of commands to any nominated key. The assigned commands can even include a Play statement, which means that an imaginative programmer can make a single key do just about anything that Paradox is capable of, including running an entire application.

PARADOX

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

A product to consider if you want maximum power from your database. Don't expect to learn it overnight.

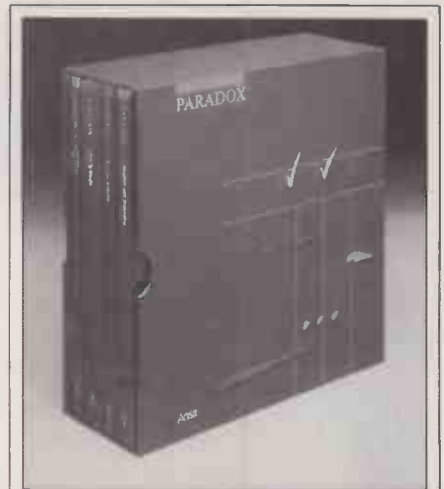
An interesting point about script files is that the record of keystrokes is held as ordinary text. Every Paradox key has an English name, and menu selections are represented by words within braces. So a script containing

Menu {View} {Customers}

will have the same effect, when run, as if the user had pressed the Menu key, f10, then selected View from the top-line menu, then selected the Customers table from the subsequent sub-menu.

This use of ordinary text is important because it allows the developer to use keyboard scripts as a starting point for more ambitious programs. These can be created via the keystroke recording technique, then enhanced and extended with a text editor or word processor. Alternatively, they can be typed in from scratch in the normal way.

In fact, PAL has its own editor, accessible from its menu. Considering that this is a small module of a very large package, it is surprisingly good. It supports all the usual



SPECIFICATION

Description: relational database with strong reporting and querying features; also includes the PAL applications development language and Paradox Runtime for running stand-alone applications

Hardware required: IBM PC or compatible with at least 512K RAM and MS-DOS 2 or later; a hard disc is strongly recommended

Copy protection: none; early versions are protected

Price: £550

Publisher: Ansa Software, Belmont, California

U.K. distributor: P&P, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744. Softsel, Softsel House, Syon Gateway, Great West Road, Brentford, Middlesex TW8 9DD. Telephone: 01-568 8866

Available: now

cursor movement, inserting and deleting operations, as well as the ability to combine text files. However, there are no cut-and-paste facilities, nor can you print the text from within the editor. As with most language processors, you would do well to have your favourite editor or word-processing program to hand for large-scale text manipulation.

Compared to most high-level languages, PAL is large. It has around 60 commands and nearly 100 built-in functions, in addition to all the usual arithmetic, relational and logical operators. There is no theoretical limit to the number or total size of variables that can exist. PAL even allows arrays, albeit with just one dimension, something which I have badly missed in dBase II and III.

There are six data types: alphanumeric strings, floating-point numbers, dollars, dates, integers and logical. Variables do not have to be pre-declared. As in dBase, their types are determined each time a value is assigned to them, and they can therefore be retyped during the course of program execution. An unusual feature is that different elements of the same array can have different data types.

PAL programs can also access records in data files — known as tables in Paradox


```

;WHAT.SC - Script to display project assignments for a person

title = format("w80,ac", "Description of the What Function")
@4,0 STYLE REVERSE
? title
STYLE
@ 7,0
TEXT
    This function asks for a person's name and then displays
    all projects that the person is assigned to.

ENDTEXT
SLEEP 3000

WHILE (TRUE)
    ; Enter a valid name in the People table to then use to query Assign

    EDIT "People"           ;Edit the People table
    END                     ;get to bottom
    DOWN                    ;append blank record
    MENU (Image) (PickForm) (2) ;select form to get name
    MOVETO [First]
    WAIT RECORD UNTIL "F2"
    IF (ISBLANK([Last])) THEN ;exit change loop on blank last name
        DEL                 ;remove last record in the table
        DO_IT!              ;get out of edit mode
        CLEARALL            ;clear workspace
        QUITLOOP
    ENDIF
    last = [Last] + ".."    ;set pattern to find key
    first = [First] + ".."
    CANCELEDIT              ;cancels edit used to get name
    CLEARALL                ;clear workspace

    MENU (Ask) (People)     ;get query form for People table
    [Last] = last [First] = first ;fill in form
    [#] = "Find"            ;place Find command in leftmost column
    DO_IT!                  ;perform the query

    ; The "Answer" table will now contain any found records.

    IF (NRECORDS("Answer") = 0) THEN
        MESSAGE "Name not found"
        c = GETCHAR()
        LOOP
    ENDIF

    last = [Last] first = [First]
    CLEARALL CLEAR
    msg = " Locating " + first + " " + last + "'s timesheets...."
    @ 0,0 ? msg

    ; Query the table to display all records for the requested name.

    (Ask) (Assign) CheckPlus Right ""last" Enter ""first"
    DO_IT!                  ;perform the query
    CLEARALL                ;clear the workspace

ENDWHILE

```

The PAL commands cover the entire range, from basic low-level tasks to sophisticated mini programs. There are a number of high-level operations which would otherwise take many lines of code to implement.

terminology. Square brackets are used to identify a field, so

[Customer→phone number] is the phone number field in the current record of the customer table. An empty pair of square brackets denotes the field currently containing the cursor.

The PAL commands cover the entire range, from basic low-level tasks to sophisticated mini programs. At one end of the scale there are the traditional statements for moving the cursor, printing a line on the screen, assigning values to variables or arrays, and the like. Some of these are features which would be very useful in other languages: the Sleep command, which simply does nothing for a specified number of seconds, is one example.

At the other extreme, there are a number of high-level operations which would otherwise take many lines of code to implement. A good example is Showmenu, which generates a Paradox-style menu on the top line of the screen, and allows the user to make a selection. The programmer supplies the names of the choices and the text to be used for the explanatory messages that go with them. You do not have to worry about the mechanics of menu selection; this all goes on behind the scenes.

PAL also supports a number of program structure commands, including If-Then-Else-Endif, Switch-Endswitch and While-Endwhile. In addition, there is a Scan-Endscan construct, which causes a sequence of commands to be executed for every record

in the current table. So you could implement a global file update with a very short program, such as:

```
Scan [Price]=[Price]*1.25 Endscan ;uplift
prices by 25%
```

The semicolon is used to introduce a comment.

As well as the commands, there is also a large repertoire of built-in functions. Many of them like ASC() and CHR(), will already be familiar to the experienced programmer. Others seem to belong in the world of spreadsheets rather than that of programming. For example, there is CNPV(), which computes the net present value of a series of cash flows; PMT() returns the mortgage payment per period for a given principal, interest and number of periods.

U.S. FORMATS

A large number of functions are available for simpler mathematical and trigonometrical calculations, as well as eight for manipulating dates and times. Unfortunately, these only work with American formats — Paradox does not support European dates. There are even functions for finding the name of the current directory, testing to see if a disc drive is ready, and determining the type of monitor in use.

If all this is not enough, you can write your own functions which can accept parameters and return values. These are in addition to subroutines, which are lower-level scripts invoked by the Play command. User-defined functions are held in RAM at run time, and are therefore suitable for often-repeated tasks. Scripts, on the other hand, are accessed from disc as they are needed.


All these goodies put PAL way ahead of its rivals. It certainly leaves dBase III standing, and is more than a match for the real heavy-weight database languages like Rbase 5000 and 4GL. For many jobs, it might even be a better option than traditional tools like Basic and Pascal although, being interpreted, it will inevitably run more slowly than compiled languages.

CONCLUSIONS

■ Paradox itself, reviewed in the first part of this article, is an extremely powerful database manager which offers a serious challenge to the market leaders like dBase III Plus. It will almost certainly sell in large numbers at the very top of the market, but it is probably too sophisticated for the majority of simpler day-to-day filing applications.

■ It is a true relational database, treating files as two-dimensional tables which can be linked in various ways. The query and report functions are especially useful.

■ The Paradox Application Language is a remarkable development tool. It puts the power of Paradox in the hands of programmers and suppliers of turnkey systems. It is likely to meet the demands of even the most ambitious users.

■ Neither Paradox nor PAL is particularly easy to learn, which is inevitable in view of their size and complexity. Ansa goes a long way in helping the user, with first-class help screens, excellent manuals and a familiar Lotus-style menu bar. 

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BBC PAGE MAKERS

CHEAP PERSONAL PUBLISHING

By Carol Hammond

Using Fleet Street Editor or AMX Pagemaker you can get full page output from your BBC system.

It is not only the likes of Rupert Murdoch and Eddie Shah who are ringing the changes in the printing industry. At the other end of the scale, the production of camera-ready copy for newsletters, catalogues, price lists and in-house publications can now be done direct from a microcomputer. The pre-eminent machine for these personal-publishing programs is the Macintosh. Its high-resolution graphics make it ideal for displaying a full page in detail. Now personal-publishing programs are also beginning to appear for cheaper micros. Mirrorsoft's Fleet Street Editor and Pagemaker from Advanced Memory Systems are available for the BBC Micro in its various forms.

Mirrorsoft is a subsidiary of Mirror Group Newspapers, and Fleet Street Editor reveals its roots in the way it approaches personal publishing. The program consists of six departments which mirror the different stages in newspaper and print production. This is fine if you are used to the jargon of the printing industry, but for most users it seems an unnecessary burden.

Fleet Street Editor comes on two discs, one containing the system disc and the other a Graphics Library. The manual is ring-bound and very helpful. It takes you step by

step through the program and explains clearly what you have to do. There are suggestions on page layout, and hints on how to run off copies of your finished page.

You start by inserting the system disc and pressing Shift and Break to enter the main menu, which consists of six icons representing the different departments. The Graphics Library is represented by an icon of a transparency, for example, and all the other icons are equally easy to understand. The 200K Graphics Library contains illustrations, symbols and typefaces you can incorporate into your own work.

The Studio is a drawing package where you can produce your own illustrations and modify existing artwork. Copydesk is a word processor for entering text; you can choose from 10 founts, and Fleet Street Editor displays type in the appropriate fount as you enter it. Page Makeup is where you define the format you want your page to take and where you put together your text and graphics to make a page. Preview and Print provides a reduced representation of your completed page on-screen; this is where you send your page to the printer. Administration is where you set up the program to suit your system, format blank discs, and integrate graphics created with other programs or systems.

To enter a department you press the space bar until the required icon is highlighted, then press Return. The first time you use Fleet Street Editor you have to go to the Administration department to set up the system. It is easiest to do two-column layout on Fleet Street Editor (left); on Pagemaker (below) it is just as simple to do multiple columns.

system to suit your printer and disc drives, and to format a working disc. You can then select Guided Tour, which takes you through the whole page makeup process.

When using the system in earnest you should go to the Graphics Library first. A large work-area window is displayed on-screen along with two smaller windows, one for messages and one saying where you are. A miniature version of the main-menu icon is displayed at the foot of the screen, indicating which department you are in. Graphics Library functions are represented by a column of icons on the right of the screen. You use the space bar or the Up and Down cursor keys to highlight the required icon, and then select it by pressing Return.

SELECTING GRAPHICS

The graphics contained in the library are reproduced at the back of the manual, complete with page number. To select a particular graphics item you load the relevant page into the work area, then Cut and Paste to get the item you want. A box appears on-screen, and you use the cursor keys to move the box to the graphic, press Return and then use the Right and Down arrows to stretch the box to encompass the graphic. Then you press Return and the screen clears, leaving a box in the middle. Using the cursor keys, you move the box to the area of the screen where you want the graphic to appear, then press Return again.

This is a long-winded process and I had difficulty remembering which key did what, and sometimes pressed the wrong one. To save a graphic to disc you have to go through a similar process of stretching a box to encompass a graphic. A template is supplied with the program to slip above the function keys, but I did not find it helped much. The complex key combinations which are required by Fleet Street Editor proved to be its downfall for me. I found it slow and frustrating to use.

To begin to make up a page you return to the main menu and select Studio. Again there are work area and information windows, plus 34 commands represented by two columns of 16 icons up the right-hand edge of the screen and 18 in two rows along the bottom. The work area has horizontal and vertical rule markings which appear 11mm. apart on an A4 sheet. You could use them to measure the space required for a photograph to stick on later, but it would be quite a fiddly process.

You select the icons using the cursor keys and space bar, but here the key assignments

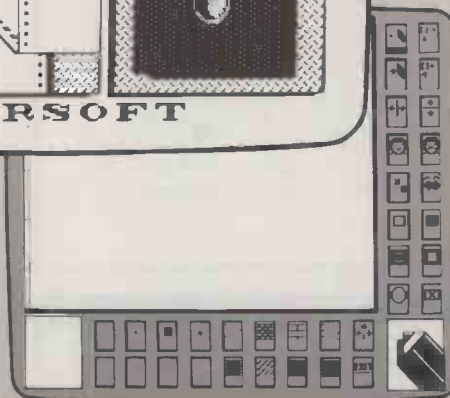
(continued on page 70)



FLEET STREET EDITOR



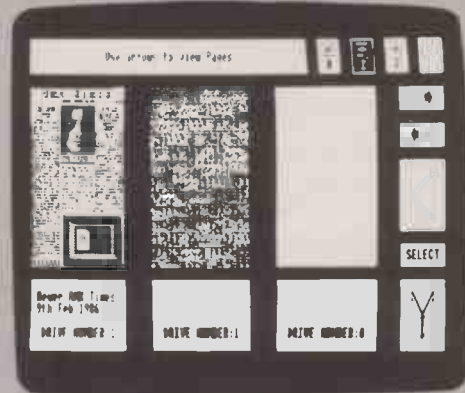
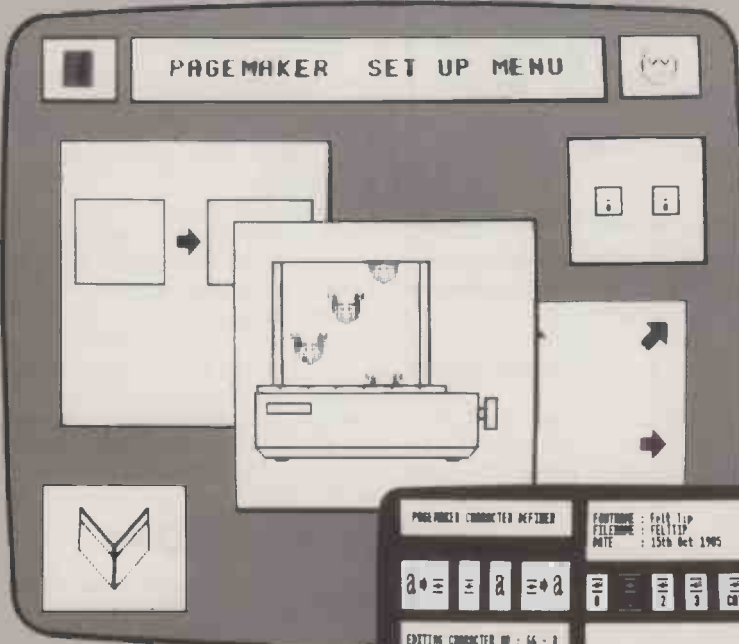
Above: The main menu.
 Top right: To select a graphic you load a page from Graphics Library into your work area.
 Right: Studio allows you to manipulate graphics.



SPECIFICATION

Description: disc-based page make-up package
Hardware required: BBC model B, B+ or Master with one or two floppy-disc drives, 40 or 80 track; version for Amstrad 6128 and 8256 expected summer 1986
Copy protection: system and four discs are protected; backup set available to registered users for £15
Price: £39.95 including VAT
Supplier: Mirrosoft, Maxwell House, 74 Worship Street, London EC2A 2EN. Telephone: 01-377 4600
Available: now

AMX PAGEMAKER



Above: The icons used in Pagemaker's Setup menu are not easy to understand.
 Top right: You can see full pages in Preview.
 Right: In Define you can design up to 91 characters, symbols or patterns.



SPECIFICATION

Description: ROM/disc-based page make-up package
Hardware required: BBC model B or B+ with one or two floppy-disc drives, 40 or 80 track; Amstrad 464, 664 and 6128 versions also available
Copy protection: Font disc may be backed up; Processor section of system disc is protected; backup discs £2.50
Price: £49.95 including VAT; AMX Mouse £40
Supplier: Advanced Memory Systems, 166-170 Wilderspool Causeway, Warrington WA4 6AQ. Telephone: (0925) 413501
Available: now

(continued from previous page)

are more confusing than ever. The Left and Right cursor keys take you through the two rows at the bottom of the screen, which is natural enough, but they also move you up and down the columns at the side of the screen. The Up and Down cursor keys switch from the bottom of the screen to the side. The space bar moves through all 34 icons in a continuous circuit. The easily recognisable selector box at the side of each icon, which is used in other departments, is replaced here by a small black bar at the bottom of each icon which is not nearly as clear.

While you are in Studio you can load in any graphics you have saved on disc and manipulate them in a number of ways: enlarge, reduce, copy, frame, rotate, fill with patterns and write on them using different pens. You use the red function keys to select the ink colour and thickness of lines and the speed at which to write with them. Once more the need to use a multitude of key combinations proved slow and confusing. However, if you do make a mistake you can select the Sad Face icon to restore things to the way they were before the current operation. It is in this department that you can prepare headlines if you want to use any of three fancy large founts contained in the Graphics Library.

COPYDESK

Once you have decided on your headline and illustrations you will want to enter text. To do so you move to the Copydesk department. You can transfer existing View or Wordwise files into Copydesk if you wish. The Copydesk screen contains a work area, plus a narrow overflow window that can store up to 256 characters. A message window lies at the foot of the screen, and at the top right of the screen is a fount window displaying the founts currently in use.

Before typing in text you load in any graphics you have made and position them on the screen. The text you enter then flows around the graphics. This is a neat feature, but it does have its traps: for example, if you position a graphic at the top left, you have to make sure there is no room around it for a stray character to flow in.

Two body-type founts are available; you press f2 to switch between them while typing. Samples of the two faces are on permanent display in a small window at the top of the screen. In addition there are six double-height founts and two single-height founts which are selected using Shift-f3.

Once you have finished deciding what text and graphics you want on your page you proceed to Page Makeup. The screen displays a large panel roughly the shape of an A4 sheet, an operations window, and a format window from which you can select either a four-panel format or an eight-panel one. Each left-hand panel on an eight-panel format can be stretched to full page width to accommodate banner headlines, etc.

A catalogue of the files on your user disc appears in the operations window. You choose which files go in which panels by using the Up and Down cursor keys to select

the file name, and then pressing Return. If you want to leave a panel blank to insert a photo you select the empty box on the catalogue. When you have filled all the panels you give the page a file name and save it.

I found this method of laying out a page hard to use. You need to have arranged your layout to fit into box-shaped areas, which means you have to be very systematic, with a good idea of how you want your page to look from the beginning. It also leads to dull layout.

To see what your page looks like you move on to Preview and Print. There are three windows: a display area, a catalogue window

FLEET STREET EDITOR				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Good for simple layout if you can master the keyboard commands.

AMX PAGEMAKER				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

As sophisticated a page layout tool as you can get on the BBC Micro.

and a mode window. The catalogue window shows the file names of the pages on the user disc. The mode window is where you decide the size and quality of output to have, and whether to have a rule down the centre of the page.

Advanced Memory Systems' AMX Pagemaker allows for more sophisticated page layouts than Fleet Street Editor. The package contains two 16K ROM chips, a system disc, a Font disc and a 92-page manual. I used Pagemaker with an AMX mouse, but you can also use it with a joystick or direct from the keyboard.

The mouse makes Pagemaker much quicker and simpler to use than Fleet Street Editor. However, the AMX unit did not seem to be up to the job: the buttons pinged off the first one we had after about five minutes' use, and a replacement fell apart in the same fashion. The movement of the mouse was also erratic, and the cursor did not always move as I wanted it to.

The Pagemaker main menu displays four

icons indicating the main modules of the program. Setup is where you set up the program to suit your system. Define is where you can define your own characters and patterns. Preview is where you preview pages created. Processor is where you lay out the pages. You select a module by clicking the cursor over the appropriate icon.

ICONS UNCLEAR

In the Setup module there are seven icons, none of which are as immediately clear in their meaning as those of Fleet Street Editor. For example, the icon for sound on/off is a boss-eyed smiling face. Sometimes the programmer indulges his sense of humour at the expense of clarity. Options are available which allow you to reposition the screen on your monitor, alter the screen colours, format and initialise discs, and select the type of printer to be used. In Define you can design up to 91 characters, symbols or patterns on a 16-by-16 grid.

Processor combines the functions that on Fleet Street Editor are divided between Studio, Copydesk and Page Makeup. The screen display shows a large window with an inch/centimetre scale on all four sides. Above it is a narrow message window, and on the right is a column of icons. Clicking the required icon will highlight it, and produces a menu in the message window. Some options have their own own sub-menus. You can use the Scroll icons to scroll up and down the screen to see what your page looks like. Processor will only display half a page at a time. To view a full page you have to go to the Preview option.

You can load text into Pagemaker from Wordwise and View files if you wish. Text can be ranged left, justified or centred, and can be positioned anywhere on the screen. You can draw boxes and then run text into them, cut and paste, stretch, resize, rotate, flip, zoom and spray patterns on text and graphics.

Text can be typed in any of 17 founts, each of which can be in a variety of sizes. For example, you can alter the body size of the founts to appear bigger or smaller. If two characters appear too close together they can be shifted a pixel at a time.


To print out a page you select the printer-dump icon. Dumps can be A4 or A5 size and of two qualities. They can be of a whole page, what appears on-screen or of a windowed part of the page.

CONCLUSIONS

■ FSE and Pagemaker bring personal publishing to the BBC Micro at a reasonable price, although Pagemaker is not so cheap if you have to buy the mouse.

■ FSE is let down by its confusing command-key assignments. Pagemaker made life simpler using the mouse.

■ FSE's six departments make it harder to use than Pagemaker, which has only four modules.

■ Both products are restricted by the lack of memory on the BBC model B, which means work continually has to be saved to disc. 

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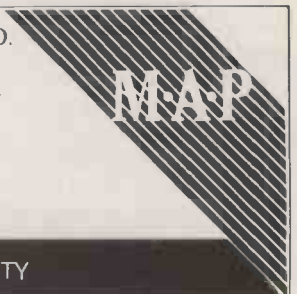
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MULTIMATE ADVANTAGE WP WITH FILING

By Susan Curran

Multimate is one of the top-selling office word-processing programs. The latest version adds a filing capability to the established, reliable WP functions.

Multimate has been among the most commercially successful of the full-featured word processors for the IBM PC and compatibles. I tested Multimate Advantage 3.5, a new package which adds a cardbox-type filing program to the word processor with spelling checker.

This adds up to a formidable package. There are four manuals, over 1,000 pages in total, and seven different discs, to say nothing of a book rest, sticky labels for the keyboard and other oddments.

The package comes in a cardboard slipcase, which you have to remove from the shelf before taking the manuals from it. It is about an inch taller than standard IBM-style slipcases. The manuals are spiral-bound with thin card covers. I found the whole arrangement rather messy and cumbersome.

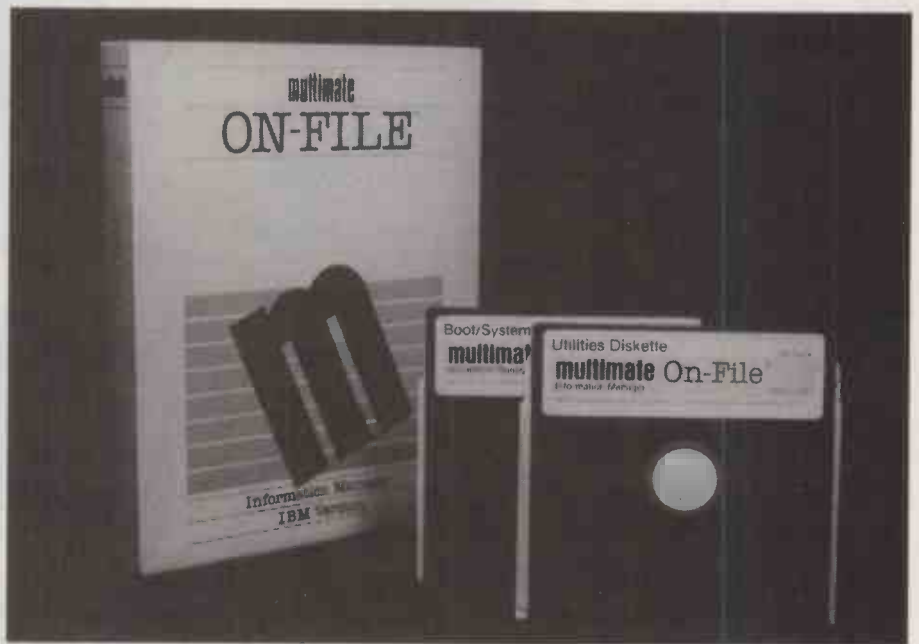
The word processor has three manuals: a Beginners' Guide, a Reference Guide and an Advanced Users' guide. There is a single index to the three in the Reference Guide.

Instead of the usual keyboard template there is a map of the keyboard and a set of rather flimsy sticky labels, several of which tore as I removed them. Many of them go on the front of the keys, and you have to prise off the keys tops to stick them on. I found this easy enough, but once in place the labels were hard to read. I also found some of their legends confusing. For instance, it took me some time to realise that Scrl1 Lft moves the cursor to the start of the line.

TAKES TIME TO LEARN

Multimate is not an easy package to master. There are a multitude of functions handled by a bewildering variety of keys. Each function key has four functions and most alphanumeric keys have a second function. However, the on-screen help is good, and there are two tutorials. One is on disc, the other is in the Beginners' Guide. The disc tutorial is a very well-presented introduction, though it does not pass beyond the elementary level.

Multimate is based around a main menu which controls editing, printing, spelling checks and the various utility functions. In edit mode, normal operations are all



The On-File cardbox is integrated with the basic WP program.



SPECIFICATION

Description: word-processing package with spelling checker and filing program

Hardware required: IBM PC, PC/XT, PC/AT or compatible with 320K RAM and two discs, DOS 2.0 or higher

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Copy protection: none

U.K. supplier: Ashton-Tate (U.K.), Oaklands, 1 Bath Road, Maidenhead, Berkshire SL6 1UH. Telephone: (0628) 33123

Available: now

handled by key commands; there are no subsidiary menus. It is necessary to quit a document and return to the main menu in order to print it.

Documents are handled entirely in pages. Only one page of a document may be viewed on-screen at once: you cannot see the bottom of one and the top of the next.

Neither are there any split-screen or alternate-screen facilities, which makes this feature particularly exasperating. Whenever you move from a page it is saved on disc, and apparently removed from memory. It is therefore necessary to wait for disc accesses before returning to a previous page to check its contents. I do not see why a page cannot be retained in memory after being saved. However, this arrangement gives the program a very high degree of data security. Saves are usually automatic, though they can be aborted.

The paging arrangements are very flexible and cope well with varying lengths, widows and orphans, and so on. The program will paginate automatically when a document is first created, but you have to order repagination after edits which alter page lengths. Repagination is rather slow. I found these arrangements confusing, particularly when headers and footers are used, and I generally found it necessary to repaginate several times to get adequate results. Manual repagination often proved better than automatic, and I cursed the lack of a conditional page-break command, as sub-headings kept being stranded at the bottom of pages.

The editing screen is clear and uncluttered. Symbols for tabs, hard Returns and printer features such as subscripts are shown within the text. The default editing mode is otype. You can toggle into an insert mode, which normally opens up a space for each insert. Push-forward insertion

No easy business, printer support. Multimate claims to support proportional spacing on this Tandy printer, but I find the results disappointing. This sample was printed with a special proportional daisywheel, but the proportions don't look right to me. However, it is rare to find a program that offers combined ps and microjustification at all.

Multimate handles microspace justification on a wide range of printers. This sample is printed on a Tandy daisywheel. You can see that the microspacing avoids the 'rivers of white' appearance that crude justification tends to give.

Multimate supports an unusually wide range of printers. On most of these models it deals automatically with proportional spacing, microjustification and extended character sets.

is available as an alternative, though Multimate seized up from time to time in this mode. Perhaps my freedom with inserts was too much for it. Text is reformatted automatically and fast after each editing change.

Reformats on margin changes are also handled automatically once the format line has been altered. However, format lines tend to proliferate throughout the text, and you have to ensure that every one is altered to achieve the desired effect. Justification and double/treble line spacing are not echoed on-screen.

There are a good range of cursor commands, though these are shared uncomfortably between the cursor keys and the function keys. In general screen response is good, though there is a discernible delay in deleting, and long pressure on the Delete Character key can have unfortunate results.

UNCLUTTERED SCREEN

Multimate is aimed at the office market. Each document comes with its own summary screen, which includes space for noting authors, operators and addressees, and the opportunity to list key words to help in retrieving documents. A word count is available through the spelling checker.

As well as all the basic functions, Multimate handles footnotes and section numbering. There is no automatic indexing, and no newspaper-style columns. Columnar calculations are handled, but maths capabilities are otherwise limited. Multimate's strong points are its printer support and boilerplating operations.

Named libraries can be set up to hold standard paragraphs for inclusion in documents. This feature is distinct from the mail merge operation. But there is no easy method to save a block of text separately within an existing file.

There is excellent provision for building macro-type key procedures, including pauses and prompts, which are well suited to streamlining completion of forms and similar tasks. Macros are available, but they are too slow to be suitable for the abbreviation of single words and phrases.

I was not impressed by Multimate's

spelling checker. You have to return to the main menu to order a spelling check, which is then performed blind. All unrecognised words are flagged, and when you return to the document file they blink at you. The blinks can be edited manually or via a separate Spell Edit routine. This lacks a command to ignore the word for this document only, but it does provide spelling suggestions. I found it very hard to locate the cursor amid the forest of blinking words, and the entire procedure is slow and tedious, even on a hard-disc machine.

Multimate has the best printer support I have seen on a word processor. An enormous number of printers are covered. I was

MULTIMATE ADVANTAGE				
VERDICT	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A competent professional word processor.

surprised to find specific support for my own Tandy printer as few other programs provide it. I found it worked quite well, though the translation table used for proportional spacing gave some weird results. Many other users of less popular printers will find the same.

Printer defaults can be altered on any print run, and it is easy to switch between alternative printers. There is good support for print queuing, including a delay feature. There is also an option to choose between background and foreground printing, though merge printing is always done in foreground mode.

My only criticism is the lack of a quick Block Print feature. To print a letter and

then extract the address for printing on an envelope you have to edit the document file, save it and go to the printer menu. You then have to re-request the file and re-edit it to cut it down to the address only before returning to the printer menu.

The Advantage word processor itself incorporates decent-merge facilities, and it is not necessary to use the On-File program in order to do form letters. However, On-File comes into its own as a means of selecting individual records for merging, and as a handy cardbox-type database.

On-File carries the cardbox analogy as far as offering the front and back of mock file cards. It is possible to use these free-form or with created templates. There is a subject line, a text area and an index line. Multiple index entries are allowed, and cards can be retrieved by searching for a word or phrase in the body of the text.

On a colour monitor, the program handles different colours of card, which can act as a sorting key. Cards can be searched and sorted in a variety of ways, but they are not saved in sort order and must be re-sorted on each access.

The menus have several failings. No names of cardboxes are displayed on first access, for instance; it is necessary to quit the program if you forget the name of the box you want. After adding a new card you are not offered the chance to add another, but are dumped back into the main menu instead. An exasperating bug also wipes all but the first word from the subject line of the card when it is saved.

One disadvantage of the program is that endless disc accesses take place throughout a session. It will not win any speed records. There are no arithmetical features at all in the program, which restricts its applicability as a multi-purpose database.

CONCLUSIONS

- Multimate is a powerful word processor well designed for non-numeric office uses.
- It is extremely reliable and flexible, though rather slow and cumbersome in operation.
- Boilerplating and printer support are its outstanding features.

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dBASE COMPILERS

SPEED AND PORTABILITY

By Mike Lewis

The code generated by a compiler can be used independently of the dBase program itself, and runs more quickly too.

If you are a serious dBase III user, or if you produce dBase applications for other people to use, you really ought to consider buying a compiler for the language. True, the purchase would set you back £650. But if time is money, a compiler could save you plenty of both.

There are two products to choose from. Wordtech Systems' dBIII-Compiler was first in the field, closely followed by Clipper from a group of former Ashton-Tate employees called Nantucket. Each product has its strengths and weaknesses, but both offer considerable advantages over the more familiar interpreted version of dBase III.

The main advantage of a compiler is speed. Once your dBase III command files have been compiled into executable programs, they will run many times faster. Just how much faster depends a lot on what the programs do and how you have written them. On the whole, though, you cannot expect to see as big a saving as you would with other languages, such as Basic.

This is not a reflection on the quality of the dBase compilers so much as on the power of the language. Given that dBase allows you to write, with just two or three commands, a global file update which might take many minutes to run, the time needed for interpreting the program, and hence the time saved by compiling, could well be negligible by comparison. That said, my benchmark tests on two fairly complex command files did show some very impressive savings.

In these and other tests, Clipper generally produced faster programs than dBIII-Compiler, although the difference was usually small compared with the overall saving of compilation over interpretation. On the other hand, dBIII consistently outperformed Clipper on compile-and-link times, and also produced smaller executable program files.

The other main benefit of compilation is a financial one. If several people are using a dBase III application on their own computers, each needs his or her own copy of the package at around £550 a time. But if one person is responsible for developing the application, only one dBase III and one copy of the compiler will be required.

A further advantage is portability. Like dBase III itself, both compilers will only run on IBM PCs and compatibles, but both can

generate programs capable of running on any MS-DOS system. dBIII-Compiler can also produce an installation program to handle your user's terminal codes. Clipper is slightly less flexible in that the target system must sport an ANSI screen driver, but this is not likely to prove too onerous a restriction.

The real differences between the two compilers become clear when you take a close look at the language elements they support. In theory, you should be able to take a working dBase command file and expect it to compile and run without change. I was certainly able to do this with both compilers, but only up to a point since both products come with a lengthy schedule of language differences.

Obviously, the compilers do not support the purely interactive commands that you enter at the dot prompt rather than write

dBIII-COMPILER				
VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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into your programs. These include Modify Command, Assist, Help, most of the Set options, and the normal form of Create. Since these are of no interest to the end-user, their omission is understandable.

But I was less happy with the absence of Edit and the plain version of Append. They were presumably left out to prevent the user from putting information into databases outside the control of the program. But when working in tandem with format files, these two commands provide a very powerful way of writing file-maintenance utilities, at least in applications where validation is not critical.

You can, of course, program round this omission, using the Read command. But the great strength of Edit and Append is that



SPECIFICATIONS

dBIII-COMPILER

Description: compiler for dBase III language

Hardware required: for compiling, IBM PC, PC/XT, AC/AT or compatible, 256K RAM, one floppy or hard disc; for execution of compiled programs, any MS-DOS system with 256K RAM

Copy protection: none

Price: £650

Publisher: Wordtech Systems Inc., Orinda, California

U.K. supplier: Micro Minder Consultants Ltd, 68 Upper Richmond Road, London SW15 2RP. Telephone: 01-870 7431

Available: now

CLIPPER

Description: compiler for dBase II language

Hardware required: for compiling, IBM PC, PC/XT, PC/AT or compatible, 256K RAM, one floppy or hard disc; for execution of compiled programs, any MS-DOS system with 256K RAM and ANSI terminal driver

Copy protection: yes

Price: £650

Publisher: Nantucket Inc., Culver City, California

U.K. supplier: Xot Software Ltd, 45 Kercroft, Milton Keynes MK8 8AP. Telephone: (0908) 566261

Available: now

they allow the user to take advantage of the Page Up and Page Down keys to browse through the records. With Read, the programmer has to provide some form of menu to achieve the same end, not to mention all the extra Store and Replace instructions that Read demands.

On the other hand, both compilers offer a useful repertoire of new features not found in the original language. For example, both provide access to command-line parameters that the user can type after the program

BENCHMARKS

Two large programs were used for these timing tests. Between them, they contain a good cross-section of dBase commands and functions, including indexing, string manipulation, calculations, and file updating.

The Chart program performs a series of calculations on fields in two databases, creates and indexes a third database, and plots the results in the form of a histogram. The Typeset program creates an ASCII file containing text and typesetting codes, using information contained in three separate databases.

The tests were carried out on an Olivetti M-24 with hard disc. All times are in minutes.

CHART

	Interpreter	dBIII	Clipper
Source file size	8.7K		
Compile and link time		1.4	4.4
Running time	27.0	8.9	7.3
Executable program size, including overlays		104K	122K

TYPESET

	Interpreter	dBIII	Clipper
Source file size	6.5K		
Compile and link time		1.2	3.8
Running time	7.0	3.0	2.8
Executable program size, including overlays		113K	121K

name on the DOS command line. Both also have an Inkey function which, like its name-sake in Basic, allows a program to test for keystrokes without suspending execution.

dBIII-Compiler has additional commands for clearing the keyboard buffer, making DOS system calls, accessing I/O ports, and testing individual bits within a byte. I am not sure how useful most programmers will find these. More interesting perhaps is the system's ability to use databases created by dBase II and dBase III interchangeably. You do not need to tell it which is which, and you may have any combination of them open at a time.

Clipper cannot access dBase II databases, but then neither can dBase III so this is hardly likely to be a problem. But Clipper is also unable to use indexes created by dBase III. It has its own, incompatible, index format, which might well cause difficulties for people who need to transfer data between the interpreter and compiled programs. Worse, Clipper uses a different file type for indexes — NTX rather than NDX — so numerous adjustments to source code will be needed.

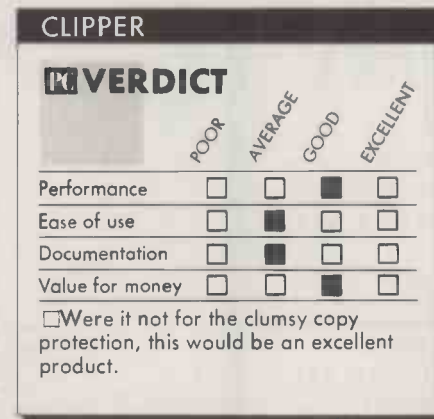
By way of compensation, Clipper has many useful language extensions. There are functions for finding the names of fields, drawing boxes, replicating character strings, determining which key the user pressed to exit Read, and quite a lot more. You can also write your own functions, along the lines of Basic's Def Fn. You can program any of the 40 Ctrl, Alt and Shift combinations of function keys, not just nine of the unshifted keys as provided by dBase III. And there is even a For-Next statement.

Unlike dBIII-Compiler, Clipper compiles to standard Intel object format. This means that you can link your dBase code with modules written in other languages. A Call statement is used to communicate between modules and to pass parameters. It also means that you can define an overlay structure for them. In fact, a modified version of Phoenix Associates' Plink-86 overlay linker is included with the Clipper package.

One of my favourite Clipper enhancements is its handling of the Help Key. This allows the programmer to write a special command file called Help.Prg, which is automatically activated whenever the user

presses f1. This program can find out at which point in the application the key was pressed, and thus display context-sensitive help screens or provide any other form of assistance which the programmer wishes to offer.

A point to remember about most of these new language features is that they are useful only if the application is designed at the outset to take advantage of them. On the whole, they are not the sort of extras that can be slotted in at the last minute. This is fine if you are writing programs specifically for compilation. But if you want to compile existing dBase III command files, or if you intend to use the interpreter as a development tool, compiling only when the code is bug-free, you will have to do without many of these enhancements.



So which of the two compilers should you choose? Clipper certainly beats dBIII-Compiler on language features. It is also slightly ahead on execution speed, although it trails on compile-and-link times. It is a little more complicated to use than dBIII, but not significantly so. One major problem with Clipper is the installation procedure, which is hindered by a clumsy copy-protection scheme. It was such a hassle I nearly gave up trying to use the package altogether.

First, I attempted to copy Clipper on to my hard disc, but the special installation program supplied by Nantucket constantly crashed, usually with a meaningless numeric error code. Nobody at the firm's U.K. agent, Xat, was answering the phone, and

the only clue I got from the manual was a warning that Clipper would not work with "non-IBM hard discs". Perhaps the disc in my Olivetti M-24 comes into the category. In the end, I gave up.

Next, I tried to install Clipper on floppies. This too failed, but by inspecting the installation batch file I managed to trace the fault. In fact, it would have worked fine with a two-floppy system, but not with a hard-disc machine. I ended up having to install Clipper itself on a floppy, with the linker, libraries, etc. on the Winchester — not an ideal situation.

None of these problems applied to dBIII-Compiler, which is completely free of the nuisances of copy protection. This fact alone would probably tip the scales in Wordtech's favour for many users, especially those who understand the importance of making regular backup copies.

Finally, a word of caution. The software industry moves fast. Wordtech and Nantucket had barely started to sell their products when Ashton-Tate announced dBase III Plus, a major upgrade of the original language. This supports some 50 new functions and commands, most of which are completely unknown to the two compilers. Just to complicate matters, Ashton-Tate is thought to be working on a compiler of its own. Whether Clipper and dBIII can keep up with this competition, only time will tell.

CONCLUSIONS

■ Both Clipper and dBIII-Compiler will repay their purchase price very quickly, especially if you regularly use pre-written dBase programs, or if several users run the same application. Software houses especially should benefit from them.

■ Both compilers are closely compatible with the original dBase III, and both support many extra language features. Clipper is the better of the two in this respect.

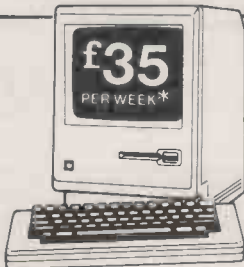
■ Whichever compiler you choose, you can expect to see a big improvement in program running times. Although execution tends to be faster with Clipper, dBIII-Compiler takes much less time to compile and link.

■ The big problem with Clipper is the messy copy-protection scheme and the resulting difficulties with installing the package.

■ Whatever Ashton-Tate's official attitude to these products, they can only enhance the value of dBase III.

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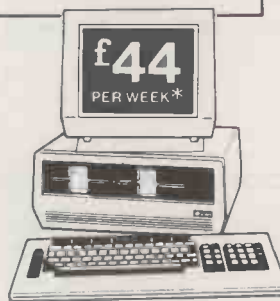
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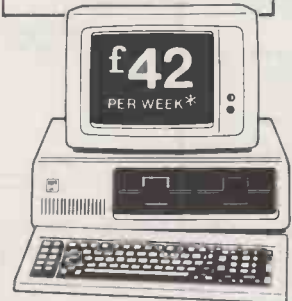
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PRIVATE: KEEP OUT

For a brief but significant period, if you wanted to make a data-processing manager turn slightly pale, all you had to do was mention the number 414. A group of young hobbyists from Milwaukee, Wisconsin, adopted these three digits — their area dialling code — as their hallmark. They went on to generate national publicity by finding their way into the supposedly secure computers of businesses, hospitals and government agencies.

The term "hacker", which once described any experimentally minded computer enthusiast, came to denote a computer trespasser. TV shows like *Whiz Kids* were spawned, with heroes that performed impressive but unrealistic feats of unauthorised access. Most of all, the 414 group and their like made computer professionals realise that even a kid with a modest knowledge of computers could penetrate their systems. Suddenly it seemed as if every telephone line had a hacker at the other end.

In many ways these early hackers did the computer industry a favour by demonstrating how vulnerable government and industrial systems really are. In fact, computer-equipped teenagers are the least of the computer industry's problems. The more serious threats include computer-related fraud, particularly by a company's own employees; industrial espionage and the consequent loss of trade secrets; misuse

Steve Gold explains some of the techniques for preventing malign or mischievous outsiders from tampering with your data.

of electronic fund transfers; and the invasion of personal privacy.

To try to prevent this kind of misuse, computer systems are now designed to demand some form of personal authentication from the user. This may be required at a number of points along the path of accessing computer data. The key points are: on entry to buildings where equipment is housed; on entry to the terminal room; in order to enable the terminal; at the encryption interface unit; on log-in; for file access; and for data-item access.

Physical devices such as cards and keys are commonly used at the first three of these access points. Passwords, alone or in combination with other techniques, are commonly used on log-in, for file access or at data-access time.

As well as authenticating users to database systems, password schemes may provide some degree of protection against other threats to the integrity of a system. Unauthorised accessing can take several different forms. Browsing is where someone with legitimate access to a part of the system

accesses unauthorised files. When a legitimate user is on-line but not actually using their terminal, someone else may gain access using a technique known as between-lines entry. In a related technique, called piggyback break-in, the authorised user's system communications are intercepted, and the intruder returns spurious system messages which fool the user into thinking he or she is on-line. Finally, hackers can masquerade as authorised users after getting hold of their password or other identification items.

The degree of protection afforded by passwords varies greatly. They provide reasonable protection against browsing when implemented at the file or data level. However, passwords are ineffective against the threats of between-lines entry and piggyback break-ins, unless each batch of data entered to a system is verified independently. This would be a laborious solution to say the least.

PERSONAL IDENTIFICATION

Data-encryption keys and the banking system's personal identification numbers are two systems which use passwords as a means of verifying identity. An encryption key controls the algorithmic transformation of raw data into unintelligible code. The PIN is typically a four- to six-digit number. It is assigned to the card holder by the bank and is normally used in conjunction with a magnetically encoded card. The U.K.'s bank card system employs three magnetic strips laid parallel to each other. Two are read-only and the other may be written to by the banking machines.

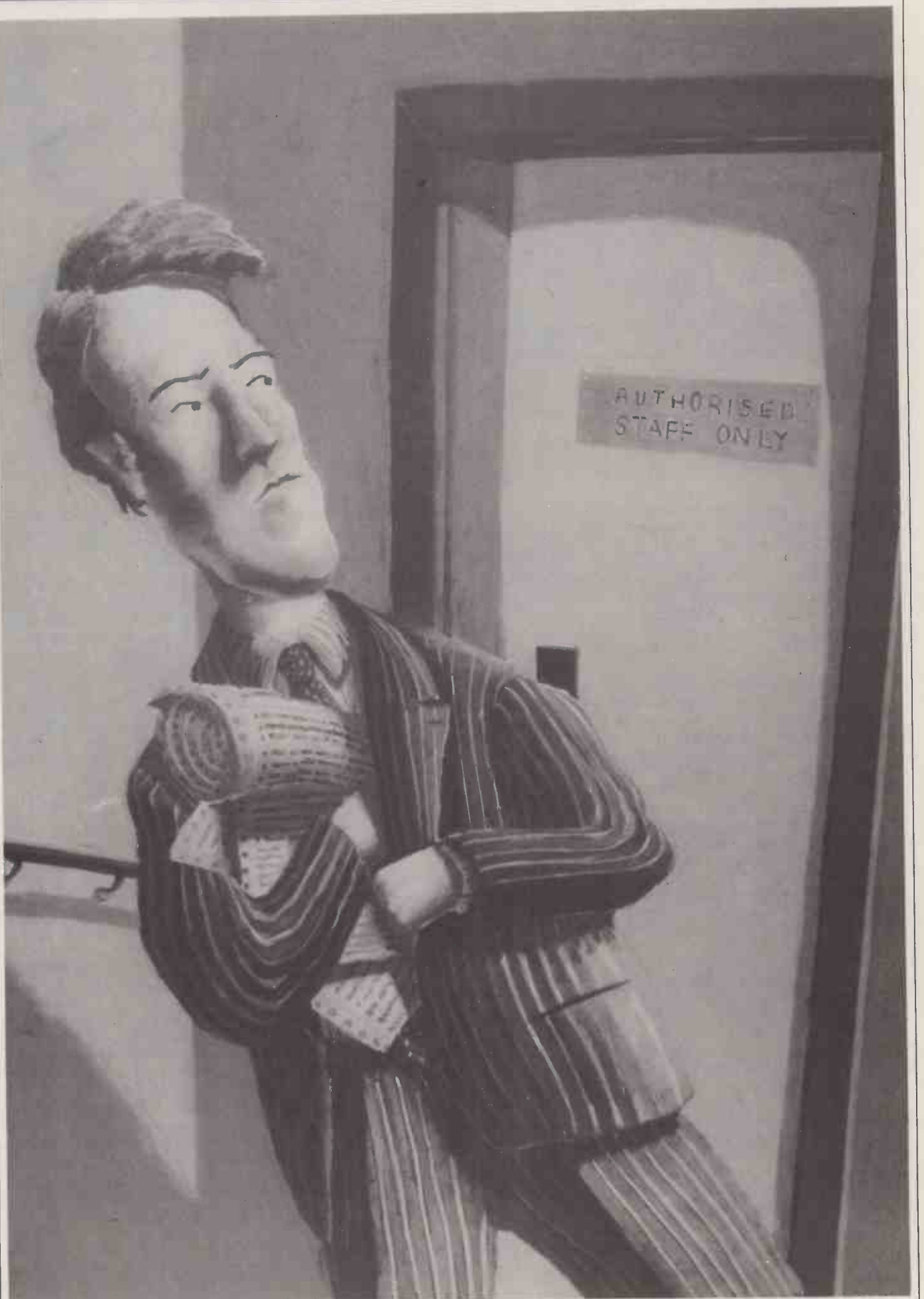
For a password to be an effective deterrent to successful database penetration, it should be difficult to guess, easy for the owner to remember, changed frequently and well protected. The degree to which a password scheme incorporates such features determines the difficulty of compromising the password. The table on this page illustrates the characteristics of the different password schemes now in use.

Other protection systems are available that compound the effect of passwords. One such system is that employed in the Society for Worldwide Interbank Financial Telecommunications (Swift), a worldwide banking network created by the Burroughs Corporation. At log-off time, the operator specifies the next log-in time, and Swift will refuse any earlier log-in attempts.

More information on password protection can be found in *The uses of passwords for controlled access to computer resources* by Helen Wood, published in 1977 by the U.S. National Bureau of Standards; reference NBS 500-9.

PASSWORD PROTECTION SCHEMES

	Advantages	Disadvantages
User selected	Easy to remember	Often easy to guess
System generated	Difficult to guess	More difficult to remember; algorithm may be deducible
Indefinite lifetime	Easy to remember	Most vulnerable to exhaustive enumeration and guessing attempts; difficult to tell if password is stolen
Fixed lifetime	Easy to remember if time interval is fairly long; more secure than indefinite	Vulnerability depends on time interval
One-off	Useful for detecting successful penetration of system; short lifetime prohibits any exhaustive tests	Difficult to remember unless written down; valid users locked out if successful penetration occurs
Size and alphabet	The larger the password and alphabet, the more difficult it is to use; less need for duplication of passwords	The larger the word the more difficult it is to remember and the more storage is required
Information contents	Could aid detection of penetration attempts if penetrator is unaware of valid password structure	May cause passwords to be long and thus more likely to be written down; if scheme becomes known, passwords could become easy to deduce





HOW TO DEAL WITH DEALERS

When dealers get together at a sales seminar, a curious mating ritual takes place. Over a cup of coffee during the afternoon break, two dealers from the same part of the country, who have been keeping an eye on each other from their seats in the conference room, begin a ritual conversation.

"How's it going then?", says Dealer John.

"Not too bad", offers Dealer Jack.

"I hear Dealer Fred isn't doing too badly either", suggests Dealer John, cautiously, feeling his way into the denouement.

"Dealer Fred! Why, he's nothing but a discounting box shifter!", obliges Dealer Jack.

"Bloody right mate . . .", trumps Dealer John. From this point on the two get on together like a house on fire.

Enshrined in this ritual, repeated across the country, is the key to a growing religion. True believers worship the one god, service, and shun the devil discount. The two trade commandments which most dealers publicly espouse are:

- Thou shalt obtain a discount from thine suppliers of between 25 and 40 percent of the recommended retail price on hardware, and between 30 and 60 percent on software.

- Thou shalt not pass any of thy margin on to thy customer, for that shall be called discounting and be an abomination until you and your salespeople.

However, some dealers, such as Jerry McDougal who runs Computer Express in St. Albans, believe that problems are just around the corner for those dealers who carry out their public beliefs in the privacy of their own showrooms. "There's going to be a big erosion of prices this year", he told me. "Dealers are not going to be able to get away with 30 and 40 percent margins. There's really no justification for them."

Jerry puts his money where his mouth is, by advertising 20 and 30 percent off the rec-

ommended retail price of many leading makes of micro. But there are limits to his generosity. "If my customers push us too close on the margins they can't legitimately expect the level of support. One man rang me up from Bournemouth and wanted to buy an Amstrad PCW-8256, which I'm already discounting from £399 to £375. But he expected delivery to be included in the price.

"It so happened I had a driver who was going within 100 miles, and I ended up making a profit of £15 on the deal. Then it turned out a couple of discs supplied with the machine were dicey, and he expected me to do some sort of rescue operation on the discs after chewing me down on the price. In that sort of case, I just don't feel the urgency of the situation."

McDougal believes that 14 to 15 percent is about the right level of margin for computer dealers, a suggestion that would shock many of his peers in the industry. He believes that this level of pricing is inevitable, and makes a comparison with aircraft travel. "Formerly, flying was exclusively for the rich, even through the sixties and seventies.

Dealers are not going to get away with 30 or 40 percent margins. There's no justification for it.

Now companies like People Express have driven the prices down, and now everyone flies. In the micro industry it's bound to be the same in the end."

At the moment, says McDougal, the strategy of many dealerships is based on having an exclusive product that people pay a lot for. While the end-user community is still in its infancy, and knowledge and expertise is in short supply, he is right. The manufacturers themselves warn you off buying a machine other than through an official dealer. In theory, authorised dealers do not discount. Instead, they are urged by the manufacturers they represent to provide top-class after-sales service.

One big advantage of buying from an authorised dealer is that if the dealer fails to provide you with satisfactory service, or goes bust, the manufacturer is usually there to pick up the pieces. What is more, most authorised dealerships are hard-won, and can be lost by dealers who consistently besmirch the good name of the manufacturer whose machines they sell.

Yet I suspect that many dealers secretly long to be box shifters. After all, wholesalers make their living selling goods at a discount, and no one thinks the worse of them for it. Yet for some reason it is not thought proper for a dealer to do the same. Sooner or later though, a dealer that becomes too successful at it will end up an outcast, and will probably become a distributor instead.

However, some highly respected dealers, have begun to realise that the reason discount structures exist in the manufacturer/distributor/dealer relationship is because they make for efficient business. In fact a new breed of dealers is emerging who value experienced customers, and if you show one of them you are not a first-time buyer you will be offered up to 15 percent discount on your system.

To find out if your dealer is one of this new breed you might ask for a support-



FIONA MACNICOL

waiver form for you to sign. But before you sign it, do be honest with yourself. Buying a computer at a discount today is like buying a new pair of shoes in a sale; do not expect any sympathy if they pinch. Every sale takes time, and every call for free support robs the dealer of valuable selling time.

There is roughly one business micro dealer for every 24,000 inhabitants of the U.K. Of those 24,000, an estimated 21,600 have never used a computer before. Some 21,599 of those assume they have the right to free training on computers from the dealer before they buy, during the purchase and after installation. Yet if you go to your local car showroom, you probably do not expect to be taught how to drive the car for free before you buy it.

As a schoolboy I used to marvel at the knowledge my language teachers had of irregular verbs. Later, as a language teacher myself, I used to marvel at my skill in keeping one lesson ahead of my students. Remember that the most you can hope for from a dealer's staff is that they have attended sales-training courses for the products they will sell you. The real technicians are usually in the back room repairing micros, or out installing them. The sales staff you speak to are not techno-freaks.

If your dealer has an on-site repair facility or a telephone-support hotline, you will know you are dealing with a more integrated firm than if you are sold a maintenance contract with a specialist maintenance organisation. Using third-party support contracts is a perfectly legitimate practice, but many dealers are now realising that there is money to be made in servicing their own customers. It is not really possible to judge whether the offer of a third-party maintenance contract on its own is a good or bad sign.

Most manufacturers are beginning to use an internal classification of their dealerships into first-division dealers and the rest. The split is usually around 80:20, the minority being first-division material. The difference is usually related to technical competence and sales volumes. In practice, you may find manufacturers unwilling to tell you which of their dealers fall into which category.

But you can work it out. Generally, the

first-division dealers carry a manufacturer's entire product line, including the top-of-the-range models. Though you may not want that particular product, an Apricot dealer who sells the Xen, an IBM dealer who sells the PC/AT or an Ashton-Tate dealer selling dBase III Plus is probably regarded as a first-division dealer.

Though these outlets probably specialise in servicing corporate accounts, they will not discriminate against individual end-user customers. Conversely, a dealer who sells only the IBM PC floppy-drive machine, the Apricot PC, and dBase II and WordStar, may be less interested in servicing complex systems.

You may think that if a dealer offers you a particular computer it is because it's the one

Having bought the machine, you begin to have doubts about anyone who gave you that much discount.

best suited to you. In an ideal world that would be true. The reality is often that a dealer will guide you towards the computer on which he or she makes most money. As the managing director of one well-known retail grouping told me: "Whether you get sold a Compaq or an IBM depends largely on whether there's a T in the month."

"T" stands for targets. For example, IBM has quarterly sales targets for its products which are sold through dealers. At the end of every quarter, IBM authorised dealers are offered extra discounts on PC products in order to help IBM hit its sales targets. Assuming dealers do not pass this saving on to the customer, they are likely to respond to IBM's generosity by selling more IBMs in those months, and make a higher margin per sale.

But there are two sides to every story. A manager of a west London store told me: "If we sold on the basis of margin, we'd be on a hiding to nothing as far as our professional reputation was concerned. Each customer's


requirements must be examined on an individual basis, and the only possible basis for selling a system is to fulfil those requirements."

Do not assume that all salespeople are on commission. Some dealerships, such as Digitus in Covent Garden, have no commission structure for their sales staff nor do they have sales targets. So two questions to ask the salesperson who is serving you are whether he or she is on commission, and whether that commission is based on product margin.

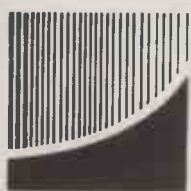
On the other hand, many dealers are wary of a customer who comes into a showroom knowing exactly what they want to buy. "It can be a major problem to have customers who won't listen to what we have to say", says a spokesman at Tasha Business Systems, "They insist on buying a particular combination of hardware and software, and then three months later return to complain that it doesn't do the job they wanted."

Try not to be suspicious of dealers who ask you to talk them through your application from top to bottom. You may think they are trying to work out your level of ignorance, and therefore how much they can get away with selling you. But in most cases they are more concerned with ensuring you get a system which will meet your needs. If they can do that for you, then they are likely to win your confidence and your repeat business.

You choose a dealer for two mutually exclusive reasons. Before you buy anything you shop around, getting as much free education as you can on the way, then go for the cheapest option. Having bought your machine, your reasoning changes. You begin to have doubts about the reliability of anyone who gave you that much discount. Will they cut back on service too? Will they still be there when you need them?

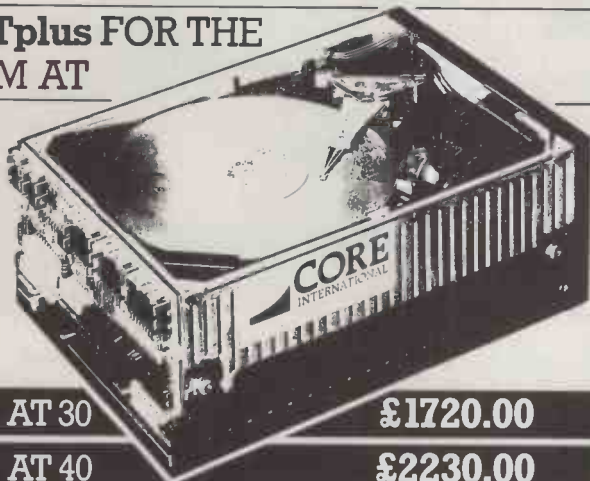
Discounting leaves little margin for free service. In fact, discounting dealers will expect you to spread the word about their wonderful prices, attracting more customers to their stores so that they can sell the volume they need to attract the higher margins they need from their suppliers to finance the discounts they are giving. 

Jerry Sanders is editor of Microscope.



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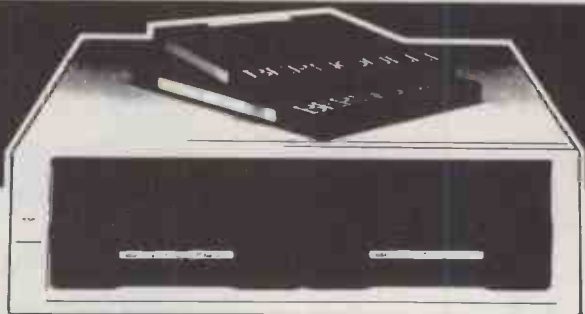
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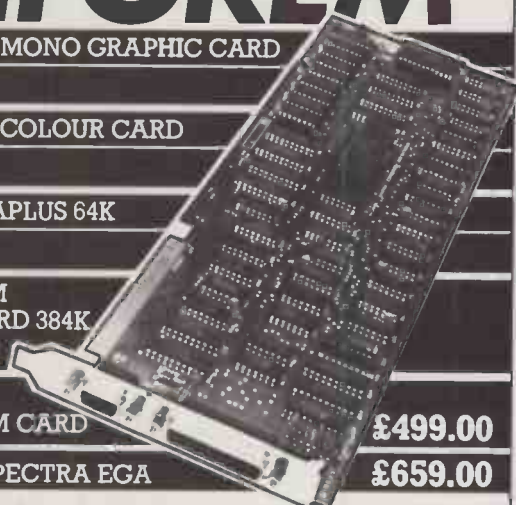
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TIME IS RUNNING OUT

Is the new data protection law about to be ignored by common consent? With the closing date for applications to register looming, this seems possible. The deadline date is 11 May, and so far the anticipated flood of 400,000 applications has not materialised. Only 10,000 forms have been returned complete on the Data Protection Registrar since he opened for business last November.

This is not an entirely surprising state of affairs. Of the considerable odds against which the 1984 Data Protection Act has to struggle, the most significant is lack of interest. Apprehension and even hostility on the part of data users might have been expected. Instead, there is a tendency for data users to dissociate themselves from the new legislation.

Many people have chosen to assume that the Act does not apply to them, or that they are exempt for some reason. This is far from the truth. Exemptions such as payroll, accounts and word processing are narrowly drafted, and will apply only to a small fraction of those users who intend to rely on them.

Although small businesses are more obviously ignoring the legislation than larger undertakings and public authorities, negative reactions are apparent everywhere. Local authorities cannot avoid registration. Regional conferences and seminars designed to promote data-protection awareness are attended almost exclusively by local-government employees. But it is clear that in many cases they are bewildered by the idea of data protection principles, fail to see their purpose, and regard the legislation as the concern of someone other than themselves.

EXTRA SECURITY

Older employees, in particular, who tend to be less comfortable with new technology in the office, are nonplussed by the additional security recommendations they now receive. They are astonished to learn that they should consider more discreet siting of terminals in busy open-plan offices and prompt destruction of personal data printouts which hitherto have been used as scrap paper. This says much about the prevailing attitudes towards security of personal data; one could almost argue a case in favour of the Data Protection Act.

However, one cannot have a great deal of sympathy for a law which rests on a

The deadline for registration is nearly here, yet apathy and inaction still reign supreme. **Anne Staines** contemplates the consequences.



manifestly false assumption. What possible incentives could induce data users — and particularly small businesses which already feel themselves to be paper-bound — to present themselves voluntarily as candidates for yet more regulation? Why should they be prepared to invest the necessary time and other resources in revealing information about their data files, and thus about their business, and then commit themselves, in writing, on an official form, with effects which they do not fully understand? The £22 registration fee may be an insignificant resource, but some small businesses are making such heavy weather of completing the 12-page form that they are commissioning consultants to do it for them.

This arrangement is extremely dangerous for both parties. Anyone giving or taking advice on data-protection registration must be sure of adequate professional indemnity insurance cover. A computer consultant is rarely qualified to give advice on legal obligations. The effect of a faulty reg-


istration might be a Prohibition Notice, which would be inconvenient at the very least.

The Data Protection Act depends for its effect on the assumption that two incentives will prevail: that data users perceive the usefulness of the exercise and will positively co-operate, and that they fear the consequences of non-compliance. Like all the aspects of the Registrar's work, the cost of enforcement must be met from registration fees. Without a sudden dramatic increase in the number of applications, the prospect of any real enforcement is remote.

LACK OF CURIOSITY

But the real weakness of the Data Protection Act lies in the assumption that data users perceive its usefulness. Data users are also, in some shape or form, data subjects and might therefore be expected to see some benefit in having personal information open to inspection. But experience in Europe and the U.S. where this type of legislation has been in force for some years, shows that data subjects are not as a rule curious to know the content of their files.

The exceptions to this rule are those files which will remain inaccessible to U.K. data subjects, even when the legislation is in force in its entirety. In France, for example, it is noticeable that the majority of disputed applications for access have been made by certified lunatics wishing to know the identity of the medical practitioner who committed them to an institution. Almost certainly this information would not be available to a U.K. data subject without the written consent — which would rarely be given — of his or her GP.

The vast majority of personal data files which will become accessible under the Data Protection Act will hold no interest for their subjects. It seems arguable that if data users could equate the new legislation with some real and much-needed benefit to the public, they would comply more promptly with its requirements. As things stand, however, there seems little cause for alarm on the part of those who do register. After some initial enquiries by a few inquisitive individuals they will probably never be troubled by their data subjects. 

Anne Staines is a barrister and Senior Lecturer in law at Newcastle upon Tyne Polytechnic.

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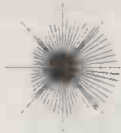
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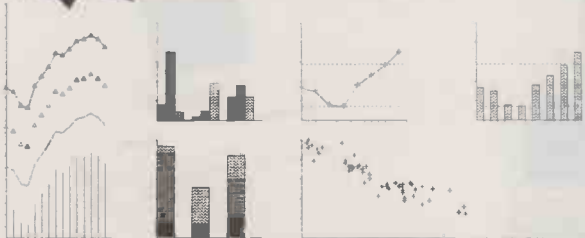
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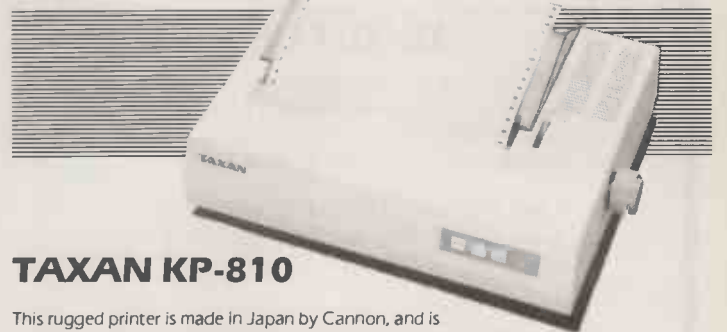
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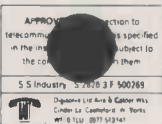
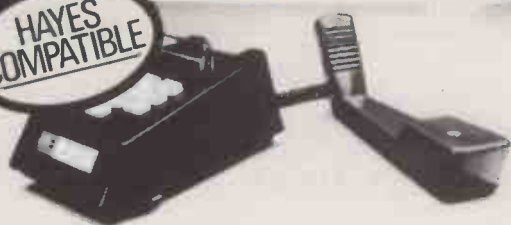
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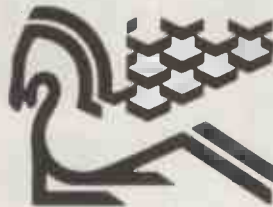
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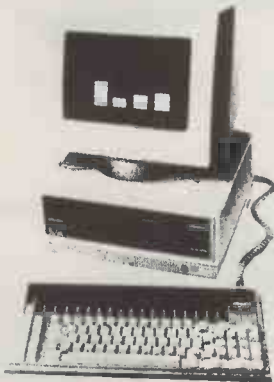
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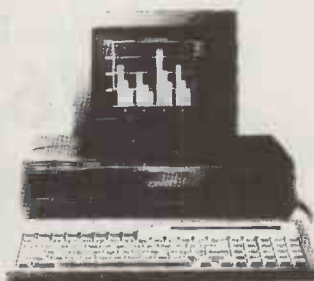
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INTERVIEW

JOHN ARIS — Director of the National Computing Centre

INTERVIEWED BY CAROL HAMMOND



John Aris joined Leo Computers in 1968, staying with the company through a succession of mergers into what eventually became ICL. In 1975 he moved to Imperial Group to become head of computer development. From 1982 he was manager of Group Management Services with responsibility for computing, telecommunications, office automation and management science. His association with the NCC began in 1981 when he was appointed Member Director. He took over as Director in 1985.

What do you think is the role of the NCC?

WE'VE just agreed a role, in fact, in discussions with the senior management, which we embarked upon when I came on board. We decided we wanted a short, snappy phrase and what we settled for was "to promote the effective use of information technology."

How are you going to do that?

WELL, at that point it all becomes a great diversity of activities. In the first instance we see ourselves being about transfer of technology, that is to say essentially picking up the best practice in the various areas in which people use information technology and trying to spread the good word around. Then within that we have certain areas where we believe the need is greatest and we have most to contribute. On the non-technical side we believe that it's very important to provide the messages that top management need to hear about information technology. It's fairly well known that management-services departments have difficulty in talking in the same language as their top managements; that's a problem from both ends and I think the NCC has an important role in helping them to meet in the middle.

On the more technical areas our lead issue is software engineering, by which I mean the whole question of how one gets programs written and into operation. We are in difficulty here because over the years hardware has improved enormously and software hasn't, and it's really time we did something about the software problem.

The other topics we'd like to single out are telecommunications, decision support, expert systems and standards. We also want to get into advanced manufacturing technology.

How do you see the relationship between the NCC and the micro user, say, in a small business?

TO TAKE the small business, I suppose our main involvement is through the Federation of Microsystems Centres. We have a microsystems centre of our own and we also provide the secretariat for the Federation as a whole. There are something like 20 of them up and down the country, each of which is very much there to be in a position to help small businesses.

How are these microsystems centres set up and who runs them?

THE government decided that there was a need for help for small businesses in the use of microcomputers and it let it be known that it wanted to encourage the establishment of these microsystems centres. Exactly where they are and who runs them was a combination of the government letting it be known that there were some pump-priming

funds available and the willingness of people to take it on.

There's quite a spectrum between purely entrepreneurial activities, where people are running this as a commercial activity, all the way through to it being a sideline by a polytechnic or organisation of some sort that has the type of expertise which it is willing to diversify in that way.

How does the NCC cope with being both a commercial organisation and a national body aiming to give independent advice?

WE haven't so far found this a great problem. We attempt to keep our strictly commercial activities visibly such, so that people aren't in any doubt as to whether we are actually in a commercial selling role or not. We then do our good works in a rather different way, and I hope people perceive the two and don't understand us to be doing one thing when we're doing another. Also our commercial activity is the only way of funding the do-gooding.


Why should somebody go to the NCC for advice as opposed to another commercial consultancy?

I THINK they must make their judgement as to who's going to give them the best advice. There are some very good consultancies around. I believe that there's room for everybody in that particular marketplace and we stand and fall by our merits as consultants.

We also run an information service which we think of as being somewhat separate from the consultancy advisory service, and that centres around some of the activities within our own microsystems centre. We make a point of collecting together and publishing directories of what's available in the micro field. If you want a list of the sources, we're probably your best bet.

How do you see the role of the NCC developing in the future?

I MENTIONED some of the points earlier, also we're clearly going to respond to changes in the technological scene which are still coming thick and fast. I would like to give a few further flavours to the way the NCC does its work. One is that I'm very keen that we develop the theme of case studies. I think the ability to quote the convincing history of a case when you're trying to persuade your colleagues or bosses to use computers is of enormous value. There isn't enough material available, and that's an ideal role for the NCC to do something about.

I'm also very much in favour of the general pursuit of excellence. That may sound like a motherhood noise but it really isn't. It really is something that one wants to emphasise to make things happen as they should. 

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TOP 10

Although IBM dominates the micro market, some manufacturers have proved that you can shy away from IBM compatibility but still find success. **Steve Malone** introduces our selection of those who chose to go it alone.

At present these devices are only fitted to the Amiga, but Atari has made no secret of the fact that it wants to fit them to the ST range and has suggested that this might happen before the summer. Although it might seem that blitters are only suitable for games programs, their potential for high-speed spreadsheets and data processing is tremendous, and only just beginning to be explored. Naturally the public is impressed. Even some loyal customers of IBM are beginning to ask when such technology is going to become available on Big Blue's own machines.

In the early days, businesses which felt they ought to invest in new technology may not have known much about computers, but

Such is the power of the prevailing standard that some Mac users need to convert their machines into a PC clone, using the Mac Charlie bolt-on kit. But will IBM soon have to adapt its own machines to someone else's standard?

they did know that those three letters spelt reliability. Once the standard had been set, that alone became the reason to continue buying IBM. But the trouble with standards is that they become set in aspic, and it is almost impossible to update them to any great extent. While the IBM standard has been frozen in 1981 technology, those who have chosen to go it alone have been able to take advantage of technical advances and pass them on to the customers, often with great commercial success. Machines like the Amstrad PCW-8256 and RM Nimbus have come to dominate whole sectors of the market, although they have been unable to dent IBM's corporate business stronghold.

It is hard not to feel a pang of sympathy for IBM, which now looks to be trapped by its own success. At some point it will be forced to break with the standard that it has created, or else allow its products to become increasingly antiquated and vulnerable to raids from ever-cheaper compatible manufacturers.

But a clean break with the past standard in the form of, say, fitting 3.5in. discs or a radical departure from PC-DOS would put IBM on an equal footing with the other non-IBM-compatible manufacturers. In these circumstances the PC II would be hard pressed to retain IBM's market share against already established competitors. History has already proved that when IBM enters a market that is well informed and knowledgeable, that market does not welcome it with open arms — witness the ignominious demise of the PC jr.

This is where the hope lies for the non-compatible manufacturers. They know that at some point IBM will have to abandon its citadel and be forced to fight out in the open where they will be waiting. Apricot is already relishing the prospect of IBM moving towards the 3.5in. MS-DOS standard which it has been using for years.

Of course, IBM may well continue to dominate the market as it has done in the first half of the 1980s. But everything suggests that next time round, customers might take a good hard look at what is on offer before opting for IBM. **PC**



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AMIGA

around £1,500

The widely heralded Amiga is the computer Commodore hopes will rescue it from its current financial woes. Certainly, the quality of the sound and graphics make it an impressive machine. Based around the 68000 processor and running the Tripos-based operating system, the Amiga offers the prospect of true multi-tasking. The secret of the Amiga lies in the four custom-built chips which move blocks of data around the memory independently of the processor, thus freeing it for other tasks. The resulting speed of the graphics display is stunning. But for potential buyers software availability is likely to matter more than glittering hardware, and the Amiga suffers in this respect. Commodore has promised an IBM emulation package to bridge the gap, but it is not yet available.

FOR Potentially a revolutionary advance in microcomputer technology.

AGAINST An unknown quantity.



AMSTRAD PCW-8256

£399

At the price, the Amstrad is hard to beat. For a mere £399 you get a computer, monitor, disc drive, printer, 256K of RAM and word-processing software. The computer is based around the Z-80 processor and runs under the CP/M operating system. The advantage to the user is that a large quantity of CP/M software is available, and following Amstrad's success much of it is being converted to the machine's 3in. disc format. By modern business standards the eight-bit technology is old-fashioned, and only able to address 64K of RAM directly. All the same, since its launch last summer, the 8256 has been a runaway success. Unless you feel the desperate need for fancy graphics or spreadsheets, why pay more?

FOR Excellent value. A rapidly increasing base of well-tried software.

AGAINST Old-fashioned technology.



APPLE MACINTOSH PLUS

£2,295

Once considered to be the only serious obstacle to IBM's complete domination of the market, the Mac was able to survive, despite non-standard I/O ports, mainly because of a unique operating system which even the complete novice could master within a few hours. However, the Mac is now surrounded by rivals, some of which have operating systems uncomfortably close to the original and often considerably cheaper. In response to this threat, Apple has recently launched the Mac Plus, which puts right many of the shortcomings that Macintosh users have learned to live with. Whether this is enough to stave off the competition has yet to be seen.

FOR Excellent, reliable operating system. Still ahead of the rest of the field.

AGAINST Expensive. Business software still limited.



APRICOT XEN

£2,099

The top-of-range machine from Britain's only volume business-micro manufacturer. Based around the high-performance 80286 processor and running under MS-DOS, the machine compares with the best in the market. Compatibility with the rest of the Apricot range means that there is a healthy software base available. In the past, Apricot has suffered from poor-quality keyboards and a tendency towards leading-edge but unreliable technology. However, this time Apricot seems to have come up with a machine that the public wants. An important machine for Apricot and one that should keep it in the game.

FOR Fast. Well designed and engineered. Good software base.

AGAINST MS-DOS without IBM compatibility. External power supply.



ATARI 520ST

£652

When the newly revamped Atari launched the 520ST in 1985, the machine looked to be a serious challenger, if not to the IBM PC then at least to the Macintosh. So far the absence of software has led many potential buyers to hold off. Now, almost a year after the launch, the Atari ST series is finally available with a bundled word processor and database, although not the products originally promised. Third-party software support is also beginning to come through. The products available suggest that software houses have yet to decide whether the machine is a serious contender in the business market or an upmarket hobbyist machine. Recently, the company has launched a 1Mbyte version of the machine, the 1040ST, although this is unlikely to resolve any of the problems.

FOR A Macintosh-like machine for less than half the price.

AGAINST Lack of software. Lack of credibility.



BBC MASTER SERIES

from £434

Despite last year's well-publicised difficulties, Acorn is still going and has launched the Master series in an attempt to follow the rest of the field upmarket. The philosophy behind the range is to maintain BBC model B compatibility by using a 65C12 eight-bit processor for the front end, while allowing the option for a series of 16-bit co-processors to be fitted. The Master range spans four computers, from the Master 128, a revamped version of the BBC B+, to the Master Scientific. The Scientific is equipped with 512K of RAM and a 32016 co-processor, and is expected to retail at around £1,600. The Master series would appear to be an obvious choice for anyone with a BBC Micro who wishes to upgrade to 16-bit computing without having to abandon their existing software.

FOR Plenty of software. Clear upgrade path from BBC B.

AGAINST Restricted by eight-bit technology. Expensive.



RM NIMBUS

£1,295

Research Machines' Nimbus looks like a computer that has found its way into the business market almost by accident. Its manufacturer is well known in the educational field and originally produced the Nimbus to take advantage of the demand in this market for computers running under the new standard. The machine proved so popular that the company has now decided to try its luck in the business market. However, sales are not made from good reviews alone, and lack of software coupled with relative obscurity outside education has meant that the Nimbus has found it hard going. However, the machine still looks good value, particularly if you can claim you are buying it for educational purposes and obtain further discounts.

FOR Good design and engineering. Lots of educational software.

AGAINST Non-standard I/O ports. Lack of business software.



TDI PINNACLE

£5,995

It is over a year since the Pinnacle was reviewed by *Practical Computing* and we still have not seen a faster machine. But if the Pinnacle is out on its own in terms of speed, it must also be pretty lonely in terms of the operating system. The p-system OS is part of the reason why the machine runs so fast — the other being the 12MHz clock speed of the 68000 processor — but it is so non-standard in business terms that few people outside academic and software-development circles have heard of it. However, in terms of raw computing power the Pinnacle has few rivals, let alone equals.

FOR Still the fastest around. Excellent for development work.

AGAINST Unorthodox operating system. Little software. Expensive.



TORCH TRIPLE X

£3,995

The Triple X's selling point is the Unix operating system, which everybody feels they ought to use but haven't actually got around to learning yet. Cambridge-based Torch has overcome Unix's forbidding reputation by incorporating a Gem-like Wimp system as a friendly front end. The Triple X has been designed to a high specification which includes the 68010 processor, 1Mbyte of RAM, a 720K floppy disc and a 20Mbyte hard disc as standard. Although the Triple X can be used as a stand-alone micro, Unix is perhaps best suited to installations using networking or which have access to a Unix-based minicomputer.

FOR Unix with a friendly face. Good for multi-user systems.

AGAINST Limited business software. Expensive as a single-user machine.



VIENNA PC

£3,795

Something of an outsider in the micro market, the Vienna PC began life as part of Northern Telecom's Vienna automated office, but has now been adapted as a stand-alone model. The most striking feature of the Vienna is the superb graphics capabilities made possible by a second 80186 processor dedicated to screen handling. The quality of the display is sufficient to sway even the most dedicated VDU-phobe. If you need a high-performance computer which runs under MS-DOS with a Gem front end, you will probably find this machine well worth the extra cost.

FOR Unparalleled graphics capabilities. Vienna Office compatible.

AGAINST Expensive.

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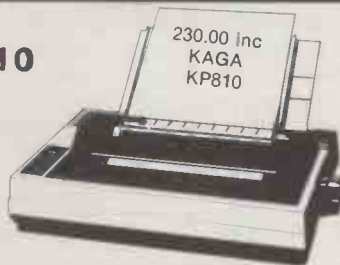
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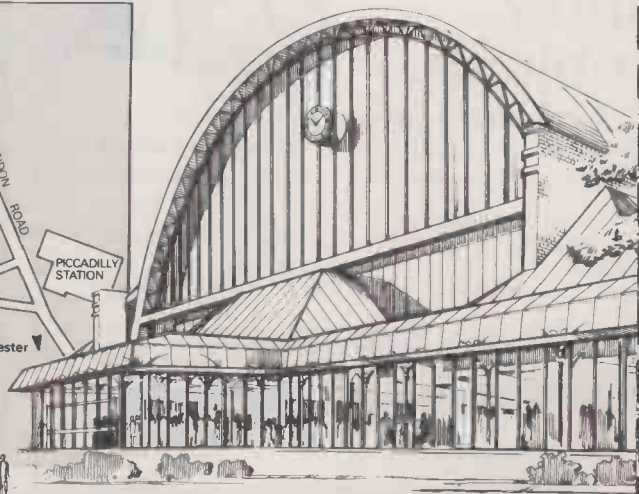
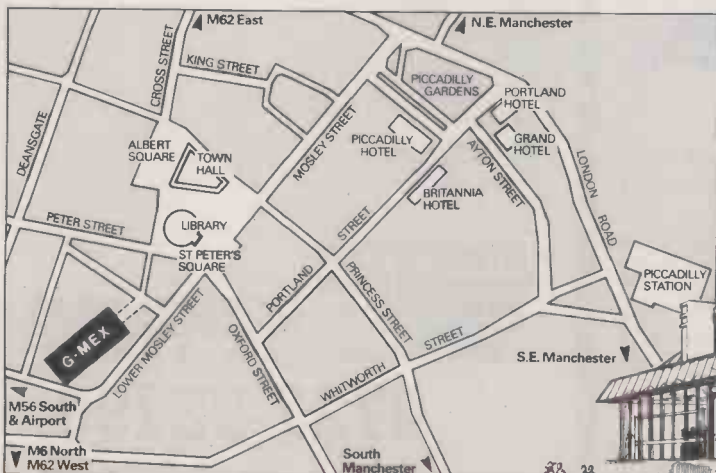
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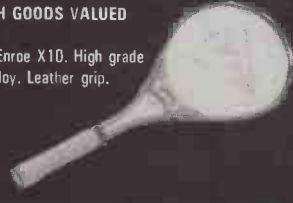


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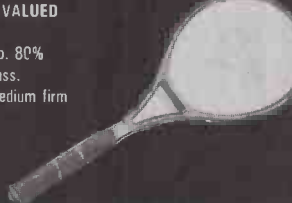
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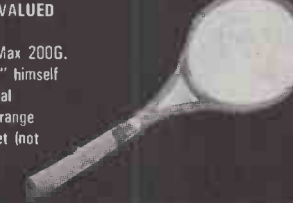
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COMPUTING BY NUMBERS

Eight years on from the birth of the first spreadsheet, **Glyn Moody** considers the future form of this indispensable application

There were no fanfares when VisiCalc, the first spreadsheet, was launched. Instead, it slipped into the world as merely another early product for the Apple II. At that time Apple was little more than two young men in a garage, and the Apple II was a fun hobbyist machine. But VisiCalc changed all that. Soon people were buying Apple IIs just to run VisiCalc. It was only the appearance of Supercalc for CP/M machines, and Lotus 1-2-3 for 16-bit micros which ended this seemingly unstoppable combination. The rest, as they say, is history.

Yet when Dan Bricklin produced the first spreadsheet back in 1978, it probably just seemed like a good idea. After all, spreadsheets are about manipulating numbers, and computers are notably able in this area. But it was more than a good idea, it was a great one.

The continuing success of the spreadsheet, and with it companies like Lotus, is largely due to the way most businesses work. Everybody concocts budgets, everybody attempts the odd forecast or two. The spreadsheet provides the perfect tool.

First, it mimics completely the way budgets are constructed on paper, with rows and columns of figures, sub-totals and grand totals. Secondly, it automates perhaps the worst chore of budget-making: totalling rows and columns, and getting the results to tally. Thirdly, and perhaps most importantly, it offers the speculative What-If? Using such trial runs, it is possible to maximise profits or throughput, at least on an approximate basis.

LOTUS 1-2-3

The world's top-selling spreadsheet package, Lotus 1-2-3, adds a couple of extras to these basic functions which have also found some favour with the business community. When it was launched amid enormous brouhaha in 1982, much was made of 1-2-3's integrated graphics and database. In truth, these are both quite limited, but they were sufficient for most executives' purposes. Now no self-respecting spreadsheet is launched without them.

Lotus 1-2-3 has had the same kind of symbiotic relationship with the IBM PC as VisiCalc had with the Apple II. There is even some suggestion that Lotus's product was a major contributory factor in the success of IBM's micro. So it is perhaps appropriate that Software Arts, the company which developed VisiCalc, should have been bought by Lotus on one of its spending sprees. Lotus has since discontinued its forebear altogether.

Like the IBM PC, Lotus 1-2-3 may be the dominant player, but it is an ageing one. The recent Release 2 of 1-2-3, reviewed in



the February issue of *Practical Computing* was mainly cosmetic: there are no radical changes nor dramatic developments. The question now is, where do we go from here?

One possibility is to use Lotus 1-2-3 as a starting point and bolt on extra features by means of auxiliary programs. S&S Enterprises is a small firm specialising in such add-ons for Lotus and other packages. Programs available include a consolidation package and a sideways print utility. Another company, called rather cheekily 4-5-6 World, has been set up in the U.K. with the express aim of extending 1-2-3 by means of add-ons.

In addition to the home-grown products, a number of U.S. add-on software packages will be available. One such is Spreadsheet Auditor, which allows you greater insight

into the logic behind the spreadsheets you have set up, enabling you to check their accuracy. Basic Concerto is an add-on for Symphony, which already boasts features such as goal-seeking and linear regression.

Goal-seeking and linear regression are two extensions of the basic What-If? idea that have proved especially popular. The development of a full-scale add-on along these lines has arrived in the form of What's Best, reviewed on page 104.

However, such tweaking of Lotus can only be taken so far. One day, even Lotus is going to have to produce a product that goes significantly further, but as yet the direction it will take is still unclear.

An obvious move would be to extend spreadsheets from two dimensions to three, allowing an extra variable to be included.

BEYOND THE SPREADSHEET

(continued from previous page)

This is the approach adopted by Report Manager, reviewed on page 100. Like many of the latest packages, Report Manager takes the Lotus command structure very much for granted. The menu approach characteristic of 1-2-3 has become widely accepted as standard both by users and by software houses.

A more radical shift in spreadsheet design is represented by Javelin, reviewed on this page. It has been tipped by some as the successor to 1-2-3. Certainly it tries to go beyond the straight spreadsheet-based approach and adds several ways of looking at your central base of data. Other products to take this route are the British Logistix, which adds extensive time-management and project-planning facilities, and Sagesoft's Options.

Beyond a certain point, spreadsheets start turning into full-blown modelling systems of the type widely found on mainframes. The danger with this approach is that one of the fundamental advantages of the spreadsheet, its ease of use, is lost in the process. Clearly such a penalty would not be acceptable for most micro users.

Given the wide appeal of the spreadsheet, it seems certain that people will constantly try to emulate 1-2-3's success by going beyond it. With Lotus's hold on the market still looking so secure, it is probably going to take more than just a superficial change. Although intended for a totally different market, Audiocalc from Davy Computing offers a hint of how this could come about. It is a talking spreadsheet designed for the blind and partially sighted. However, the idea of keeping spreadsheet functions the same but changing the way you interact with them has wider applications. Coupled with artificial intelligence, it could offer that radical step beyond today's spreadsheet that software houses — including the mighty Lotus itself — are all so busy seeking.

SUPPLIERS

Supercalc: Sorcim-IUS Micro Software, Edinburgh House, 43-51 Windsor Road, Slough, Berkshire SL1 2EQ. Telephone: (0753) 77733.

Lotus 1-2-3: Lotus Development U.K., Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281.

S&S Enterprises: 31 Hollow Way Lane, Chesham Bois, Amersham, Buckinghamshire HP6 6DJ. Telephone: (02403) 4201.

4-5-6 World: Saracen's House, 25 St. Margarets Green, Ipswich, Suffolk IP4 2BN. Telephone: (0473) 225951.

Options: Sagesoft, NEI House, Regent Centre, Newcastle upon Tyne NE3 3DS. Telephone: 091-284 7077.

Logistix: Grafox, 65 Banbury Road, Oxford OX2 6PE. Telephone: (0865) 516281.

Audiocalc: Davy Computing, Moorfoot House, 2 Clarence Lane, Sheffield S3 7UZ. Telephone: (0742) 71201.

JAVELIN

Familiar as it is, the spreadsheet is just one way of expressing the relationships between your data.

Glyn Moody looks at a program which combines it with numerous other formats for entering and displaying data

Conventional spreadsheets concentrate on the basic row and column format. In doing so, they can often obscure what lies behind the figures. Javelin, from Javelin Software Corporation, regards the spreadsheet as just one View or way of looking at the data. More importantly, it is only one of several possible representations of the logic which links that data together. There are 10 such Views available for any given set of information.

These Views can also be used for entering data. So, for example, you can enter figures in a tabular form for each variable, which shows the variation with time. Or you can draw a bar chart on-screen to prescribe data. By moving a bar up or down with the cursor keys you can alter the value while maintaining a direct visual representation of how data varies with time. Data entered by either of these methods can be carried across to a conventional spreadsheet format. You can switch from one View to another at any point or display two Views simultaneously in a pair of windows. Any changes to data in one format will automatically carry across to other Views.

LOGICAL LINES

The logic which links together variables can also be set up in a number of ways. Both the tabular and graphical input methods allow you to enter and edit formulae. Similarly, the spreadsheet can be used in the standard way to set up relationships between rows and columns.

Javelin offers two other ways of looking at the logic which lies behind the data. First there is a formula listing which shows all the functional relationships between variables and can also indicate which variables depend on a named variable. For example, if you had a variable representing total sales, it might depend on the sales of two different regions, each of which would depend on the

SPECIFICATION

Description: spreadsheet program with advanced financial functions and logic analysis feature

Hardware required: 512K IBM PC, PC/XT or PC/AT, hard disc and more RAM advisable, the Intel Above Board RAM expansion is supported

Copy protection: system disc cannot be backed up; two copies may be made to hard disc

Price: around £550

Publisher: Javelin Software of Cambridge, Massachusetts

U.K. supplier: Ashton-Tate (U.K.), Oaklands, 1 Bath Road, Maidenhead, Berkshire SL6 1UH. Telephone: (0628) 33123

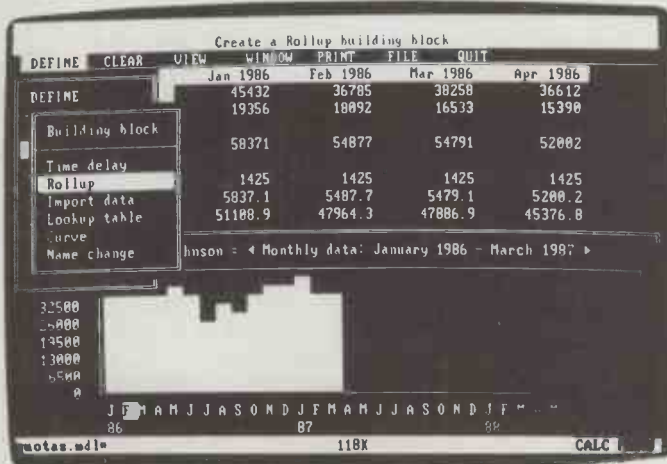
Availability: now

performance of individual towns or sales-people. Javelin would show the dependence as a series of indented formulae, relating total sales to regional sales, and the regional sales to their component parts.

This kind of organisational relationship can be shown graphically. Boxes representing each variable are linked together in the form of a flow diagram. Arrows indicate the logical dependence of variables on each other. Again, whatever way the formulae are set up, they are immediately accessible from any View.

In addition to these main input and display Views, there are several auxiliary ways of looking at data. Two are graphical, and allow the usual type of graphs to be produced from data, as in other spreadsheets. There is a View called Notes, which allows any variable to be annotated comprehensively. An Errors View analyses what errors there are in the central base of information and formulae.

Control of windows, synchronisation and everything else is effected from two places.



Left: Javelin displays parallel Views simultaneously.

They can be synchronised so that, for example, alterations to the bar chart are reflected in the spreadsheet table.

Right: The formula listing shows all the functional relationships between variables.

Far right: Each View has its own pull-down menu.

BEYOND THE SPREADSHEET

First there are function-key assignments to those commands used most frequently. A template is provided. Many more detailed functions are handled from pull-down menus along the top of the screen. As in Lotus and so many other packages, they are invoked by using the Slash key, and then their initial letters or cursor keys. Each View also has its own specific pull-down menu, which is only visible and accessible from that View when it is active.

In addition to the function keys, the Tab key plays a very special role in Javelin. Called the Spell key, it is probably one of Javelin's most useful features. Whenever you are changing the View of data, or setting up relationships between variables, you are required to input the necessary variable name. If you cannot remember the exact spelling or format, Spell comes to your aid by listing the possibilities. It will also work out from any initial letters you have entered what the nearest match is.

ASSUMPTIONS

If Javelin can safely make an assumption, it does. For example, as you feed in variable names in a spreadsheet which together define a cell, it will automatically retrieve the data from the central base and place it at the correct position in that cell. When you enter dates in columns, it will not only recognise various formats, it will normalise them to its own preferred form.

In many respects the spreadsheet remains the central View of any given data. In addition to the auxiliary Views which give you so much more information about the basic spreadsheet structure and data, there are a number of extra features which extend the power of the ordinary spreadsheet.

Many of these are advanced spreadsheet functions. Although Javelin lacks some of the more mundane operators found on conventional spreadsheets like @log, @sin and so on, it makes up for this with a staggering array of financial functions. For example, Bondprice returns the price of a bond with a listed yield, face value, listed coupon rate and maturity date. There are correlation functions, depreciation, net present value, and a function for calculating the slope for the least-squares line for a series.

Many other extra functions refer to time. Javelin assumes that practically all variables will be time-dependent. There is a screen which allows the time characteristics to be set up. Among its clever features is one which mixes monthly and quarterly figures by means of totalling functions which convert between the two.

Time also plays a part in the so-called building blocks which can be set up for collection of data. For example, it is possible to construct a profile for a time delay between two variables. Typically this might

JAVELIN

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Goes beyond 1-2-3 — if you need to.

be the delay in payment for invoices sent out: 20 percent come in one month, another 40 percent in the second month, and the rest in the third month. Clearly this will affect the overall cash flow in quite a complex way. Javelin lets you set up this kind of time-lag profile, which is then automatically built into the relevant variable.

Another useful building block is the Rollup, which is what most people would call consolidation. Suppose you have several subsidiaries to a main holding company. Using the Rollup building block you can specify how revenues are consolidated into the main company's accounts. This process then takes place automatically as any changes are made to the subsidiary companies' figures. Similarly, the Import Data block lets you pull in data from other Javelin models.

The Look-up Table building block is useful if you have a series of rates, say for income tax, which need to be applied to a

variable in prescribed bands. Using a look-up table, the total tax paid, for example, can be calculated automatically. Further, any changes in tax rates and bands can be effected by altering the look-up table rather than fiddling with formulae.

The look-up tables in particular are very powerful additions to the normal repertory of spreadsheet functions. However, they are quite complex to use. Similarly, the advanced financial functions described require fairly detailed knowledge before they can become useful. This is generally true of Javelin. Although the command structure is sensibly implemented, and the Spell key very useful, the feel of the program is that it is a tool for the power user.

In this respect it is unlikely to displace Lotus 1-2-3 from the corporate desks of the world. Most spreadsheet users do not require the additional features: they only need a basic electronic budget sheet. That said, there is no denying that the ability to monitor and audit spreadsheet logic is a tremendous boon. But it is likely to be most useful for departmental specialists, or those who use spreadsheets intensively.

The quality of Javelin's workmanship is high: it is no mean achievement to produce a 400K program, and I came across no obvious bugs. The documentation is also beautifully presented, though a little lacking in practical examples. A tutorial on several discs is provided, but I found this of little help in coming to grips with the details.

CONCLUSIONS

■ Javelin is a powerful analysis program which incorporates spreadsheet techniques as one way of many of looking at data.

■ Because of its power and complexity, it is probably best suited to power users and those with a need for the special financial features it offers.

■ The size of the program means that even on a 512K machine there is precious little room left for applications. A hard disc is also a must. For this reason, Javelin is best regarded as a product for the IBM PC/AT and above.

■ The U.S. price is high, but then so is the level of functionality offered. The manuals in particular indicate a premium product.

■ Javelin is a very interesting product, but not one that Lotus should lose any sleep over.

Adjust window. Use arrow keys to move divider, then press **4**.

Net profit = Total sales - Total commissions - Total salaries

Jan 1986	51108.9	Jun 1986	49956	Nov 1986	42306
Feb 1986	47964.3	Jul 1986	34386	Dec 1986	44916
Mar 1986	47886.9	Aug 1986	39686	Jan 1987	45086
Apr 1986	45376.8	Sep 1986	35736	Feb 1987	35646
May 1986	48975.9	Oct 1986	39696	Mar 1987	36986

Formulas for all variables that affect Net profit:

Net profit = Total sales - Total commissions - Total salaries

Total sales = Sales Johnson + Sales Smith

Sales Johnson = 4 Monthly data: January 1986 - March 1987

Sales Smith = 4 Monthly data: January 1986 - May 1987

Total commissions = Commission Johnson + Commission Smith

Commission Johnson = commission rate * Sales Johnson

commission rate = 0.1

Sales Johnson = 4 Monthly data: January 1986 - March 1987

Commission Smith = commission rate * Sales Smith

commission rate = 0.1

Sales Smith = 4 Monthly data: January 1986 - May 1987

Total salaries = Salary Johnson + Salary Smith

Salary Johnson = 780

notes.mdl 118K CALC READY

Copy contents of cells.

	Jan 1986	Feb 1986	Mar 1986	
Sales Johnson	39815	36785	382	#WORKSHEET
Sales Smith	19356	18092	165	#WORKSHEET
Total sales	58371	54877	547	
Total salaries	1425	1425	14	
Total commissions	5837.1	5487.7	5479	
Net profit	51108.9	47964.3	47886	

Formulas for all variables that affect Net profit:

Net profit = Total sales - Total commissions - Total salaries

Total sales = Sales Johnson + Sales Smith

Sales Johnson = 4 Monthly data: January 1986 - March 1987

Sales Smith = 4 Monthly data: January 1986 - May 1987

Total commissions = Commission Johnson + Commission Smith

Commission Johnson = commission rate * Sales Johnson

commission rate = 0.1

Sales Johnson = 4 Monthly data: January 1986 - March 1987

Commission Smith = commission rate * Sales Smith

commission rate = 0.1

Sales Smith = 4 Monthly data: January 1986 - May 1987

Total salaries = Salary Johnson + Salary Smith

Salary Johnson = 780

Salary Smith = 780

notes.mdl 118K CALC READY

REPORT MANAGER

Conventional spreadsheets are as flat as the pieces of paper that gave them their name. **David Barlow** looks at a new product that makes life easier by going into the third dimension

To have any chance of success a new spreadsheet must either be incredibly cheap or have something very different to offer. At £495, Datamation's Report Manager plainly misses out on the first count; after all, Lotus 1-2-3 now retails for £100 less. Report Manager's distinguishing feature is its ability to construct a spreadsheet model in three dimensions.

One of the major advantages of the three-dimensional approach is flexibility of viewing. It is useful, for example, where a series of annual reports are consolidated over several years. In a conventional spreadsheet this could be handled either as one huge model, or as a separate model for each year along with a summary which consolidates the rest. Both methods are extremely awkward when it comes to viewing equivalent figures from different years, and are cumbersome to manipulate.

The same model on Report Manager is best visualised as a cube several slices thick: one slice for each year and one for the consolidated figures. The cube can be viewed in all three dimensions to reveal different angles on the same data. Viewed from the front, in what is called Page View, the cube looks like a conventional spreadsheet displaying the first year's results. Subsequent pages show the spreadsheets for the following years.

The Page View will be the most used, but there are also two others called Column View and Row View. In Column View the horizontal dimension represents pages, the vertical dimension represents rows and the depth dimension represents columns. In Row View the horizontal dimension represents columns, the vertical dimension represents pages and the depth dimension represents rows.

SIMPLE INSTALLATION

Report Manager is available for the IBM PC, PC/AT and close compatibles. It requires a minimum of 256K of memory. Though it runs in colour on suitable monitors it does not demand a graphics screen driver. Installation is very simple. The entire program and associated Help files are supplied on just one disc, and the program is not copy protected.

User's models are held in RAM while active. This permits a maximum theoretical matrix of 255 cells high by 255 cells wide by 255 cells deep. The precise cell count is dependent on the amount of RAM available.

Like most spreadsheets, Report Manager opens with a blank matrix. Commands are also entered in a very conventional manner. Pressing the Backslash key brings up the

main menu headings along the foot of the screen, just as in Supercalc. Items can be selected from here by typing in their first letter and can then be followed up with selections from sub-menus. With familiarity a rapid succession of selections can be entered very quickly.

The main menu hides a very complex command structure. An excellent colour hierarchical chart supplied with the documentation helps you make sense of it. Users are also kept well informed by status messages displayed in the bottom right-hand area of the screen. Apart from cell references, the information includes the current file name, cell format, cursor direction, status of Num Lock and Caps Lock keys, and the memory available.

If you wish, you can operate Report Manager in the conventional two-dimensional mode. Columns are then

REPORT MANAGER				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ideal for unravelling complex consolidated models.

referred to as letters A, B, C, etc., and rows as numbers. In the three-dimensional mode, pages are also referred to as A, B, C, but in practice this is not too confusing. The page letter sits at the end of the cell reference so, for example, the top left corner of the front page is referred to as A1A. On the fourth pages the same cell becomes A1D, and the final cell in the maximum-size database has the long-winded reference of IU255IU.

Apart from its three-dimensional aspects, Report Manager is much like any other spreadsheet in the way it works. A useful windowing feature is provided, but its convenience is limited somewhat by the lack of keyboard macros. Report Manager supports the use of look-up tables.

The graphics facilities on Report Manager are totally integrated, unlike those on 1-2-3 or Symphony. Because Report Manager does without a graphics-display system, graphs are built up using one of the standard IBM character sets. This means that relatively few presentation formats are available. Bar

SPECIFICATION

Description: three-dimensional spreadsheet with built-in program generator and graphics
Hardware required: IBM PC, PC/XT or PC/AT with 256K RAM; Apricot PC, Apricot Xen
Copy protection: none
Price: £495
Publisher: Datamation Corporation of Northbrook, Illinois
U.K. distributor: Sapphire Systems, Wellesley House, 102 Cranbrook Road, Ilford, Essex IG1 4NH. Telephone: 01-544 0582
Available: now

charts will generally be the order of the day, though it will also be possible to produce some rather gimmicky presentations using some of the odd characters available.

Despite this limitation Report Manager does have distinct advantages. Being integrated with the main program module, it can produce graphs very quickly from either directly entered data, spreadsheet data or from an external data file. The windowing facility allows the graph to be placed next to the spreadsheet in question, and any changes made in the data are then instantly reflected in the graph. As a spreadsheet, Report Manager is quite fast, but in everyday use, the need continually to call overlays from a floppy disc slows things down somewhat. With memory now so cheap, this approach is totally unnecessary.

SCHEMATIC DIAGRAMS

One interesting aspect of Report Manager's graphics is the ability to produce a combined spreadsheet and schematic diagram. This can be used to great effect for educational purposes. The example illustrated opposite shows an operational amplifier schematic where the input and output parameters are calculated spreadsheet cells. This is undoubtedly an interesting idea but creating schematics is a complex and tedious business. We also experienced difficulty dumping schematic screens on to the printer with the Ctrl-P command.

Data can be sorted by column, row or page on up to three different key fields. Complex repetitive sort routines can be stored in cells and then subsequently called up as required. A keyword-search feature moves the cursor to the next location of a user-specified character string or sub-string. These facilities come into their own when Report Manager is used in its Visual Database mode, where rows form the individual records and columns the data fields.

Once the interactive aspects of Report Manager have been mastered, repetitive processes can be automated by using the built-in programming language, Exec. It uses the full set of screen commands, plus around 30 extra commands similar to conventional programming statements. Exec

BEYOND THE SPREADSHEET

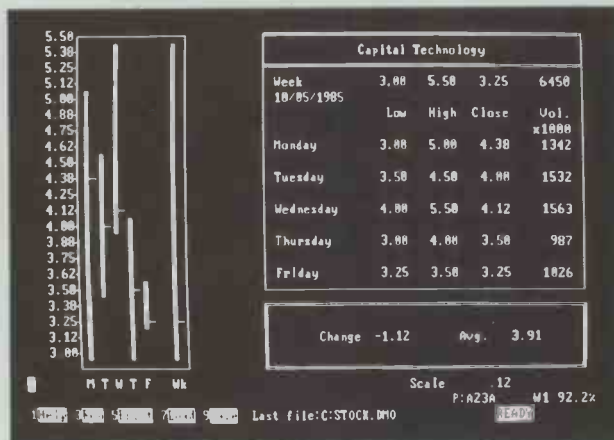
	B	C	D	E	F	G
WESTERN REGION - QUARTERLY REPORT 1983						
001	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	TOTAL	AVG.
002	1983	1983	1983	1983	1983	198
004	SALES					
005	Product A	77,000	80,050	84,892	89,137	331,880
006	Product B	96,500	101,325	106,391	111,711	415,927
007	Product C	136,000	142,000	149,940	157,437	586,177
008						146,544
009	Total SALES	389,500	324,975	341,224	358,285	1,333,984
010						333,496
011	EXPENSES					
012	Equipment	13,000	13,650	14,332	15,049	56,032
013	Salaries	87,000	91,350	95,918	100,713	374,981
014	Utilities	1,000	1,090	1,984	2,084	7,758
015	Rent	12,000	12,600	13,230	13,892	51,722
016						12,930
017	Total EXPENSES	113,000	119,490	125,464	131,738	490,492
018						122,623
019	Gross INCOME	195,700	205,405	215,759	226,547	843,491
020	Taxes	70,200	82,194	86,304	98,619	337,396
021						84,349
022	NET INCOME	117,420	123,291	129,456	135,928	506,095
						126,524

Page View looks like a conventional spreadsheet.

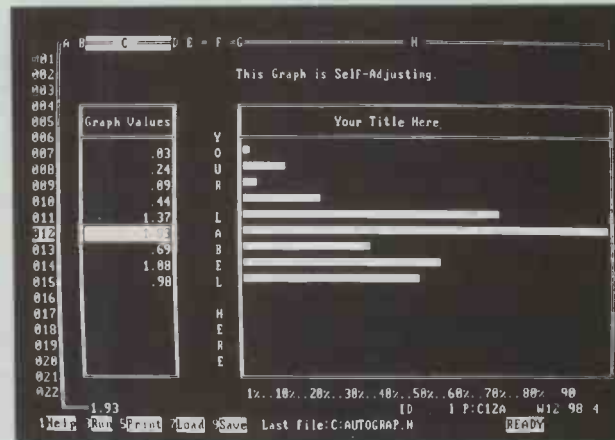
ITEM REF	JAN-ACT	FEB-PJT	MAR-PJT	QTR-PJT
Prd A-Sales	150.00	153.00	156.06	459.06
Prd B-Sales	875.00	892.50	910.35	2677.85
Tot A&B	1025.00	1045.50	1066.41	3136.91
Cst of Sales	375.00	522.75	533.20	1430.96
Grs.Profit	650.00	522.75	533.20	1705.96
Oper. Exps.	100.00	139.40	142.19	381.59
Deprec. Exp.	15.00	15.00	15.00	45.00
Interest	15.00	15.00	15.00	45.00
Pretax Inc.	520.00	353.35	361.02	1234.37

Month	PRE-TAX INCOME
JAN	520
FEB	353
MAR	361

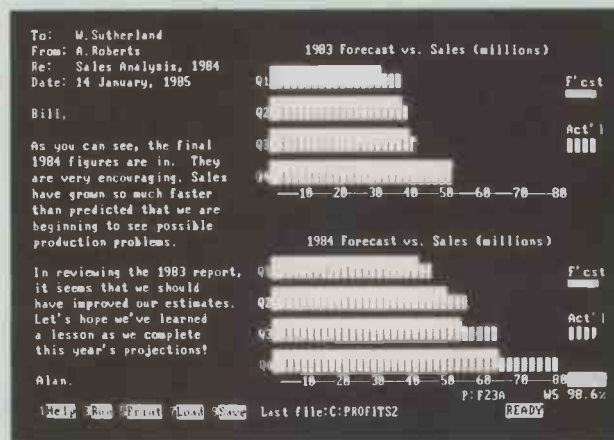
Graphics are closely integrated with the spreadsheet.



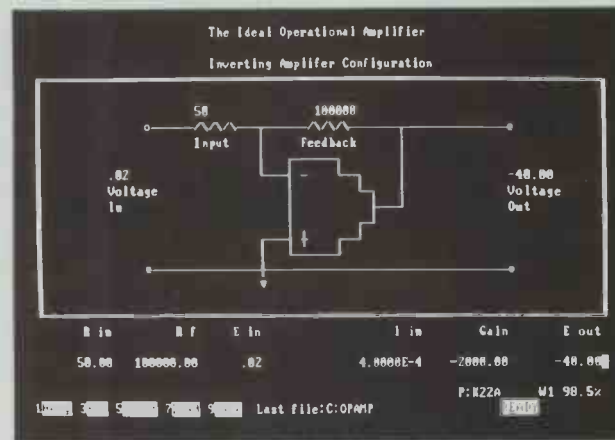
Display styles are more limited than in Lotus 1-2-3.



Changes made in data can be reflected instantly in a graph.



You can combine graphics and text.



Schematic diagrams can be displayed next to the spreadsheet.

program files can be built up using Report Manager's own text editor or an external word processor working in non-document mode. Completed Exec files can be saved and run automatically whenever required. Specified Exec files can also be loaded automatically from the operating-system prompt, making it ideal for use by inexperienced personnel.

Report Manager has a very powerful set of pre-programmed functions covering mathematical, date and statistical applications. Its forte is financial applications, for which no fewer than 15 complex functions are available.

The documentation is well organised and comprehensive, though let down by the word-processed look. There is a handy pocket-size reference guide and an excellent wall chart. It takes some effort to understand the three-dimensional element of Report Manager, but the package as a whole is quite easy to use. In any event, context-sensitive help is never more than a keystroke away.

Sapphire Systems, the U.K. distributor, offers customer support for a fee of £100 per year. Product support and upgrades are both included in this scheme. Sapphire also runs one-day introductory and advanced training courses at its east London offices.

CONCLUSIONS

- Report Manager's three-dimensional approach makes it especially suitable for consolidated models. In other respects it is a conventional though versatile spreadsheet.
- The powerful built-in programming language tool can be used to generate sophisticated customised applications.
- Report Manager's ability to display text and graphics simultaneously is well executed, but presentation facilities are not up to the standard of Lotus 1-2-3.
- The documentation is comprehensive though the presentation is somewhat unattractive. Sapphire Systems offers excellent support facilities at extra cost.

BEYOND THE SPREADSHEET

Anybody launching a new spreadsheet program these days needs to have a lot of faith. Users tend to be very protective about the spreadsheet they use and will take a lot of wooing before deserting to another. The market leaders have recognised this, and have made their new offerings supersets of their originals. So if you know how to use Multiplan it is not a traumatic task to convert to Excel; Symphony is an upgrade of 1-2-3 with more bells and whistles. It was, therefore, with some concern as to its commercial viability that I opened Mindsight, a new financial-modelling tool for the Apple Macintosh from the U.S. company Execucom.

The packaging is professional and the format of the documentation is reminiscent of the IBM manuals. It presents all the essential information in an easy-to-read tutorial fashion, followed by a comprehensive reference section.

Reading the manual shows that Mindsight is no ordinary spreadsheet. In fact you do not see a spreadsheet until well into the modelling process and you do not enter numbers into a matrix of cells. Instead you write formulae in English. The best analogy is that you write the program, and then Mindsight compiles it to produce the spreadsheet.

Instead of having to enter a formula in the first cell and then replicate it across all the columns, you simply enter the formula and then move to the next row. You can either define the number of columns you require or let Mindsight work it out for you. A nice touch is that the columns you define to be years, quarters or even months will be produced automatically.

Each row is defined as a named variable which then has values assigned to it. You can enter the values one by one, define them in terms of a formula which can call on previous values in that row or variables in other rows, or even call them in from another model. For more complicated work a number of built-in functions and sub-routines can be used to work out such things

MINDSIGHT

John Lewis discovers that this package's ability as a financial modelling tool for the Mac may make it worth getting to know.

	FEB	MAR	APR	MAY	JUN
Units sold	300.00	420.00	588.00	823.20	1152.48
Price	38.00	38.00	38.00	38.00	38.00
Gross Marg	11400.00	15960.00	22344.00	31281.60	43794.24
Unit Cost	18.00	18.00	18.00	18.00	18.00
Commission	0.00	0.00	0.00	0.00	4379.42
Gross prof	11382.00	15942.00	22326.00	31263.60	39396.82

The model and its solution. The scroll bars can be used to gain access to parts of the window not currently displayed. The commands are simple and English-like. The Salaries variable will receive its information from another model during the compilation.

as net present values, median, straight-line depreciation and many more. The logic operators And and Or are supported, as too is If-then-Else.

Mindsight allows you to build up a composite model by combining data from up to eight separate areas. The data is entered in the separate models, which can then be consolidated to produce a final model. If required, the results from any area can be scaled by a constant factor before being incorporated into the final model to account for, say, currency differences.

Once you have defined the business model you solve it, and it is at this point that the familiar spreadsheet appears. No changes can be made directly to the numbers in this solution. If you need to alter anything you have to go back to the model and alter the statements there. Any errors in the model definition are signalled by friendly and helpful warning messages. You have to implement the alterations before the program can proceed.

While working on the solution you can alter column widths, change the format of

A menu allows you to select variables to be included in either the graphs or the report.

	FEB	MAR	APR	MAY	JUN
Gross prof	11382.00	15942.00	22326.00	31263.60	39396.82

The variable Gross Profit has been selected for plotting.

BEYOND THE SPREADSHEET

SPECIFICATION

Description: financial-modelling package with graphics and report generator

Hardware required: 512K Macintosh with second floppy disc or hard disc

Copy protection: original system disc must be present on start-up

Price: £150

Publisher: Execucom Systems Corporation, Austin Texas

Supplier: Package Programs Ltd, 91 Blackfriars Road, London SE1 8HW.

Telephone: 01-633 0121

Available: now

the columns and find which other variables are used in the definition of any particular variable. This is useful in large models when you may have forgotten just how all the variables interact. Help screens are available at all times from the Apple menu, but if you know what you are doing you can leave the Help file off your disc to save space.

Once your model is complete you can experiment with certain of the variables to fine-tune its performance. The usual What-If? questions can be implemented to see what changes occur across the whole model. Even more useful is Goal Seek, which allows you to specify a goal for a particular variable, leaving Mindsight to calculate what changes need to be made to its dependent variables in order to achieve the new target. For example, you may decide that you require a profit of, say, £100,000 instead of the £60,000 predicted by your current model. The profit will depend on the number of units sold and their price, so you could see what effect the new profit requirement would have on these two variables.

It is important to be able to present the results of your model in a way that other people will find easy to understand. Spreadsheets may give you the option of producing a graph, but the main bulk of the report will still be the whole of the spreadsheet itself. It is very difficult to select just the rows or

columns required to give the broad picture. Mindsight has a range of different plots, including a three-dimensional one, for displaying results graphically. You can choose which variables and which columns are displayed.

The same freedom of choice applies to the report-making stage too. A format for the report can be set up to show only the parts you require, and in any order you want. It does not have to follow the layout of the solution. There are no problems with £ signs. You can arrange for negative numbers to be displayed in brackets, which is ideal for financial statements. Mindsight reports are formatted as Macwrite documents, so you can alter them further if need be. The manual claims that you should be able to produce part of a report and then append another part to it, but this did not work for me and gave two separate reports instead.

Mindsight lets you insert previously defined quantities or fragments of text at a specified place at the time of execution. These fragments are known as micros. Standard micros supported are Date, Time and Page. When using the Date micro in a report I found that it did not work properly when right-justified in the footer. You can swap the columns and rows around if you decide you would like to have months running down the page rather than across.

Execucom produces the mainframe-based Interactive Financial Planning System (IFPS), and obviously expects some users of Mindsight to develop models on their Mac and then transfer them to the larger machine. To assist in this process a Macterminal clone called Link is provided, which additionally allows you to select the type of host computer you will be working to as well as providing a special IFPS transfer

Mindsight makes good use of the Macintosh environment, with pull-down menus and option keys defined for many of the more common commands. Splitter bars are provided, and clicking in the size box enlarges the active window to fill the screen. The standard desk accessories are supported.

A so-called high-quality printer driver comes with the package, but I could see no discernable difference to the normal high-quality mode using the standard Imagewriter driver.

Two discs are provided in the Mindsight package. The first is a U.S. system disc, so the localiser will have to be used, with the Help and Link files on. The second disc is the copy-protected program disc. A selection of templates is also provided, but they have a transatlantic flavour and may not be suitable for use in the U.K.

Mindsight hung up on me on two occasions and gave a system error on another. It also gave problems when used with the Switcher and Macwrite, perhaps because of its memory requirements: the program occupies 336K on disc. The system master disc is copy protected and has to be present at start-up.

MINDSIGHT

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

A worthwhile financial modelling tool ideally suited to the Mac. Shame about the copy protection.

CONCLUSIONS

- Mindsight is a genuine advance on the spreadsheet which offers real advantages for financial modelling.
- The presentation of results is superior to that produced by spreadsheets; the graphics are more limited but still adequate.
- There are a few bugs, but they are not serious and will no doubt be eradicated in later releases.

The screenshot shows the Mindsight software interface. At the top, there are menu options: File, Edit, Model, View, Plot Options, and Interrogation Setup. The 'Plot Options' menu is open, showing options like Percent, Line, Pie, Clustered, Stacked, Legend, Grid, Markbars, Titles..., Range..., and Scale... The main window displays a spreadsheet with columns for FEB, MAR, MAY, and JUN. The data includes 'Gross prof' with values 11362.00 and 159... The spreadsheet also shows formulas like 'Gross Margin = Units Sold * Unit Cost - 18'.

Mindsight has six standard plots. Their attributes can be changed according to requirements.

The screenshot shows the 'GENREPORT OPTIONS' dialog box. It has several sections:

- 'Specify Widths: Column' (10), 'Decimals' (-1), 'Name' (25), 'Line' (80)
- 'Specify Format: 999,999 3[999,999]'
- Checkboxes for: Show column titles, Show model titles, Suppress if all zero, LInewrap, Invert, Underline column titles with, Underline values with, Use printname, Indent names as in model.
- 'Spacing: @ 1 0 2 0 3' (where 1 is selected)
- 'Scale @ Divide 0 Multiply Constant 1.00 Variable'
- Buttons: Variables, Columns, Cancel, OK

A personalised report format. The 3 [] is a replicator of the 999,999 format, which sets up six figures with a comma separator for thousands and no decimals.

WHAT'S BEST

Jerry Sanders explains how this Lotus add-on takes the guesswork out of What-If? and guarantees the optimum result every time

Spreadsheets allow What-If? calculations. You take an educated guess at what the solution to your problem might be, set the variables in your spreadsheet accordingly, and then make it recalculate the result. If you have a large number of variables you probably have to make a number of guesses before you either get an answer you are satisfied with or you get fed up.

What's Best works in conjunction with Lotus 1-2-3 to remove the element of guesswork. It automatically provides the best answer to a problem involving multiple variables by taking the formulae and constants in a Lotus model as input into linear-programming (LP) code. It then formulates and solves the necessary linear equations to provide optimum answers, which are then placed into appropriate spreadsheet cells.

If this sounds complicated, be reassured. The program does all the necessary number crunching behind the scenes in RAM. There is no need to understand what linear programming is to operate What's Best, although to exploit its advanced features this is an advantage. The manual contains excellent LP tutorial material which goes a long way to optimising your use of the program itself.

What you do need to be able to do is construct a spreadsheet which accurately models your problem. In that sense, What's Best is an ideal tool for consultants or knowledge engineers who analyse their clients' problems and provide solutions. If you can model your own problems with Lotus, then you will have no difficulty learning how to tell What's Best which cells of your spreadsheet contain the constant, constrained and variable data on which to operate.

MEMORY RESIDENT

The basic What's Best Commercial program requires 256K of RAM. A more expensive version, known as What's Best Professional, can make use of 640K and allows you to set up larger models as shown in the table below. What's Best is memory resident, and must be run from the operating-system prompt before running Lotus. This installs it in RAM, after checking the drive for a master program disc. You then boot Lotus in the normal way, leaving the system disc in drive A. When What's Best returns its results it reboots Lotus, and if the Lotus master disc is not available the program will crash.

Two example problems illustrate what What's Best does. The first could be solved by drawing graphs, since there are only two variables to cope with — a piece of paper can represent only two dimensions. What's Best

can handle as many variables as your RAM can cope with, and the second example demonstrates how limiting even a good spreadsheet is for solving complex What-If? problems by trial and error.

For the first example, imagine you are a hi-fi manufacturer making two models of cassette recorder. The standard model has a profit per unit of £300, while the deluxe model has a profit per unit of £500. The two models are produced from three components: the standard chassis, the deluxe chassis and tape drives. A standard computer has a standard chassis and one tape drive; a deluxe computer has a deluxe chassis and two tape drives.

MAXIMISE PROFIT

As the manufacturer, you have to decide which combination of standard and deluxe models will maximise your profit from the components currently in stock. You could draw a graph such as figure 1. This shows that by joining the extremes of producing 60 deluxe units or 120 standard ones, all combinations on the line or below it are feasible because they do not exceed tape drive availability. On the other hand, any combination above the line would require more tape drives than are currently available. If you now add in chassis stock you get a second graph, like figure 2, showing which combinations are feasible allowing for tape drive, standard chassis and deluxe chassis availability.

SPECIFICATION

Description: linear optimiser for Lotus 1-2-3 spreadsheets

Hardware required: IBM PC or compatible, at least 256K RAM, two disc drives; What's Best Professional requires 640K

Software required: DOS 2.0 or later plus Lotus 1-2-3 release 1A

Copy protection: protected, as Lotus 1-2-3

Price: \$695; Professional version \$995

Publisher: General Optimisation Inc., 2251 N Geneva Terrace, Chicago, IL 60614. Telephone: (U.S. area code 312) 248-7300

U.K. supplier: none

Available: direct from U.S.

	WB Commercial	WB Professional
Numeric cells	800	8,000
Optimisable cells	400	4,000
Integer 0/1 cells	40	400
Constraints	200	2,000
Instructions	4,800	24,000
Co-efficients	6,400	32,000

Capacities of Commercial and Professional versions of What's Best.

FIGURE 1



FIGURE 2

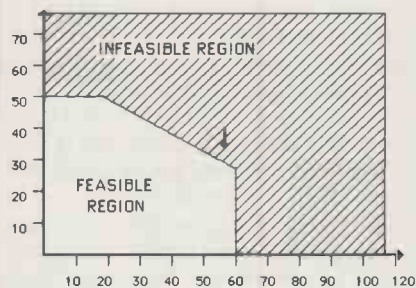
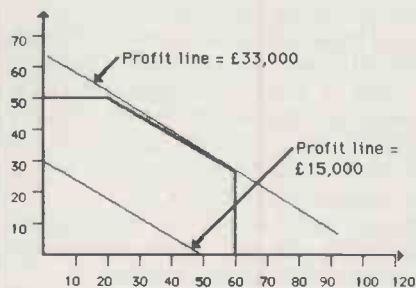


FIGURE 3



The final step is to draw a profit line within the feasible region for an arbitrary profit level, as in figure 3. Since total profit is equal to (£500 * deluxe units) + (£300 * standard units)

You can draw the profit line for, say, £15,000 as joining the production of 30 deluxe units, with that of 50 standard units. Any combination on that line will produce a profit of £15,000.

A higher profit will be produced by making more units, within the stock constraints. So by plotting further profit lines parallel with this one, while not stepping outside the feasible region, you find that the most profitable solution is the one which is farthest from the origin but still touches the feasible region.

In a two-product case it is easy to graph these constraints. Add any more to the mix and it is not. But LP code such as that produced by What's Best constructs a feasible region even when a problem has many dimensions.

As a manufacturer you might want to decide on a production mix, where limited resources must be combined for maximum profit. As a transport executive you will want

BEYOND THE SPREADSHEET

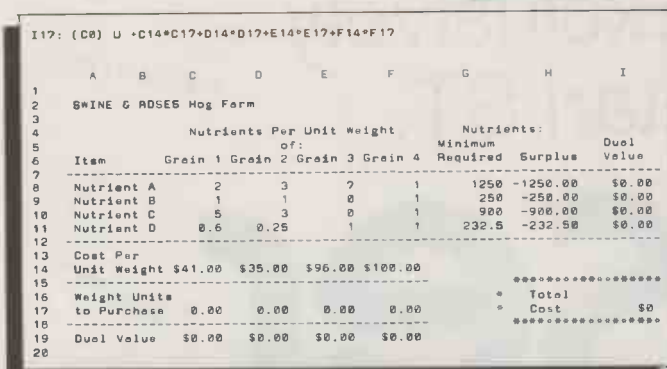


Figure 4. The basic Lotus spreadsheet.

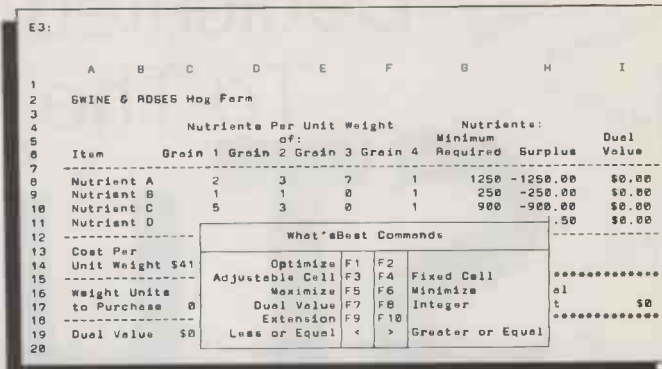


Figure 5. What's Best overlays a command menu.

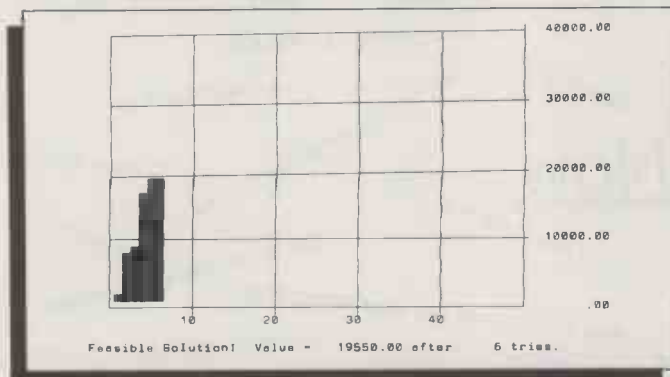


Figure 6. Attempts at optimisation are presented graphically.

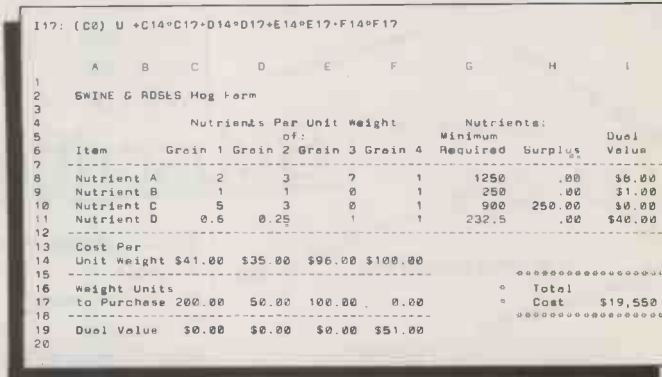


Figure 7. The final result is added to the spreadsheet.

to achieve optimal routing, to ship goods from multiple sources to demand points at minimum cost. Or you may be a livestock farmer having to mix animal feed by blending raw materials, again at minimum cost.

In the second example you are a pig farmer and have to provide your pigs with the required quantities of four nutrients by buying quantities of four different kinds of grain, while keeping the total cost to a minimum. Figures 4 to 7 show how What's Best copes with this problem.

Having constructed your spreadsheet within Lotus — see figure 4 — invoke What's Best, by pressing the PrtSc key on the numeric keypad — see figure 5. Then, using the cursor keys and function keys you label cells as either adjustable, constrained or to be maximised or minimised.

BEST TOTAL

Adjustable cells, in this case C-17 to F-17, are so defined by pressing f3, using the cursor keys to highlight the cells and pressing Return. On the Lotus Help line the message "Enter range to unprotect." should be ignored.

The Best cell is obviously the one containing Total Cost, F-17. In this case you want to minimise it, so after placing the cursor in F-17, press PrtSc to invoke What's Best, followed by f6 to have that cell minimised. The constraints in this case do not need to be set, since formulae entered into the spreadsheet will ensure that the cells in the surplus columns will be negative until sufficient quantities of nutrient have been acquired.

This is because What's Best allows

WHAT'S BEST

PC VERDICT

POOR AVERAGE GOOD EXCELLENT

Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

An innovative and genuinely useful product but a difficult concept to market.

constraints to be specified by means of a rule of constraints. This states: All adjustable cells and all cells containing linear formulae depending directly or indirectly on adjustable cells, will be forced to be non-negative during optimisation.

However, in the case of the cassette recorders mentioned earlier, the constraints would be that the quantity used should be less than or equal to the number in stock. So these are declared by invoking PrtSc and placing a < sign between the quantity used and the Quantity Stocked cells of the spreadsheet. A new column must be inserted in the spreadsheet to take the character.

All that remains is to press PrtSc, followed by f1, the optimisation key. The Lotus screen temporarily disappears, to be replaced by a graph — see figure 6 — showing how many tries What's Best is making to get a solution.

When What's Best has finished, the

spreadsheet returns, and the Weight Units to Purchase cells contain the best permutation of quantities to obtain the most cost-effective yet nutritious purchasing plan — see figure 7. The time elapsed between hitting f1 and obtaining the answer is just eight seconds.

By comparison you might like to try a What-If? exercise on this model by entering the appropriate values into cells C-17 to F-17. By trial and error you will eventually reach what appears to be a satisfactory result, but you will have no guarantee that it is actually the best possible.

What's Best has excellent error checking, which returns cell numbers as pointers to why optimisation is not possible. This may be because there are unbounded constraints in your spreadsheet, because you are using non-linear formulae in your spreadsheet, or because you have exceeded the limits of constraints or cells available in your version of the product. If you are in doubt as to whether a formulae is linear or not, try optimising the model. If it is not, What's Best will return an error message saying so.

CONCLUSIONS

■ What's Best performs a service normally only available on minicomputers running very expensive software.

■ Only minimal knowledge of algebra or LP techniques is required for basic use of the program. Best results will undoubtedly be obtained by users who are familiar with the concepts involved.

■ Its potential for saving money is enormous.

■ It performs optimising calculations faster and more accurately than even a professional mathematician could.

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OPEN FILE

CONTENTS

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We welcome serious software for any of the micro systems listed opposite, especially short routines and utilities. Programs can be in Basic, Pascal or any other language.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a disc of the program, and a printed listing from a fully debugged, working program; hand-written listings cannot be accepted.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Make sure all special graphics, inverse-video characters or any other non-standard symbols are listed correctly, or else include Rem statements to explain them.

Each program listing or disc must have your name and address on it, or we cannot promise its safe return. A stamped addressed envelope is appreciated.

If you write in with a comment, correction or enquiry please state the machine and the program title.

We pay at least £10 for any programs used, or £35 per page and pro rata for part pages.

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Sinclair QL	Glyn Moody

LANGUAGES

108

HORSES FOR COURSES

Ashley Oliver begins his two-part series explaining how you can improve your programs by choosing the language best suited to the application in hand

BUSINESS STATISTICS

110

ESSENTIAL STATISTICS

Some key functions to help make sense of your data, described by Owen and Daniel Bishop

FILE TRANSFER

114

KERMIT

The Kermit file-transfer protocol has been implemented for just about every computer under the sun — and the programs are free. John and Timothy Lee explain how it works

HORSES FOR COURSES

Every programming language has its strengths and weaknesses. **Ashley Oliver** details the factors to take into account when choosing the one to program your application.

THE IDEA that programs ought to be coded as efficiently as possible is frequently bandied about, not least in the pages of this magazine. Though Basic is the mother tongue of most microcomputer programmers, a wide variety of alternatives is now available. Choice of the correct language may be the key factor in determining the efficiency of the program you finally produce.

So what factors make a program an efficient one? There are two areas in question: time and resources. Given two computer solutions to a problem and given that all other things were equal, you would probably prefer solutions that consume less time and fewer resources. The total time taken for a computer solution to a problem depends crucially upon the machine used, but since this article is supposed to be about programming I shall assume from here on that we are considering a specified machine.

The total time can be divided into four portions:

- Development time required to design, code and debug the program.
- Translation time, for conversion of source code to object code.
- Run time.
- Maintenance time.

The final heading covers a variety of ills. Specifically, it relates to any time spent after the program has first run successfully. This may mean modifying the program, enhancing it, porting it to a new machine, changing the data it uses, attempting to optimise the algorithm and so on.

As far as resources are concerned, the main factor is the amount of RAM needed. With mainframes memory is not often a major constraint, but with micros it can be a major problem. The amount of memory needed can be divided into two areas:

- Preparation space for preparation of source code and for the translator program.
- Execution space occupied by the object code and its workspace and data areas.

When people speak of efficiency, particularly with regard to algorithms, they are often referring to run time alone. That is perfectly acceptable if run time is the most important thing to them. However, the vast majority of programs are likely to take less time in execution than they are in

writing. So if a program is to be run once only, then the development time is likely to be the dominant factor in the total.

If a program is to have frequent minor modifications, then the time taken for translation could become dominant. If a program is to be ROM resident then space is a major constraint. And so on. In each case the program that consumes the least time or resources overall is the more efficient. This depends not only on the program itself, but also on how it is to be used, how often, by whom, and so on. You must make a separate decision in each case based upon your priorities at the time.

The language used will have a bearing on each term of the time/resources equation. In some cases choosing the right language is simple. In others it isn't, especially when the efficiency equation depends upon more than one of the parameters. You then have to weigh gains in one area against potential losses in others. Experienced programmers usually develop their own semi-intuitive guidelines about which language to use in a given situation.

To illustrate how the choice of language can influence program efficiency I have chosen three program fragments in BBC Basic, ISO-Pascal and BCPL. Each is more efficient in its language than in either of the other two.

In each language, development time is a fairly subtle parameter. To make a prognosis here you have to consider not only what you are going to do, but also how. You should have some idea of the algorithm to be used before you select a language. The point is that the facilities offered by a language can have a great bearing on how easily a particular algorithm can be encoded.

Basic is good at interactive I/O, number crunching, and has a very sophisticated set of string-manipulation functions. The interface to the operating system and to machine code is usually good — and particularly so in BBC Basic. RAM allocation can be well controlled. The fact that storage for variables is allocated dynamically at run time allows great flexibility and means that variables do not have to be declared before use. Of course, such flexibility can be dangerous in careless hands. A particularly

powerful feature of BBC Basic is the run-time evaluation of expressions using Eval.

On the minus side, the Rem method of in-line documentation is rather clumsy. The control structures offered are not as extensive as they might be, although bemoaning the lack of multi-line If-Then-Else, While-Do and Case statements normally reflects more on the programmer than on the language itself. There are elegant ways of achieving the same effects in Basic.

More serious drawbacks are Basic's data types and the way it handles variables. Basic's lack of data types is merely a feature, neither good nor bad on the whole, but the language could badly do with a pointer type for

dynamic structures and extensions to its array handling. Although BBC Basic has perfectly adequate mechanisms for controlling the scope of variables, the scope of a particular variable is not usually obvious from a quick glance at a listing. On the other hand, being able to declare a global variable inside a procedure is very useful.

It is easy to take for granted the fact that Basic has the great advantage of being interpreted, which makes the debugging much more straightforward and convenient. Some who have taken an extreme position on the question of structured programming would claim that properly structured programs cannot be written in Basic and that this makes design more difficult. I don't understand

BBC BASIC EXAMPLE PROGRAM

```

100 DEFPROCperm(A$)

110 LOCAL X$

120 FOR I%=1 TO LEN(A$)

130     IF LEFT$(A$,1) <> MID$(A$,I%,1)
                                     THEN I%=LEN(A$)+2

140 NEXT

150 IF I%=LEN(A$)+1
                                     THEN PROCtest(T$+A$):ENDPROC

160 X$=FNunique(A$)

170 REPEAT

180     P$=LEFT$(X$,1)

190     X$=FNdelete(X$,P$)

200     T$=T$+P$

210     PROCperm(FNdelete(A$,P$))

220     T$=LEFT$(T$,LEN(T$)-1)

230 UNTIL X$=""

240 ENDPROC

250 DEFFNunique(A$)

```


how this conclusion is arrived at. I would maintain that a program in a procedural version of Basic can be as well structured as one in another language.

Translation time is effectively zero in an interpreted language, so the next factor to consider is run time. This is Basic's biggest handicap. Interpreted languages are generally slow. A compiled or semi-compiled language is typically three to 10 times faster. But some programs will run as fast in Basic as in a compiled language, and a few will run even faster. It is all part of the skill of picking the right language for the job.

Maintenance of a Basic program or indeed a program in any other high-level language is principally affected by the style of the original programmer. If the program is unstructured and undocumented this will always be a nightmare. Basic's interpreted nature makes the mechanics of code changes very quick. Against this one has to hope the original programmer was

skilful enough to avoid undocumented side effects; in other languages an unskilled programmer probably wouldn't know how to introduce them. Don't forget either, how powerful the Data statement can be and how quickly these statements can be amended or added. Basic offers a level of convenience here that can only be achieved in other languages by maintaining separate program and data files. One exception arises if the maintenance required is porting the program to a new machine. Basic exists in numerous versions, so extensive re-writing will often be required.

The amount of preparation space required for Basic source code is normally favourable. Since Basic interpreters can be made to tokenise keywords, the source will be very compact. Indeed, Basic code occupies less space while it is being written than it does when it is running. This is the converse of the general case with compiled or assembled languages.

The amount of space required by Basic in running is difficult to compare with other languages. It will certainly take more space than a compiled-source to interpreted-intermediate code language such as BCPL or Pascal. It may take less space than machine code in certain circumstances.

The example on this page takes as its input a single string parameter A\$, and produces every possible permutation of the characters comprising A\$. These permutations are passed to a procedure called ProcTest, which simply outputs them to the screen. The main part of the program is written as a procedure ProcPerm, which means that it may either be incorporated into a larger program or called interactively in immediate mode. The string parameter, A\$, may be of any length up to a maximum of something over 20 characters, when BBC Basic runs out of stack space on the standard Model B. In fact, the practical limit is likely to be hit much earlier.

Only unique permutations are produced by ProcTest: the input 1122 would produce the six strings 1122, 1212, 1221, 2112, 2121 and 2211. Obviously for a string of n different characters the run time is proportional to n!. To produce all possible permutations of 987654321 would take about 20 hours. One other warning: T\$ is global to ProcPerm, and should be initialised to a null string before the procedure is entered for the first time.

The algorithm is highly recursive, as can be seen from inspecting the listing. The function FNUnique takes a single string parameter and returns a string containing all the unique characters in its input, in the order in which they occurred. So given

```
ASHLEY OLIVER
```

it would return

```
ASHLEY OIVR
```

FNDelete takes as parameters two strings, either of which could be a single character. It searches for the first occurrence of the second in the first and, if found, returns the string formed by striking the second out of the first and closing up the gap left. If the match fails the first string is returned unaltered. So given

```
ABCABCBC
```

and

```
BC
```

it would return

```
AABCBC
```

What is it that makes Basic so particularly suited to this algorithm? The algorithm as I developed it demanded ordered lists which could be accessed randomly. A string is an ordered


list, and Mid\$ allows random access to a string, so Basic's string-handling features look promising. Further, the complexity and novelty of the algorithm made me lean towards an interpreted language, as it was obvious from the start that debugging would be a headache.

As it turns out, the choice of Basic was better than I knew. This version of the algorithm leans so heavily on strings that it actually runs faster in Basic than it does as a literal translation in BCPL. If you tried to code it in Pascal setting up the primitive routines would be far too tedious. In Pascal you could not readily use the equivalent of strings — that is, the packed array (1..n) of char — because of Pascal's insistence that these should be of constant length. If I had to choose another language for this algorithm, then the only other serious contender, would be Lisp, which is generally not faster than Basic anyway.

This is not to say that a faster routine to do the same job in the same space could not be developed in assembler, BCPL or even Pascal. But the much greater time taken in such a development would have made the approach inherently less efficient than the implementation in Basic.

Basic is likely to be the natural choice for any program that is going to be run a limited number of times. Its interpreted nature should mean that the savings on development and translation time more than cover any losses on run time. Basic is so good at string handling that it should always be considered if a lot of this is required. It is also good at interactive I/O, to the extent that it is often worth writing the input/output portion of a program in Basic and the processing portion in another language.

Basic is unlikely to be suitable if the program needs to run very rapidly or to execute in the minimum of space. Programs that are logically very complex might make you wish that Basic had a larger set of control structures. Programs that use very complex data structures might require a lot of work to set up in Basic. If overlays are inevitably required, then Basic is far from good at this.

Above all, don't be too ready to dismiss Basic. Unlike other languages it does not stand or fall entirely upon the quality of the original definition/implementation. The fact that it has always been offered as standard on micros means that it is probably better adapted to the micro environment than most languages. 

```
260 X$=LEFT$(A$,1)
270 REPEAT
280     A$=FNdelete(A$,X$)
290 UNTIL A$="" OR A$=FNdelete(A$,X$)
300 IF LEN(A$)>1 THEN =X$+FNunique(A$)
        ELSE =X$+A$
310 DEFFNdelete(M$,N$)
320 IF LEN(M$)>LEN(N$) THEN =M$
        ELSE X%=INSTR(M$,N$)
        :REM This function can be simplified by
replacing the line above by the contents of
the ELSE clause alone if run under BASIC2
where the bug in INSTR has been fixed.
330 IF X%=0
        THEN =M$
        ELSE =LEFT$(M$,X%-1)+MID$(M$,X%+LEN(N$))
340 DEFPROCtest(A$): PRINT A$: ENDPROC
```

ESSENTIAL STATISTICS

In part 4 of their series, **Owen Bishop** and **Daniel Bishop** present a program for the BBC Micro which works out the key statistical parameters for your data.

MANY PEOPLE think of statistics as being concerned with incomprehensible masses of figures, but the aim of statistics is generally to reduce such masses of figures to a very few. These few useful figures, which might be called essential statistics, are the subject of this month's article.

As an example, we shall look at ways in which you might specify the quantity of mustard flour in a tin of one of the standard sizes. The same considerations apply to quantities of other kinds, such as the number of matches in a matchbox, the number of grams of potato crisps in a packet, the number of metres of cable in coil, the number of customers entering a store in a period of five minutes, and countless other kinds of numerical data.

In the case of the mustard, it is obviously impracticable for a mustard manufacturer to weigh each tin after it is packed and to print on the label the exact quantity of mustard it contains. Not only would this be an expensive matter, but it would be a waste of time. People who buy mustard are not interested in the exact weight of mustard. However, the manufacturers need to specify the approximate amount that a tin contains. What amount is to be printed on the label?

TAKE A SAMPLE

In practice, a sample of tins is taken — say, 10 tins each day — as a check on the quantity being packed. Table 1 shows the results of weighing such a sample. Usually, the mustard would be weighed more precisely than to the nearest gram but, for the sake of keeping the arithmetic simple, fractions of a gram can be ignored here.

With the sample shown in table 1, and assuming that the sample is representative of the production standard of the factory, the average quantity is 113g. The average or mean quantity is one of the essential statistics. It provides an idea of how much mustard to expect to find in the tin. In this example, the mean was obtained by averaging the contents of 10 sample tins.

Strictly speaking, this value is the amount found in those 10 tins. In other words, it is the sample mean. It does not necessarily apply to any other sample of 10 tins, or to the factory output as a whole.

So to what extent can this mean be used instead of the mean that might have been obtained by weighing every tin ever produced, or ever to be produced, by the factory? In statistical terminology, to what extent can this sample mean be used instead of the population mean?

The sample mean is the best available estimate of the population mean. Given this, and knowing that it is obtained by weighing only 10 tins, is it reasonable to print "113g." on the label of all tins produced by the factory?

Table 1 shows that there is variation in the amount of mustard in a tin. The average of this particular sample is 113g, but it is easy to imagine that another sample of 10 tins might include more tins with only 112g, and none with as much as 116g., giving a mean of, say, 112g. What is needed is some measure of the extent by which samples are likely to vary from one another.

To obtain this, you have to estimate what spread of values occurs in the population. Again, there is only the sample to refer to for information. The easiest way of describing spread is to specify the range of the sample — in this case 111g. to 116g., a range of 5g.

However, the spread is not a reliable statistic. It depends on the unusual tins, the smallest and the largest, and ignores the majority. A more reliable statistic is the interquartile range.

To understand what is meant by the interquartile range you must first know about the median. The median weight is the weight such that half the tins are of median weight or less, while half are of median weight or more. Table 2

TABLE 1

114	113	114	111	112
113	114	116	112	112

TABLE 2

	111		
	112	} Inter quartile range	} Range
Lower quartile	112		
	112		
	113		
Median	113		
	114		
Upper quartile	114		
	114		
	116		

shows the values of table 1 written out in numerical order. The median of the sample is 113g. This happens to be the same as the mean, though such may not be the case with other data.

The quartiles or quarter-way weights are 112g. and 114g., so the inter-quartile range is 2g. This is a more precise statistic than ordinary range as it is less influenced by the extremes. Note that the median in table 2 actually lies between the fifth and sixth values, since there is an even number of values in the table. The values on either side of the median are both 113g., so the median is also 113g. However, if the fifth value had been 112g. the median would lie between 112g. and 113g. In this sample, the quartiles lie at the third and eighth positions, and so have exact values, 112g. and 114g. respectively.

Medians and quartiles are easy to calculate, and may provide a sufficient guide to average size and spread. However, there are other statistics which, like the mean, are particularly important. They have special properties that allow them to be used in a number of statistical tests, which we will cover in future articles.

The most useful estimate of spread is the standard deviation. It is obtained by calculating the deviation of each value in the sample. The deviation is simply the amount by which each value in the sample differs from the mean of the sample; it is positive for values greater than the mean, and negative for values less than the mean. But the squares of the deviations are all positive, and you can add them together to get the sum of the squares. Taking the square root of the sum and dividing it by the number of items in the sample gives you what is known as the standard deviation of the sample (SDS). Instead of dividing by the number of items in

the sample, you can divide by one less than the number of items. This gives the estimated standard deviation of the population (ESDP). It has a value slightly greater than the SDS, to allow for the fact that the population is likely to include tins containing less than 111g. or more than 116g. and so has a greater spread.

One simple use for ESDP is that you can expect the contents of 95 percent of the tins to be no further away from the mean than twice the ESDP. In this example, in which the ESDP is 1g., then 95 percent of tins hold between 111g. and 115g. Furthermore, well over 99 percent of all tins will be within three times the ESDP — that is, between 110g. and 116g. The tins could reasonably be labelled "minimum contents 110g."

These deductions apply strictly only if the weights are scattered around the mean in a particular way, known as the normal distribution. We shall discuss this in a future issue. In the meantime, you can assume that most data meets this condition closely enough for the deductions to be valid.

ESDM

Another statistic calculated by this program is the estimated standard deviation of the mean (ESDM). Suppose you were to take repeated daily samples and calculate the daily means, you should obtain a set of means, which would itself have a standard deviation, the ESDM. We will explain next month how the ESDM is used to compare means from two supposedly different populations and to determine whether the difference is significant.

The program in this article, file name Esstats, accepts a table with one or more columns. When you load and run the program you are offered two options:

1. mean and SD
 2. median and quartiles
- Press key 1 or 2 to select the option. You should already have prepared a data disc created by the Data Maker, as described in the February issue of *Practical Computing*. Place the data disc in the drive and key in the name of the data file.

The data is analysed immediately for each column, each row and for the whole table. In

(continued on page 112)

ESSTATS

```

10 REM- ESSENTIAL STATISTICS
20 REM- A Statistical Utility Program
30 REM- -----
40 REM- by Owen and Daniel Bishop
50 REM- -----
60 REM- Version 1.0 - 6/10/85
70 REM- For the BBC Micro Model B
80 REM- -----
90 *FX4,1
100 *TV 255,1
110 L$=STRING$(10,CHR$32)
120 MODE7:PROCcol:PRINT"ESSENTIAL STAT
S"
130 PROCbtm:PROCcol:PRINT "Do you wish
to find":PROCcol:PRINT"(1) means and st
andard deviations, OR":PROCalpha("(2) me
dians and quartiles? ",1)
140 IF QR$<>"1" AND QR$<>"2" THEN VDU7
:GOTO 130
150 OP$=QR$
160 PROCbtm:PROCcol:PRINT "Enter name
of file to be loaded":PROCalpha("(max 7
letters): ",7)
170 ON ERROR PROCferror:VDU31,20,0:PR
OCc1s:GOTO 160
180 FILE$=QR$:A=OPENIN FILE$
190 VDU31,20,0:PRINT FILE$
200 INPUT#A,DF$:VDU31,29,0:PRINT"DATE:
";DF$;
210 INPUT#A,NC,NR:PROCcol:PRINT"COLS:
";NC;" ROWS: ";NR
220 IF OP$="1" THEN DIM SC(NC+4,NR+4),
CL$(NC+4),RL$(NR+4),DP(16) ELSE DIM SC(N
C,NR),CL$(NC),RL$(NR),H(NR,3),DP(12),Q(N
C,5)
230 INPUT#A,CW,LC:CW=10
240 IF LC=0 THEN LC=1:GOTO260
250 FOR J=1 TO NC:INPUT#A,CL$(J):NEXT
260 INPUT#A,LR
270 IF LR=0 THEN LR=1:GOTO290
280 FOR J=1 TO NR:INPUT#A,RL$(J):NEXT
290 FOR J=1 TO NR:FOR K=1 TO NC:INPUT#
A,SC(K,J):NEXT:NEXT
300 FOR J=1 TO NC:INPUT#A,DP(J):NEXT:I
NPUT#A,DF$
310 IF OP$="2" THEN 340
320 HI=0:FOR J=1 TO NC:IF DP(J)>HI THE
N HI=DP(J)
330 NEXT:FOR J=1 TO NC+4:DP(J)=HI:NEXT
340 CLOSE#0:ON ERROR OFF
350 IF OP$="2" THEN PROCsort
360 NC=NC+4:NR=NR+4
370 CL$(NC-3)="MEAN":CL$(NC-2)="SDS":C
L$(NC-1)="ESDP":CL$(NC)="ESDM":RL$(NR-3)
="MEAN":RL$(NR-2)="SDS":RL$(NR-1)="ESDP"
:RL$(NR)="ESDM"
380 DIM NV%(NC-4),SV%(NR-4)
390 SW=36-7*LR:CC=INT(SW/CW):IF NC<CC
THEN CC=NC
400 CS=0:RS=0:HB=4+7*LR
410 IF LR=0 AND NR>=100 THEN HB=5
420 RB=NR+4:IF NR>16 THEN RB=24
430 FR=0:FOR J=1 TO NC:IF DP(J)>0 THEN
FR=1
440 NEXT
450 VDU31,0,2:PROCc1s
460 PROCbtm :PROCcol:PRINTSPC(5)"Pleas
e wait while calculating":PROCmean:PROCB
tm
470 RD=16:IF NR-RS<RD THEN RD=NR-RS
480 CD=CC:IF NC-CS<CD THEN CD=NC-CS
490 PROCcolumns:PROCrows:PROCdata
500 *FX21,0
510 VDU31,39,22:K$=GET$
520 IF K$=CHR$139 AND RS>0 THEN RS=RS-
16:GOTO 470
530 IF K$=CHR$136 AND CS>0 THEN CS=CS-
CC:GOTO 470
540 IF K$=CHR$137 AND CS+CD<NC THEN CS
=CS+CD:GOTO 470
550 IF K$=CHR$138 AND RS+RD<NR THEN RS
=RS+RD:GOTO 470
560 IF K$="R" THEN RUN
570 IF K$="P" THEN PROCprintout:GOTO 5
00
580 VDU7:GOTO 500

590 DEF PROCprintout
600 PROCbtm:PROCnum("Width of printout
(40-132) ? ",1,40,1,132)
610 PW=QN
620 ON ERROR PROCpterror
630 VDU2,21:PC=INT((PW-12)/CW)
640 PRINTTAB(0)CHR$13
650 SC=0:PP=PC
660 IF PP>NC THEN PP=NC
670 PRINT"FILE: ";FILE$;"DATE: ";DF$
680 FOR J=1 TO PP-SC
690 PRINTTAB(12+(J-1)*CW);J+SC;
700 NEXT:PRINT:IF LC=0 THEN 720
710 FOR J=1 TO PP-SC:PRINTTAB(12+(J-1)
*CW)CL$(J+SC);:NEXT:PRINT
720 FOR K=1 TO NR
730 PRINT;K;:PRINTTAB(3)RL$(K);
740 FOR J=1 TO PP-SC
750 IF SC(J+SC,K)=1E-29 THEN A$="" ELS
E @%=&102000A+(DP(J+SC)*&100):A$=STR$(SC
(J+SC,K)):IF RIGHT$(A$,1)=". " THEN A$=LE
FT$(A$,LEN(A$)-1)
760 @%=&90A:PRINTTAB(11+(J-1)*CW)RIGHT
$(L$+A$,CW);
770 NEXT:PRINT
780 NEXT
790 IF PP<NC THEN SC=SC+PC:PP=PP+PC:PR
INT:GOTO 660
800 VDU6,3:ON ERROR OFF
810 ENDPROC

820 DEF PROCmean
830 LOCAL J%,K%,C%,SUM,NT%
840 FOR J%=1 TO NC-4:C%=0:FOR K%=1 TO
NR-4:IF SC(J%,K%)<>1E-29 THEN C%=C%+1
850 NEXT:NV%(J%)=C%:NEXT:FOR J%=1 TO N
R-4:C%=0:FOR K%=1 TO NC-4:IF SC(K%,J%)<>
1E-29 THEN C%=C%+1
860 NEXT:SV%(J%)=C%:NEXT
870 NT%=0:FOR J%=1 TO NC-4:NT%=NT%+NV%
(J%):NEXT
880 FOR J%=NC-3 TO NC:FOR K%=NR-3 TO N
R:SC(J%,K%)=1E-29:NEXT:NEXT
890 FOR J%=1 TO NC-4:SUM=0:FOR K%=1 TO
NR-4:IF SC(J%,K%)<>1E-29 THEN SUM=SUM+S
C(J%,K%)

```

(listing continued on next page)

ESSTATS

(listing continued from previous page)

```

900 NEXT:SC(J%,NR-3)=SUM: NEXT
910 FOR J%=1 TO NR-3:SUM=0:FOR K%=1 TO
NC-4:IF SC(K%,J%)<>1E-29 THEN SUM=SUM+S
C(K%,J%)
920 NEXT:SC(NC-3,J%)=SUM: NEXT
930 FOR J%=1 TO NC-4:SUM=0:FOR K%=1 TO
NR-4:IF SC(J%,K%)<>1E-29 THEN SUM=SUM+S
C(J%,K%)*SC(J%,K%)
940 NEXT:SC(J%,NR-2)=SUM: NEXT
950 FOR J%=1 TO NR-4:SUM=0:FOR K%=1 TO
NC-4:IF SC(K%,J%)<>1E-29 THEN SUM=SUM+S
C(K%,J%)*SC(K%,J%)
960 NEXT:SC(NC-2,J%)=SUM: NEXT:SUM=0:FO
R J%=1 TO NC-4:SUM=SUM+SC(J%,NR-2):NEXT:
SC(NC-2,NR-2)=SUM
970 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC-2,J%)=SC(NC-2,J%)-(SC(NC-3,J%)*S
C(NC-3,J%))/SV%(J%)
980 NEXT
990 FOR J%=1 TO NC-4:IF NV%(J%)<>0 THE
N SC(J%,NR-2)=SC(J%,NR-2)-(SC(J%,NR-3)*S
C(J%,NR-3))/NV%(J%)
1000 NEXT
1010 SC(NC-2,NR-2)=SC(NC-2,NR-2)-(SC(NC
-3,NR-3)*SC(NC-3,NR-3))/NT%
1020 FOR J%=1 TO NR-4:IF SV%(J%)>1 THEN
SC(NC-1,J%)=SQR(SC(NC-2,J%)/(SV%(J%)-1)
) ELSE SC(NC-1,J%)=1E-29
1030 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)>
1 THEN SC(J%,NR-1)=SQR(SC(J%,NR-2)/(NV%(
J%)-1)) ELSE SC(J%,NR-1)=1E-29
1040 NEXT:IF NT%>1 THEN SC(NC-1,NR-1)=S
QR(SC(NC-2,NR-2)/(NT%-1)) ELSE SC(NC-1,N
R-1)=1E-29
1050 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC-2,J%)=SQR(SC(NC-2,J%)/SV%(J%)) E
LSE SC(NC-2,J%)=1E-29
1060 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)<
0 THEN SC(J%,NR-2)=SQR(SC(J%,NR-2)/NV%(J
%)) ELSE SC(J%,NR-2)=1E-29
1070 NEXT:SC(NC-2,NR-2)=SQR(SC(NC-2,NR-
2)/NT%)
1080 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC-3,J%)=SC(NC-3,J%)/SV%(J%) ELSE S
C(NC-3,J%)=1E-29
1090 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)<
0 THEN SC(J%,NR-3)=SC(J%,NR-3)/NV%(J%) E
LSE SC(J%,NR-3)=1E-29
1100 NEXT:SC(NC-3,NR-3)=SC(NC-3,NR-3)/N
T%
1110 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC,J%)=SC(NC-1,J%)/SQR(SV%(J%)) EL
E SC(NC,J%)=1E-29
1120 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)<
0 THEN SC(J%,NR)=SC(J%,NR-1)/SQR(NV%(J%
)) ELSE SC(J%,NR)=1E-29
1130 NEXT:SC(NC,NR)=SC(NC-1,NR-1)/SQR(N
T%)
1140 ENDPROC

1150 DEF PROCdata:LOCAL J,K:VDU23,1,0;0
;0;0;:FOR J=5 TO 20:VDU31,HB-1,J-1:PROCC
11: NEXT
1160 FOR J=1+CS TO CD+CS:HH=HB-1+(J-CS-
1)*CW
1170 FOR K=1+RS TO RD+RS
1180 IF SC(J,K)=1E-29 THEN 1200 ELSE @%
=R0102000A+(DP(J)*%&100):A%=STR$(SC(J,K)
):IF RIGHT$(A%,1)=". " THEN A%=LEFT$(A%,LEN
(A%)-1)
1190 VDU31,HH-1,3+K-RS:PRINT RIGHT$(L$+
A%,CW):@%=&90A
1200 NEXT: NEXT
1210 VDU23,1,1;0;0;0;
1220 ENDPROC

1230 DEF PROCcolumns:LOCAL J:VDU23,1,0;
0;0;0;:VDU31,0,2:PROCC11:VDU31,0,3:PROCC
11
1240 VDU31,0,2:FOR J=1 TO CD
1250 VDU31,(HB-1+(J-1)*CW),2:PRINT;J+CS
;
1260 NEXT
1270 IF LC=0 THEN VDU23,1,1;0;0;0;:ENDP
ROC

1280 VDU31,0,3:FOR J=1 TO CD
1290 VDU31,(HB-1+(J-1)*CW),3:PRINTCL$(J
+CS);
1300 NEXT:VDU23,1,1;0;0;0;:ENDPROC
1310 DEF PROCrows:LOCAL K:VDU23,1,0;0;0;
;0;:FOR K=5 TO 20:VDU31,0,K-1:PROCC11:NE
XT
1320 FOR K=1 TO RD:VDU31,0,K+3:PRINT;K+
RS: NEXT
1330 IF LR=0 THEN VDU23,1,1;0;0;0;:ENDP
ROC
1340 FOR K=1 TO RD:VDU31,3,3+K:PRINT RL
$(K+RS)
1350 NEXT:VDU23,1,1;0;0;0;:ENDPROC
1360 DEF PROCnum(Q$,Q1,Q2,Q3,Q4)
1370 *FX21,0
1380 PROCcol:PRINT Q$;:INPUT"Q%$
1390 QN=VAL(QN$)
1400 IF QN=0 AND QN$<"0" THEN 1430
1410 IF QN<INT(QN) THEN 1430
1420 IF (Q3=0 OR QN<Q4) AND (Q1=0 OR Q
N>Q2) THEN ENDPROC
1430 PROCline
1440 GOTO 1370
1450 ENDPROC

1460 DEF PROCalpha(Q$,Q1)
1470 *FX21,0
1480 PROCcol:PRINT Q$;:INPUT"Q%$
1490 IF LEN(QR$)<=Q1 OR Q1=0 THEN ENDP
ROC
1500 PROCline:GOTO 1470
1510 DEF PROCline:VDU11:PROCC11:VDU7:EN
DPROC
1520 DEF PROCbtm:VDU31,0,20:PROCC1s:VDU
31,0,20:ENDPROC

1530 DEF PROCcol
1540 PRINT CHR$130;
1550 ENDPROC
1560 DEF PROCc1s
1570 LOCAL CRS%,V,H
1580 V=VPOS:H=POS
1590 CRS%=999-H-(40*V)
1600 VDU23,1,0;0;0;0;
1610 REPEAT:IF CRS%<255 THEN 1630
1620 CRS%=CRS%-255:PRINTSTRING$(255,CHR
$32);
1630 UNTIL CRS%<255
1640 PRINTSTRING$(CRS%,CHR$32);
1650 VDU31,H,V
1660 VDU23,1,1;0;0;0;
1670 ENDPROC

1680 DEF PROCc11
1690 LOCAL V,H
1700 V=VPOS:H=POS
1710 PRINT STRING$(40-H,CHR$32);
1720 VDU31,H,V
1730 ENDPROC

1740 DEF PROCferror
1750 ON ERROR OFF
1760 CLOSE#0
1770 VDU7
1780 IF ERR>44 OR ERR=6 THEN 1820
1790 CLS:VDU11:REPORT:PRINT " at line "
;ERL
1800 *FX4,0
1810 END
1820 PROCbtm:IF ERR=22 THEN PRINT"No s
uch file";:PROCcol ELSE VDU11:REPORT:PRO
Ccol
1830 PRINT" error. ":PROCcol:PRINT"Pres
s SPACEBAR, when you are ready "
1840 *FX21,0
1850 REPEAT:A=GET:UNTIL A=32
1860 VDU11,11:PROCC1s
1870 ENDPROC

1880 DEF PROCterror
1890 ON ERROR OFF
1900 VDU 6,3,7
1910 CLS:VDU11:REPORT:PRINT " at line "
;ERL
1920 *FX4,0
1930 END

1940 DEF PROCsort
1950 PROCbtm:PROCCol:PRINT SPC(7)"Pleas
e wait while sorting"
1960 FOR K=1 TO NC
1970 EC=K
1980 PROCq
1990 FOR J=1 TO NT
2000 SC(K,J)=SC(0,J)
2010 NEXT
2020 IF NR=NT THEN 2070
2030 FOR J=NT+1 TO NR
2040 SC(K,J)=1E-29
2050 NEXT
2060 IF NT<2 THEN 2120
2070 IF INT(NT/2)<>NT/2 THEN NM=(NT-1)/
2+1:Q(EC,2)=SC(0,NM):Q(EC,3)=SC(0,NM):NM
=NM-1:GOTO 2090
2080 NM=NT/2:Q(EC,2)=SC(0,NM):Q(EC,3)=S
C(0,NM+1)
2090 IF NT<4 THEN 2120
2100 IF INT(NM/2)<>NM/2 THEN NQ=(NM-1)/
2+1:Q(EC,0)=SC(0,NQ):Q(EC,1)=SC(0,NQ):Q(
EC,4)=SC(0,NT+1-NQ):Q(EC,5)=SC(0,NT+1-NQ
):GOTO 2120
2110 NQ=NM/2:Q(EC,0)=SC(0,NQ):Q(EC,1)=S
C(0,NQ+1):Q(EC,4)=SC(0,NT-NQ):Q(EC,5)=S
C(0,NT+1-NQ)
2120 NEXT
2130 VDU31,0,2:PROCC1s
2140 PRINT "Column"TAB(10)"L.QTILE"TAB(
20)"MEDIAN"TAB(30)"U.QTILE"
2150 VDU14
2160 FOR J=1 TO NC
2170 @%=&90A
2180 PRINT;J;TAB(3)LEFT$(CL$(J),7);
2190 TB=0:FLAG=FALSE:@%=&102000A+(DP(J)
*&100):FOR K=0 TO 4 STEP 2:A%=STR$(Q(J,K
)):IF RIGHT$(A%,1)=". " THEN A%=LEFT$(A%,
LEN(A%)-1)
2200 TB=TB+10:PRINTTAB(TB);RIGHT$(L$+A%
,10);:IF Q(J,K)<>Q(J,K+1) THEN FLAG=TRUE
2210 NEXT
2220 PRINT:VDU11
2230 IF FLAG=FALSE THEN NEXT:GOTO 2260
2240 TB=0:FOR K=1 TO 5 STEP 2:A%=STR$(Q
(J,K)):IF RIGHT$(A%,1)=". " THEN A%=LEFT$(
A%,LEN(A%)-1)
2250 TB=TB+10:PRINTTAB(TB);RIGHT$(L$+A%
,10);:NEXT:PRINT:VDU11: NEXT
2260 @%=&90A
2270 VDU15
2280 *FX21,0
2290 REPEAT :K%=GET$:IF K%<>"R" THEN VD
U7
2300 UNTIL K%="R"
2310 RUN
2320 DEF PROCq:LOCAL J
2330 NT=0:FOR J=1 TO NR
2340 IF SC(EC,J)=1E-29 THEN 2370
2350 NT=NT+1
2360 SC(0,NT)=SC(EC,J)
2370 NEXT
2380 PROCquickSort(1,NT)

2390 ENDPROC
2400 DEF PROCquickSort(P%,R%)
2410 LOCAL I%,J%,W,X
2420 I%=P%:J%=R%:X=SC(0,(P%+R%)/DIV2)
2430 REPEAT
2440 IF SC(0,I%)<X I%=I%+1:GOTO 2440
2450 IF X<SC(0,J%) J%=J%-1:GOTO 2450
2460 IF I%<=J% W=SC(0,I%):SC(0,I%)=SC(0
,J%):SC(0,J%)=W:I%=I%+1:J%=J%-1
2470 UNTIL I%>J%
2480 IF P%<J% PROCquickSort(P%,J%)
2490 IF I%<R% PROCquickSort(I%,R%)
2500 ENDPROC

```

(continued from page 110)

option 1 the table is displayed as usual, with additional columns and rows to show mean, SDS, ESDP and ESDM. Use the cursor keys in the normal way to examine parts of the table which are not displayed on the screen. The mean, SDS, ESDP and ESDM

calculated for the table as a whole are displayed in a diagonal row from the bottom right corner of the table. Key P and Return to obtain a printout. Key .R and Return if you want to return the program.

In option 2, median and quartiles are displayed for each

column as two rows of figures. Where the corresponding figures in the two rows are equal, both show the value of the median or quartile concerned. If the figures are unequal, the median or quartile lies between the two. Key R and Return to return the program.

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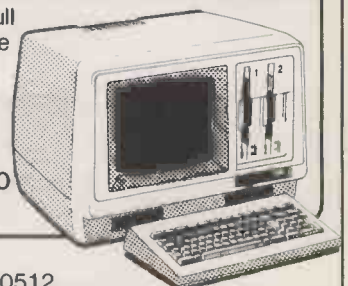
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IT IS often difficult to transfer programs or data from one kind of computer to another. Different machines may store information on different types of devices such as tapes, Microdrives or discs, and even when both micros have floppy-disc drives the discs may be incompatible in size, format or density.

To solve the problem of data transfer you must wire the two computers together, and a suitable program must exist to send information from one to the other. There are several ways of doing this. One is to use a local area network. This requires hardware for each machine, which tends to be quite expensive and is often limited to one type of machine.

The mainframes and mini-computers in British universities and polytechnics have been connected together for a number of years by a set of X-25 networks running on lines leased by British Telecom. Recently they have been merged into a single network called the Joint Academic Network (Janet). Machines connected to Janet can exchange files with each other using a standard network-independent FTP program. This is a very well-designed and efficient system, but it is for mainframes talking to mainframes. It is of no use to micro users.

For many years users of Unix machines have been able to exchange programs and data with other Unix machines through a network, or via a telephone line and modem, using a program called UUCP. Another way is to use commercial file-transfer programs such as BSTAM, Move-It and Ascom for communication between CP/M or MS-DOS machines, and BSTMS between a specific micro and mainframe. You must buy a program for each machine, so this is an expensive solution if you only use it occasionally or wish to connect a lot of machines.

A pair of machines can exchange text files using the built-in utility program Pip simply by connecting their serial ports together. This method has the advantage that Pip

KERMIT

Originally developed as a mainframe-to-micro link this data-transfer protocol and its associated public-domain comms programs have become something of an international standard. **John Lee** and **Timothy Lee** explain how they work.

is provided free with CP/M, but it does not detect or correct transmission errors and it only works for small files which do not involve disc accesses.

We have written two programs that will transfer files between CP/M machines more easily and more reliably. Both have been published in *Practical Computing*. The first, called Undump, appeared in the March 1980 issue, pages 89 to 91. The more recent one is called CPM2CPM and appeared in the January 1985 issue, pages 122 to 126. Both transfer binary or Com files as well as ASCII files. They will detect most errors, but if an error is reported they are unable to correct it and the transfer of the file must be started again from scratch.

SINGLE STANDARD

It is obvious that a single, standard file-transfer protocol that was universally used would be more useful than the existing variety of methods. Such a protocol has to define exactly how data is transferred between machines, so that the transmitting computer sends it in this way and the receiving computer understands what it receives. The same standard could be used to handle communication between two micros, two mainframes or between mainframes and micros.

It is more important that the file-transfer protocol is widely used and universally available than that it is particularly elegant or efficient. The CP/M-80 operating system illustrates this; it became the de facto standard for eight-bit machines simply because it runs on so many of them.

A good file-transfer protocol should have the following features:

- It must run on a lot of micros and mainframes.
- It must be able to copy a file from one machine to the other, and guarantee that no errors have been introduced. Serial communication lines occasionally drop or scramble a few characters because of noise on the line. The file-transfer program must detect if this happens and automatically correct any errors which may occur in consequence.
- The protocol must be able to transfer different types of file, such as ASCII text files, binary files, tokenised Basic or compressed files, regardless of whether seven or eight bits are significant in each byte.
- It is desirable that the commands are user-friendly. Some help facilities should be built-in if possible.
- It would be useful to be able to move a whole family of files, or an entire disc or directory at a time.
- The transfer protocol should be efficient, so that file transfers take place in the shortest possible time.

KERMIT PROTOCOL

Kermit is a file-transfer protocol that was designed at Columbia University, New York. The first Kermit programs were used to transfer files between mainframes and micros. The aim was to allow students to save and archive their files on the floppy discs on their own personal microcomputers, thus saving space on the discs attached to the mainframe. The original Kermit allowed, communication in either direction

between the large central computers in the computer centre and smaller computers scattered around in the departments and laboratories.

The name "Kermit" actually applies to two separate entities: the file-transfer protocol and the set of programs that attempt to implement it. Kermit is not a single computer program; Kermit programs written for individual machines may be very different. The messages may be different, the features implemented may differ and the programs may even be written in different languages. But, because the underlying protocol is the same, any machine running a Kermit program can exchange files with any other machine running a Kermit program.

The Columbia network had to be cheap and reliable. It had to use ordinary terminal lines on-site or telephone lines off-site. Columbia used the RS-232C port to connect the computers, since this was the only common means of communication between the wide range of machines.

Kermit programs have spread throughout the U.S. and are rapidly gaining a hold in the U.K. Kermit has become the most widely used communications package for transferring data between all types of machines, and is the nearest thing there is to a universal file-transfer system.

There are several reasons for Kermit's success. One is that the basic Kermit protocol is simple, and so can be implemented on even the smallest and slowest micros.

Also, Kermit is a public-domain program; everyone is entitled to use it, copy it or give it away. You are not allowed to sell it for profit. Because it is a public-domain program it has been widely distributed by bulletin boards and user groups.

Further, there are no secrets about the way Kermit works. The source code is readily available, so anyone can adapt an existing version to run on their own computer or can write an entirely

CONTENTS OF A KERMIT PACKET

MARK	LEN	SEQ	TYPE	DATA	CHECK
start of packet character	number of characters that follow in the packet	packet sequence number 0 to 63 then wraps round to 0	one character indicating the type of packet: DATA, ACK, NACK, SEND, RECEIVE etc.	The contents of the packet	check-sum

MACHINES SUPPORTED

CP/M-80	Callan
Aculab	Codata
Apple II	DEC Vax
Bigbrd II	Gould
CPT-85xx series	Hewlett-Packard
Cifer 1886	Motorola
Compupro IF3/4	NCR Tower
DEC VT-180	PDP-11
DEC VT-180 Robin	Plexus
DEC Mate II	Perkin Elmer
Delphi 1000	Pyramid
Generic CP/M ver 2.2	Sun
Generic CP/M ver 3.0	Texas Instruments
Heath/Zenith-100	Valid Scald
Heath/Zenith-89	Many of the Unix
Heath H8	implementations are based on a
Kaypro II	common C program.
Lobo Max 80	
Morrow D.1	MISCELLANEOUS
Morrow MD.1	Alpha Micro 68000
Nokia M. Mikko	Altos 986
North Star Horizon	Apollo
North Star Advantage	Apple II
Ohio Sci.	Apple Macintosh
Osborne 1	Atari Home Computer
Sanyo 1100MBC	BBC Micro
Superbrain	BBN C/70
T.Zorba	Commodore 64
TRS-80 II	DEC Professional 350
Torch	Fortune 16:32
Vector Graphics	HP-98xx series
Xerox 820	Heurikon
Most implementations are a	IBM PC/XT/AT
single .ASM program with a	ICL Perq
small machine-specific terminal	Intel 310
handler.	Intel Dev.Sys.
	Luxor ABC-800
MS-DOS	Masscomp
ACT Apricot	NCR Tower
Generic MS-DOS	Pascal m/engine
Honeywell L6/10	Pro 3xx series
Heath/Zenith-100	RM 480Z
HP110	Ridge 32
HP150	TRS-80/16
IBM PC, PC/XT, PC/AT	TRS-80
NEC APC	Terak 8501A
Rainbow 100	Whitechapel MG1
Sanyo MBC	
Seequa Chameleon	MAINFRAME
Sirius 1	Data General
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TI Professional	Hewlett-Packard
Wang PC	Harris
	Honeywell
CP/M-86	IBM
Fujitsu M-16	ICL
Honeywell MSE	LMI
NEC APC	ND
Rainbow	PD-8 and PDP-11
Tektronix 4170	Perkin Elmer
	Symbolics
UNIX	Tandem
AT&T	Univac
Cadmus	Vax

new program which implements the Kermit protocol. Your computer can then exchange files with any other Kermit computer. A large variety of different implementations of Kermit have been developed for many micros and mainframes.

The Kermit protocol is designed to transfer a single file from one computer to another. The sending computer transmits a predetermined number of bytes from the file, together with a checksum; together these are called a packet of data. The receiving computer

stores the data bytes as they arrive, and calculates the checksum from the data, which is then compared with that sent from the other computer. If the two checksums agree, the receiving computer knows that the data has arrived correctly. It then sends an ACK signal to the sending computer, requesting the next set of data.

If the checksum does not match, or if the receiving computer times out because characters have been lost, leaving the computer waiting for more data, the receiving computer sends a NAK signal to the sending computer. The sending computer responds by retransmitting the last packet. The entire file is transferred packet by packet in this fashion, and any transmission errors that occur are corrected automatically.

LOST DATA

Terminal lines from mainframe computers generally have a VDU and a person typing at the end of the line. People type relatively slowly — say, five characters a second. If you connect another computer to the terminal line it can send characters much faster — say, 120 characters a second or 1,200 baud. Columbia discovered that if a large number of characters were sent rapidly down a terminal line to a mainframe, then the mainframe operating system could not keep up. Consequently the mainframe lost some of the characters.

The problem is solved by breaking the file into a series of packets that are small enough for the mainframe to be able to handle in their entirety. A packet is not sent until the mainframe has assimilated the previous one; in practice this usually restricts the size of a packet to about 80 or 90 characters.

Loss of data occurs with many micros, though the causes are different. Once a micro has received a certain amount of data — often 16K — the data is automatically written on to a disc. Most micros stop listening to their serial port when they are using their discs, so if any characters are received at the serial port during this disc-writing period they will probably be lost. This can be overcome by the micro not sending an ACK signal until the data has been safely written to disc.

In addition to containing data bytes from the file being transferred, each packet contains a beginning, an end, a checksum or CRC, and a packet number. There is also a byte indicating the sort of data contained within the packet. The non-data bytes ensure that all errors are detected.

Sometimes the pathway for transmitting data is only seven bits wide. This may be because one or both of the computers, or the connection between them, corrupts the eighth parity bit. This presents no problem with ASCII files, since ASCII characters only require seven bits, and the top bit in each byte is not used and can be ignored. However, binary or machine-code files, tokenised or compressed Basic files, graphics data files and WordStar files all use the eighth bit, and unless all eight bits are transmitted and received the file will be corrupted. If both Kermit programs are told that all eight bits are significant and must be transmitted, but only a seven-bit pathway is available for data transfer, then a special means of communication is used. The eighth bit is either high or low, and this information is transferred by sending a special character to say that the next character received should have the parity bit set on. Thus eight-bit data can be copied down a seven-bit pathway.

When two computers running Kermit are connected together, they negotiate with each other to find what each machine is capable of so as to establish the best way of performing the transfer. They decide the length of the packets, whether to preserve parity and whether to use data compression.

Data compression is an optional feature that allows repeated characters to be transmitted efficiently. For example, files containing tables of figures, graphics or machine-code source files often contain a large number of consecutive spaces.

DATA COMPRESSION

Another time when the data-compression feature is important is when transmitting Fortran files which have been stored as card images. Since a punched card can contain 80 characters and most lines of code are only about 20 characters long, a lot of time will be wasted if 60 blank spaces are transmitted one by one at the end of each line. Provided both Kermit programs implement the compression facility, then the transfer can be carried out more efficiently by giving the number of spaces instead of transmitting a byte for each space. If either Kermit implementation does not support compression, then the file is sent in full. **PO**

The second part of this article will appear next month, and will show in detail how the Kermit program may be used to transfer files. Details will also be given of where you can obtain a copy of the program.

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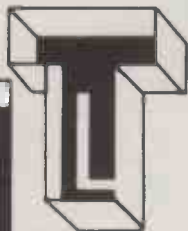
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LAST WORD

KEEP IT SIMPLE

As the need for multi-tasking operating systems on micros increases, **Ralph Cornes** suggests there are lessons to be learnt from mistakes already made by the designers of mainframe software.

THERE ARE those who maintain that to talk of the design of mainframe operating systems (MOS) is a nonsense and a contradiction in terms. Others reckon that any MOS is inevitably an automated example of Parkinson's Law. A third group, noting the gothic architecture of their procedures and the logical gargoyles that startle the unwary programmer, insists that they were designed according to the principles used in building Chartres cathedral, which collapsed three times before the architect managed to invent the flying buttress. However, the story of the development of mainframe operating systems has become especially relevant as pressures are growing to introduce multi-tasking operating systems for micros.

At one time the high price of hardware provided the spur to cutting the operational costs of a few big programs by multi-programming. When telex-type terminals were first connected by telephone and modem to a computer, it became necessary to have lots of little programs operating in parallel. This was achieved by providing the original operating systems with a superstructure which allocated two or three milliseconds to everyone in turn. Unfortunately, system efficiency was low because the batch-orientated design of the base system was unsuited to time sharing.

SQUEEZED IN

With the steady increase in on-line applications, many more programs had to co-reside in memory, and the technique of virtual memory became yet another superstructure. The program became a book in virtual memory on disc, with only the page that was being processed residing in core. You could put a quart into a pint pot, but it took time and lots of machine cycles.

When the first telecommunications monitors were written, the subsequent problems were akin to those of squeezing a V8 engine into a rickshaw. Then, when scores of users needed simultaneous access to the same subroutine in the operating system, a technique called re-entrant programming was utilised. The system kept a single copy of the subroutine and

modified it from a scratch pad before passing it on to a user.

By then 80 percent or 90 percent of the available machine cycles were often taken up by system software. It was about this time that informed opinion in the world of computing concluded that an elephant was a mouse with an IBM operating system.

Unfortunately, none of the lessons learnt from designing mainframes have been applied in the design of multi-tasking systems for micros. Designers still seem bent on providing extra facilities from an unsuitable base. They give little thought to where they are going or of the eventual penalties of large complicated systems — a multiplicity of bugs and high operating overheads.

The ICL Quattro can handle four users each running four tasks at once. It uses Concurrent CP/M, an expanded version of the system which had its heyday in the late seventies. The parallel with mainframe systems is obvious and ominous. There is also a concurrent MS-DOS, and a growing tendency to adapt full versions of Unix, an operating system intended for software development and IT product design. Operating systems are becoming massive and fragile once more, and again the application program is shrinking to the proportion of a pimple on the elephant's bottom.

It seems that there is no design strategy for operating systems, other than to hit a problem over the head as soon as it peeps over the parapet. But one simple design strategy could be borrowed from the hardware designers, and that is to make the product as modular as possible.

An operating system is a collection of programs that carry out well-defined tasks. There is an allocator and deallocator for peripherals, a program loader and sometimes a link editor. It allocates memory, fixes partitions,

allocates priorities, handles spooling and input/output, logs usage, transfers control, signals errors, handles interrupts, and so on. On mainframes these modules were not written as self-contained tasks with a standard interface to other tasks. Originally they were written for a particular type of application program, and as the application programs changed so the operating system was butchered.

ADVANTAGE UNIX

A design strategy for micro operating systems could be to write a series of alternative or mutually exclusive modules for all the operating tasks. There might be four or five different spools, static and dynamic methods of allocating core, I/O which is defined at compilation time or at run time, etc. They would all have a standard interface. The design philosophy of Unix with its pipelined logic should give it a head start. The operating system then becomes a core program with the logical equivalent of slots for additional boards.

Once alternatives exist, a pre-packed collection will provide a small, robust, fast and idiot-proof operating system. It is difficult to design systems frameworks to provide subjects which in some cases cannot yet be defined. But the hardware designers have managed to provide open-ended systems with interfaces and add-on boards.

There are those who argue that operating systems must be successful and well designed because people are using them successfully and profitably. Another argument is that you must not provide alternative modules, but a single omnibus module with a large number of parameters to fit particular tasks. There are reasoned arguments against this, but it is not necessary to use them. You have merely to point the finger to

the story of operating on the mainframe.

A design parameter for modular operating systems must have the ability to produce some basic subsets. The first requirement is a routine in a fixed memory partition to handle communications in batch. It should accept a list of all the messages to be sent and probably all the calls to be made, and work through the list. It should also receive incoming messages and stack them. It is a small routine, not to be confused with an inter-departmental and larger communications manager for networked systems.


Another task is a simple spooling operation. Output from a job should build a file on disc. When the job is finished, the spool should start printing from the file while another file is being constructed from another job. This is not a complex mainframe-type spooling system, as it is impossible to generate the volume to justify one. It is only about 1/10th of the size of more complicated spools in the same operating system.

The next requirement is a utility concerned with copying discs, sorting files and compiling programs. These operations are only allowed to proceed in this partition because they fight each other for resources. If you time-share sorts and compilations even on a big mainframe, all of them suffer.

A batch application partition is used to produce standard letters, carry out some analysis of data, produce a trial balance, or whatever. Finally, there is an on-line partition.

STANDARD MODULES

Only two frills are now needed. One is the ability to set up a queue of work with icons and pointers. The other is an analyser which takes samples of the machine status every few milliseconds to highlight the bottlenecks.

The scheme I have described is an example of a proposed set of fixed facilities for the intermittent professional user. It is based on standard modules which are screwed together to meet his or her needs. Software designers should borrow the hardware design concepts of the bus and standard interface and adopt a common, straightforward design philosophy for different end-user markets. 

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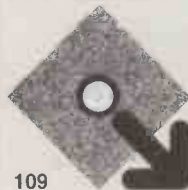
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The Art of Daisywheel Printing

JUKI

2100

FULLY PORTABLE
TYPEWRITER/
PRINTER

FOR ABOUT £ 169*

2200

WITH PARALLEL
OR SERIAL
INTERFACE

FOR ABOUT £ 229*

JUKI

6100

20CPS(max)

13" Platen

No. 1 Best Seller

FOR ABOUT £ 349*



When you're looking for your printout to look its best, then there's nothing to beat the letter quality of daisywheel printers. When it comes to choosing a daisywheel printer you can't buy better than JUKI. With a choice of several machines for both the home and professional user alike, and a vast range of printwheels to choose from, you too can add a little character to your text. Take for example the following three models from the JUKI range, ideally suited for home and small business use.

JUKI 2100/2200

Even with the advent of low-cost wordprocessors, the low cost electronic typewriters still offer the easiest and most flexible means of putting the printed word onto paper. The JUKI 2100 & 2200 offer unparalleled features at a realistic price. Printing at 10cps in either 10, 12 or 15 pitch they will print up to 135 characters on a line. The portability of the JUKI electronic Typewriters allow you to produce true letter quality print almost anywhere. While the JUKI 2100 offers all the standard features such as auto correcting, centering and tabulation, the JUKI 2200 offers the additional feature of either parallel or serial interface to enable connection to almost any micro-computer.

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JUKI 6100

Ideal for the small business/home/educational user alike, the JUKI 6100 includes many features normally only found on more expensive printers. With its Diablo 630 compatible protocols it will run most wordprocessing packages including WordStar and even offer a graphics capability — all at a speed of up to 20cps. The JUKI 6100 will print in 10/12/15 pitch as well as proportional spacing and features a 2k buffer, parallel interface, revolutionary linear motor mechanism and uses IBM Selectric ribbons. Optional extras include tractor feed, sheet feeder and serial interface.



Micro Peripherals Ltd

'THE POWER BEHIND THE PRINTED WORD'

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