Australian Personal Computer

SECRET CODES ON MICROS

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$2.50*

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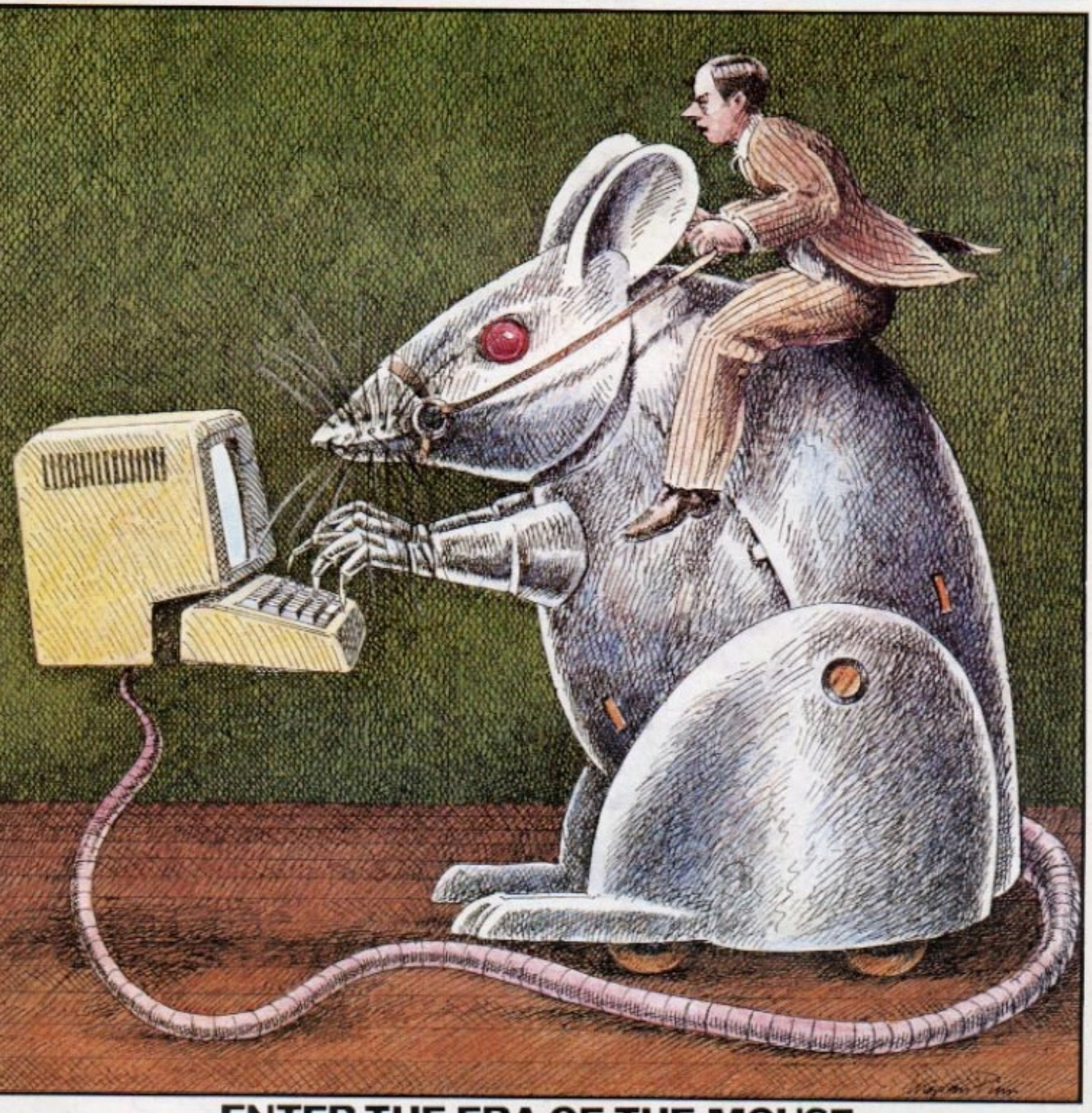

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The BBC Microcomputer is at the heart of a massive computer education project: 'The Computer Programme', now running on ABC National Television.

This complete computer literacy programme includes two series of television programmes, each ten episodes, for students and novices on the use and applications of computers.

The first series commenced on ABC-TV in June in most states (September in SA) at classroom viewing times.

The BBC Microcomputer, designed and used extensively in UK schools computer education, can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system which can synthesise music and speech. Its high resolution colour graphics provide a 'picture' of exceptional quality.

The BBC Microcomputer has been approved for use in Australian Schools by the Education Departments of WA, SA and Tasmania. (Other Australian State decisions on approved computers for schools are pending.)

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DEALER ENQUIRIES WELCOME

inside

Managing Editor Sean Howard; *Consultant Editor* David Tebbutt; *Art Director* Mike Northcott; *Assistant Production Manager* Chris Nisbet; *Photographer* Mark FitzGerald; *Typesetter* Marcia Brown; *Advertising Manager* Gerard Kolunc; *Advertising Executive* Philip Treyvaud; *Subscriptions Manager* Valerie Meagher. Printed by Quadricolor Industries Pty Ltd. Subscription rates Australia $30.00 per annum. Overseas A$40.00 (surface); A$100 (airmail). Published by Sean Howard Productions, 3/300 Clayton Road, Clayton 3168. P.O. Box 298, Clayton 3168. Telephone (03) 544 8855. Telex AA 30133 AMJ.

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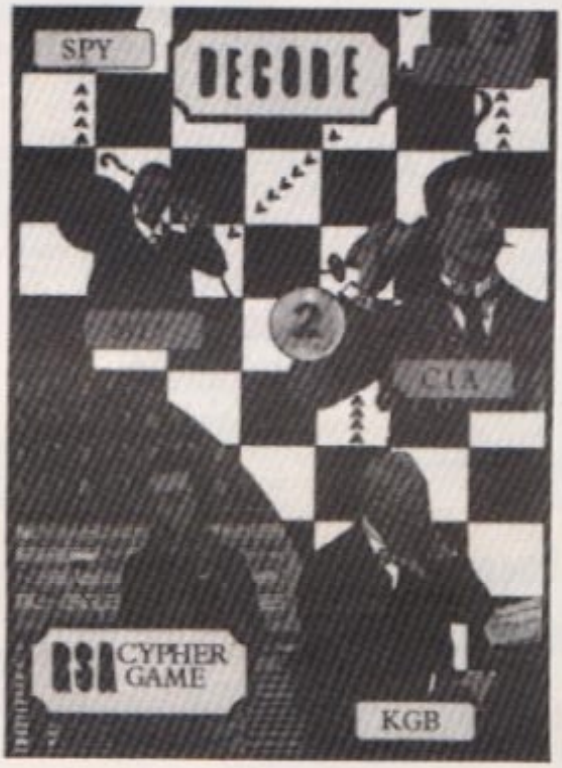

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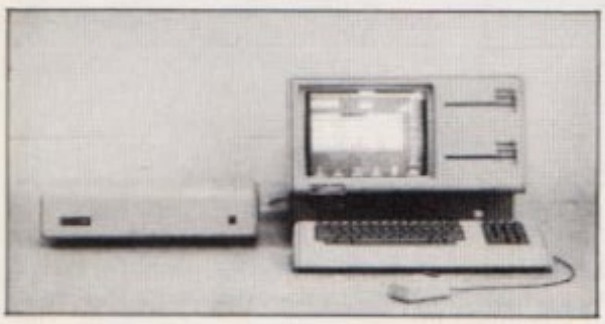

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APC reports on the latest news from the world micro scene

Atari adapts top software

Atari is to convert its top software packages to run on other manufacturers' machines, to make the most of its arcade-game publishing deals and in-house programming expertise.

This decision means that best-selling games like PacMan and Centipede will be available alongside Atari's educational packages on machines such as the TI 99/4A and the Commodore Vic 20 and 64.

Texas faces $100m loss as computer war rages

Texas Instruments became the latest consumer electronics giant to announce that its results will be severely affected by the continuing price competition in the home computer and video games industries. TI said it could lose up to $100 million in the second quarter. Warner Communications Inc., parent of Atari, and Mattel Inc. has announced that it expects to report second quarter losses. But Commodore and Coleco expect to report record profits for the same quarter.

TI said sales of software to retailers dropped sharply late last month and in early June with sales of home computers also dropping. A TI spokesman said the company had no specific explanation for the drop in software sales, but insisted that TI's exclusive software development policy, discouraging unauthorised third party developers, wasn't at fault.

TI said it will reduce production of both hardware and software but will remain in the home computer business. The company plans "vigorous software expansion" and increased dealer support. TI home computers and software are sold at 20,000 outlets across the country.

The company said price cutting on its computer also is contributing to deteriorating financial results. TI had to write off $50 million in the first quarter in connection with a defective home computer component that forced a temporary halt in production of the machines.

TI sold its one millionth home computer in April, but a company spokesman wouldn't disclose current shipments of hardware or software.

TI stock dropped more than 39 points to 118¾ during the first trading day after its announcement, a loss of about 25 percent of the company's market value, or more than $395 million.

Concurrency focus for op. system battle

Tacit agreement between rivals Digital Research and Microsoft to concentrate on concurrency indicates that this will decide the standard 16-bit operating system.

Digital Research recently announced a $5½m deal to provide Epson with 100,000 copies of Concurrent CP/M — the largest quota so far for DRI. This was the latest in a series of similar contracts with US and Japanese suppliers, which has forced Microsoft to talk more openly about version 3 of MS-DOS, due for release in September.

"MS-DOS 3 — it will be marketed under another name — will be more like Xenix and a point in between MS-DOS and Xenix," said David Fraser. He sees DRI's move to offer languages for PC-DOS as a deathblow to Concurrent CP/M on the IBM PC. "A company that provides the extremes such as MS-DOS and Xenix has to set the standard for the middle ground. Concurrent CP/M will be missing the first link in the chain; it will be a one-off product standing on one leg."

DRI naturally doesn't see

Data Decor's Personal Computer Workstation carries the keyboard, disk drives and VDU of a personal computer on the main work surface, and has a printer pedestal above the VDU. The printer paper is carried on a steel rack at the back of the system, and has a second 'paper catcher' rack above for continuous printouts.

The main work surface is 600mm wide by 760mm deep, and the printer pedestal is 400 by 600mm.

Data Decor is at Waterloo Place, Richmond, 3121. 'phone (03) 428 3842.

INTRODUCING MOSQUITOES.

Write for a free catalogue

A sparkly new dimension in computer games from an all-Australian programme.

If Harrison Ford had you at the edge of your seat, when he was chased by boulders and poison darts; if the tense excitement of seeing him trapped in the ancient Egyptian ruins, in search of the lost ark, with all those serpents left you breathless; then this is going to be a real treat for you.
You're entombed beneath massive stone walls. Your only escape is through the locked door. You see the key, but there are swarms of deadly mosquitoes. You do have some insecticide so you may get courageous, but if they strike from above or below you are defenceless. Is there no escape? Yes! The ventilation tunnels. But where do they go? You won't find that out until you come out the other side.
So the heart-pounding race is on and if you have the nerve and skills of a true adventurer you may make it through the first door, only to find you're now in the dark. The key. You see the key, but finding your way through these secret chambers, evading the mozzies, and making it through the next door will leave you faced with the ultimate challenge.
This very original experience of electrifying graphics and startling sound will blow your mind, now, that the danger of the mosquitoes is compounded with the mystery of locating the key ... and we can't tell you where to find it because it doesn't play the same way twice, and you've never had as much fun with a VIC 20 until you take up the challenge of Mosquitoes!

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PARATROOPER

Realistic smooth action and true hi-res graphics. You are the only one left to stop them. The sky is full of enemy choppers. Paratroopers keep dropping into your area with a non-stop barrage of enemy troops. They are out to destroy you. This new game is an unbeatable blend of arcade action and quick thinking strategy. You must make every shot count — don't be too fast on the trigger. Every time you hit a chopper or paratrooper you get extra points. Wait until you see the climax of this game — you won't believe it! This is a multiple skill level game with razor-sharp graphics and sound. Joystick or keyboard runs in standard VIC 20.

ANNIHILATOR

Defend your moon base in this fast-pace, high-action game against attacking aliens who launch sophisticated heat-seeking missiles at you. Your Commodore 64 will amaze you with the complexity of sound and graphics in this programme. A similar programme is also available for VIC 20 and they'll provide hours of entertainment for everyone, or just about everyone because we all can't have a keen eye and a fast wit!

BUG-BLAST

The 'get-them' before they 'get-you' fun of Bug Blast is superb entertainment for the young and the computer novice. If you thought Centipede was fun, then shooting through the cactus with the hit-and-miss action of Bug Blast is going to inspire your imagination. Available for VIC 20, and Commodore 64.

ROAD TOAD C64/VIC 20
A new and unique version of Frogger, now a multi-action game for both computers. $19.95 VIC 20; $24.95 C64.

CHICKEN CHASE C64/VIC 20
Collect all the eggs from the chicken coop without being killed by the fox. $19.95.

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it that way, and intends to continue supplying CP/M-86 for the IBM PC, according to Gary Kildall, founder, chairman and chief executive of DRI.

"CP/M-86 fits very nicely as a bridge to Concurrent CP/M," he said. "We have not given up selling it to the IBM market but have changed the whole approach to a sale. Previously it has been sold through IBM at $40 per copy which is prohibitive to the end-user. Version two of CP/M-86 will have many more utilities including graphics, for $60."

Commenting on Microsoft's attacks, Kildall added, "There will never be an absolute standard for single-user, single tasking 16-bit systems — we will see both CP/M and MS-DOS there. Microsoft had ignored concurrency, while we have had it for three years. Now they have inadvertently put the stamp of approval on ours by announcing theirs."

Both companies are convinced, that the key to portability lies in the languages supplied rather than in the operating system itself.

DRI's Tom Rowlander (designer of MP/M and CP/NET) is working on a project in C, in which by changing one statement in the compiler, the software can be targeted to a variety of operating systems, including MP/M, VAX VMS, Unix, CP/M-68k or the Apple Lisa.

Fraser: setting the middle ground.

While anxious to dominate in the field of operating systems, Microsoft may be willing to work with DRI on all-round environments, in the interests of the customer.

Pitman software

Pitman Publishing has announced the formation of a new division, Pitman Education Software to cater to the education market for Australian and imported software. PES has just released its first catalogue of software which is solely for the BBC micro but it is the company's intention to supply software for other microcomputers including the Apple II.

For further information contact Mariel Beros on (03) 347 3055.

On TV

Television viewers are likely to be inundated with personal computer advertisements during the 1984 Olympic Games. This austere prediction is offered confidently by *APC* following IBM Australia's announcement of its sponsorship of the games' coverage by the 10 Network. Acceptance of the advertising package, announced by Brian Finn, MD of IBM Australia, provides the company with a Silver Sponsorship offered by the 10 network.

It will allow IBM extensive coverage throughout Australia, in five main metropolitan areas and 36 regional areas.

But, while IBM will be plugging its wares ad nauseam during the "13 hours live coverage of The Games each day, including the opening and closing ceremonies", it's a safe bet the other major micro companies will spend up big

on other channels.

Apple will, no doubt, have educated the paper-work swamped exec. who will probably have finally "got have finally "got home to see the kids", Olivetti will be bragging about how its M20 is faster than 45 others tested (without having the good manners to say who tested them) and you'll probably get to see our favourite micro ad. with the deranged adolescent in front of the fish bowl (courtesy Commodore). Of course, none of this will affect the average micro hacker who's likely to have eyes glued to another sort of CRT.

New Apple DOS

Apple Computer Australia is currently distributing a new disk operating system for its Apple II to Apple-licensed software developers for applications development. Called Prodos, it provides increased compatibility between Apple II and Apple III environments and "the higher performance required for more sophisticated Apple II applications".

Prodos uses the hierarchical file structure, file naming conventions and data formats of the Apple III sophisticated operating system (SOS). So, Prodos data files and data media are interchangeable on the Apple II or Apple III.

Prodos' design frees the Apple II from the physical limitations of the 143 kilobyte Apple disk II drive. Using Prodos, the Apple II can handle larger files, such as those often required by word processing and data base applications, and can recognise any storage device, either floppy or hard disk, that uses Apple's protocols.

"Developers have expressed great interest in a standard operating system for the Apple II that provides the capabilities for advanced applications such as networking, business graphics, and large database management", said Natalie Shuttleworth, Apple Computer Inc. marketing manager for Apple II and Apple III operating systems. "Prodos is our response to this need.

According to Shuttleworth, using Prodos, the Apple II eventually will support a common file structure for all languages and applications. Prodos presently supports Applesoft basic and 6502 assembler languages, but its SOS-like design will enable other languages, such as Pascal, to be added easily, all using the same data formats as SOS.

Prodos does not make the Apple DOS 3.3, SOS or Pascal operating environments obsolete, and all will continue to be available as licensed products from Apple. Users will be able to convert DOS 3.3 data files so that they work with Prodos-based application programs to take advantage of the advanced capabilities that Prodos provides.

Prodos-based applications will not require hardware changes to the Apple II, Apple II Plus or Apple IIe. The current disk II interface card will work with DOS 3.3, Apple Pascal and Prodos applications on all Apple IIs.

The Prodos development tools distributed to Apple-licensed software developers include the disk-based operating system, assembler, editor, debugger system utilities, user's guide, technical reference manual, basic programming with Prodos manual and 6502 assembler/Prodos tools manual.

For more information

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The bottom line is that Computer Devices has the experience and power to back up the DOT. That's right, the same company who's been providing reliable terminal/printers for people like you to access someone else's computer resources, now puts that experience to work in a personal computer. So wake up — if you want to make it through the day, you need a DOT.

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- Microsoft's Fortran, Pascal, Cobol, and Macro Assembler.
- The newly fashionable Volkswriter Wordprocessor.
- Datamension Corp's Suite-record Manager, Report Manager, Project Manager and Time Manager.
- Relational Data Base, Personal Pearl, and Application Generator Pearl Level 3.
- Fully integrated accounting packages for Australian business.
- Optional Z80A CPU to implement CP/M 2.2.
- Provision for optional Iintel 8087 numeric data processor.
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- Programmes for DOT, and the IBM PC plus a connecting cable to download PC software to DOT, a service which Radaro Computer Devices offers to provide for customers.

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*DOT specifications: MS/DOS™ operating system; 16-bit 8088 processor; optional Z80 CPU to implement CP/M2.2; 128K memory on single board, expandable to 740K; dual 3½" floppy disks with 287K each; built-in 160 CPS printer, with 80 or 132 characters/line and graphics capability; easy-to-read 5" x 9" monitor with bit-map graphics with high resolution 1056 x 248 Dots and complete range of character display capabilities; asynchronous and IBM communications.

™MS/DOS is a trademark of Microsoft Corporation.

Offices located in Burlington, MA; Atlanta, GA; Chicago, Il; St Louis, MO; Houston, Dallas, TX; London UK; New York, NY; Philadelphia, PA; Washington, DC; Los Angeles, San Francisco CA; Paris, France; Melbourne, Australia.

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MYTEK WORDPROCESSOR is not a plaything. Although simple to use, it is one of the most powerful cassette based word-processors currently available on any microcomputer.

$50

MACHINE CODE TUTORIAL consists of eight interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. MACHINE CODE TUTORIAL is designed to bridge the gap between BASIC programming and being able to understand and use typical Z80 manuals.
Topics covered include the following:

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- 6545 Video Driver Chip Explained
- RESET Options
- Special GO addresses in the BASIC Language
- Z80 Speeds and Timing
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- Parallel and Serial Interfacing
- Cassette Interface and Associated Subjects
- Sound Effects Generation
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BASIC TUTORIAL is a super teaching aid for any classroom. BASIC TUTORIAL is a set of nine interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed.
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ASERTOIDS PLUS is the finest high resolution graphic arcade game available for the MicroBee computer. It features spinning 3-D point by point resolution graphics, shields, intelligent beings, guided missiles, black holes, high-score board and breathtaking sound effects. ASTEROIDS PLUS took more than 1,000 man hours to write and cost in excess of $20,000 to develop. You owe it to yourself to experience the best in arcade games on your MicroBee.

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METEOR RESCUE is a high speed graphics arcade game. The mission is to shuttle earthlings from the planet surface to the mother ship without colliding with meteors and other spinning 3-D objects. The game increases in difficulty as the score rises.

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GHOST MUNCHER is styled after the very popular ATARI arcade game: PACMAN. What more needs to be said?

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MusicB is a music Composer/Editor that lets you create and save music and sound effects with a flexibility that makes chopsticks of the Basic PLAY command. MusicB can create music that may be added to your own programs. MusicB is a great way to learn and play music! Comprehensive instructions are included.

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TOUCH-TYPE TUTOR employs one of the worlds most advanced methods of learning to touch-type. Most computer users are one-finger typists. As well as typing slowly, they contract eye strain by having to keep glancing between the keyboard and screen. TOUCH-TYPE-TUTOR quickly teaches the student to type without looking at the keyboard with a unique method of combining sight and sound. TOUCH-TYPE-TUTOR gives graded exercises and displays a keyboard on the screen. It also lights up the next key, flashes and beeps if any error is made and gives an accuracy rating. As well as all this, the words-per-minute rate is displayed and if the student does well, the MicroBee will actually compliment him in a human voice!

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DIGITALKER is a Computer Voice Storage & Retrieval System. Give your MicroBee a Voice! DIGITALKER allows the MicroBee user to store his voice in the computer as digital data which may be played back at some later time.
Once the voice has been recorded, it may be played back immediately or stored on cassette. The digitized voice may easily be incorporated into the users own programs without detailed knowledge of machine code. The DIGITALKER hardware is not required in order to play back the voice. Thus any MicroBee user many play back a voice previously recorded with DIGITALKER!

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TRSBEE is a package of three programs that loads TRS-80 Model 1 and 3 program tapes into the MicroBee without any additional hardware. Although some program editing will still be required prior to their running, the majority of program typing time is saved by TRSBEE. The first program loads TRS-80 BASIC programs into MicroWorld BASIC. Most programs may then be edited and run. The second program in the package loads any TRS-80 machine code file into MicroBee memory. The third program loads TRS-80 assembler files into the MicroBee EDITOR/ASSEMBLER. Any TRS-80 Model 1 or 3 tape may be loaded. TRSBEE opens up a whole new world of possible software on your MicroBee!

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The following three programs are about to be released. Orders may be placed for them now and the programs will be sent out as soon as they are available.

MYTEK Z80 EDITOR/ASSEMBLER is a low cost cassette based Z80 Assembler. Full and detailed instructions are included.

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KILOPEDE is yet another very popular arcade game. It is designed after the popular ATARI game CENTIPEDE.

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WANTED: WE wish to contact programmers who are capable of producing high quality software in any area of programming on the MicroBee. MYTEK is the largest independent producer of software for the MicroBee and if you wish to join our team of skilled programmers, please phone or write to us.

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CP/M death exaggerated

Digital research (the CP/M company) has decided to support the rival IBM-based PC DOS — but is taking a very great deal of trouble to make sure nobody interprets this as an admission of defeat.

What DRI has done is to announce that all its programming languages are now available on IBM micros whether they have CP/M-86 or not.

Microsoft, its main operating system rival, has in the past been reluctant to support CP/M-86 versions of its programming languages.

Further, DRI insists that this is indeed an aggressive strategy, "in view of the $120 million size of the languages market".

However most people consulted by us noted with some amusement that Digital Research was being rather coy in its insistence that it was supporting PC DOS, rather than Microsoft's MS-DOS, which is essentially the same.

Guy Kewney writes: "The term "market driven" used by Digital Research to explain the support for "PC DOS" will inevitably be seen by opponents of the CP/M family as an admission of defeat in the struggle for dominance.

Further, there are widespread rumours that Digital Research is planning to offer an "emulation" of MS DOS under CP/M-86, possibly this year.

However, the suggestion by Microsoft that CP/M is dead enough to start hammering in nails, is clearly an exaggeration.

With IBM pushing

This is the first picture we've been able to get our hands on of the Fox-640. It is called a "multi-system" computer because it has no ROM and no fixable language but is instead compatible with more than fifty expansion cards available on the open market or from Fox Computers. Fox therefore says it's compatible with Microsoft Basic, CP/M, the Z80 Softcard, the 80 Column cards, Apple's FP card and the RS232 disk controller card.

Amongst the features included with the standard Fox are 64k of RAM, 8 expansion slots, Forth programming card, 6502 cpu (1.2 Mhz), the Fox Operating System Card (FOX DOS is described as work-a-like with additional features). Fox Computers are on (02) 476 4582.

MS-DOS, Microsoft has a powerful advantage over CP/M, especially with CP/M-86 still not readily available with the more sophisticated hard disk and big file handling abilities of CP/M Plus.

But many of the attractive features of MS-DOS — graphics, and concurrency particularly — are still lagging, waiting for version 3.0, while Digital Research can justifiably claim to be in the market with standard products.

It is probably more important to watch the race between the two companies as they struggle to provide a rival to the Apple Lisa and its sophisticated "window" integration software, than to compare the comparatively archaic terminal-based systems currently on offer.

End of magnetic media

Doom is hanging over the magnetic disk business, in the form of an optical disk system for $5,000, capable of storing one-and-a-half gigabytes.

To compete on a simple cost-per-byte basis, a standard five megabyte hard disk system would have to cost under $17, and it would also have to have replaceable media.

The big price jump is being secretly prepared inside disk maker Shugart, under the name of Optimem.

It will be able to write data onto a 3M optical disk, with a laser. Previous optical memories have been video disks, available only in pre-recorded format.

Executives of 3M on the company's stand at the NCC told us that until recent announcements by Japanese electronics giant NEC, the assumed price of a laser disk writer would be around $100,000.

The NEC system will drastically cut this price to the $15,000 level, however the 3M executives felt that the Shugart move was the one which would push the technology into common use.

"With the Optimem system, whenever it becomes available, we will see the cost of the media drop very fast," said 3M. "At this stage, we don't know what the unit cost can come down to, but it will be under $50 and probably under $30."

Shugart executives were very cagey about the status of the Optimem project. However they conceded that it was more than just a research project, and agreed that an official announcement could be expected.

Low end Vector

Dicker Data Projects has introduced a new "entry level" version of its Vector 4 8/16-bit computer. Called the Vector 4/10, it has a single integrated 5¼inch floppy disk with a capacity of 630k as well as the standard 128k of user memory.

Priced at $4295, the Vector 4/10 can be used as a standalone computer or as a workstation on Vector's LINC local area network. It

can be expanded with the addition of another 630k floppy drive or a winchester disk in 5, 10 or 36 Mb units. Included with the standard machine are CP/M and CP/M-86 dual operating systems, graphics software, the ZSM assembler language, Basic 80, Memorite III word processor and the Execuplan II financial modelling package.

Dicker Data is at 78 Captain Cook Drive, Caringbah. Telephone (02) 525 2122.

Keyboard postponed

Futuretronics Australia (distributors of Atari) announced that shipments of PAL keyboards for the Atari 2600 computer system have been postponed.

The low cost computer keyboards announced earlier this year, with 8k of memory, have been delayed due to unforseen manufacturing commitments by Atari in the US.

Noel Thurlow, General Manager of Futuretronics Australia said "Due to heavy commitments to produce NTSC keyboards for the US domestic market and rising production commitments to video computer systems, home computers and Atari software, the production of PAL keyboards has been postponed for the remainder of 1983."

For further information, contact Noel Thurlow, General Manager, Futuretronics Australia Pty Ltd, 1076 Centre Road, Oakleigh, Vic 3167. Telephone: (03) 579 2011.

Apple unveils its Lisa toolkit

Apple has taken its Lisa a step nearer the market by officially announcing the 'software toolkit' needed for putting independent software packages into the integrated system.

But it will not actually release these tools — beyond one or two test sites — until March next year.

The good news for independent software vendors is the fact that the Pascal-derived programmer tools look extremely easy and simple to use. Also, the company aims to make them available at a 'nominal charge'.

Ile 80 column card

Vision 80 has announced that its 80 column card is now available for the Apple

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IIe with a price tag of $299. The card contains on-board communications software to allow Apple to Apple communication and to allow the Apple to act as a terminal with a range of data bases. It can be used with the Netcomm card to give an 80 x 25 display when emulating IBM 2780 and 3270 and DEC VT52 terminals.

Vision 80 also has a 128 or 256k RAM expansion card for the Apple II and IIe which uses bank selection so that it's 8 bit processor can address the 256k of RAM. The 128k card costs $499 and the 256k is $699. Vision 80 can be contacted on (02) 745 1888.

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Other features include LED warning light to ensure you don't inadvertently exchange expansion boards while the system is in operation; a powerful Z80 CPU keyboard, 13 pre-programmed keys for additional functions and attractive upper and lower case characters: There is also built-in twin speakers with volume control. Our FOX-DOS, exclusively written in Australia, is Apple-work-alike, but with many added special features.

And now, perhaps our most outstanding feature. Because the FOX-640 is built right here in Australia (under rigid quality control), we can offer you this amazing package for only $980 plus tax.

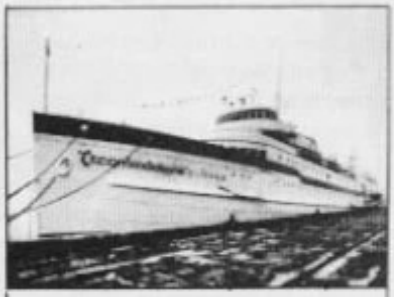
Growth will tail off in 1984

Home computer hardware and software sales will slow beginning in 84, following a decline in sales growth of video game consoles and cartridges, which apparently began this year, according to projections presented at the Consumer Electronics Show.

Two million home computers were sold for $1.3 billion in 82, said William Boss, chairman of the Electronic Industries Association's Consumer electronics group. Hardware unit sales are expected to increase 150% in 83, but dollar sales will grow at a rate of only 69%, indicating continuing drops in per unit pricing. A 40% increase in sales versus only a 27% increase in dollars.

Home computer software sales in 82 were $250 million, with a growth rate of 220% to $800 million, projected for 83 and 163% to $2.1 billion in 84. Video game cartridges won't be hit as hard as video game consoles, according to the projections. In 82, $1.2 billion in cartridges were sold with $1.4 billion expected in 83, a 17% growth rate. Sales in 84 will reach $1.5 billion, a 7% increase.

Consoles will suffer losses this year, with a decline in sales of 15% for units and 16% for dollars from 82 to 83. Sales last year were $950 million for 8.2 million units, with 7 million units for $800 million predicted for 83. Next year's sales will decline to $450 million for 5 million units, a 44% decrease.



The Commodore Clipper.

"COMMODORE CLIPPER" christened (Chicago, June 5, 1983) — Editors covering Chicago's Consumer Electronics Show learned about Commodore Business Machines, Inc.'s newest hardware and software offerings aboard the "Commodore Clipper" today.

During the first "floating" press conference in the history of CES, Commodore introduced the first complete 64k microcomputer system (Commodore 64th microcomputer, plotter/printer, monitor and disk drive), which should be available for less than $1,000 in retail stores, unveiled more than 70 new software packages, and announced software price reductions, many of up to 50 percent, as well as hardware price reductions, many of up to 25 percent for trade customers.

Hardware pricing will spill over to software sales

Low volume and high volume may soon characterise the software industry.

once thought to be immune to the commodity-like economics of hardware marketing. Commodore introdced more than 70 software titles at the Consumer Electronics Show, all expected to sell for less than $100 and many for as little as $10.

Atari and Romex Inc both took aim at Texas Instruments' exclusive policy for software development, which may increase competition and lower prices. Another factor that could drive down software prices is Coleco's Adam, a $600 computer system containing 80k memory, data storage device, keyboard, letter-quality printer, and software package including a word processing program and a game.

While the battle for software dominance has only begun, there is no consensus on how hardware developments could affect the software industry. Clive Smith of the Yankee Group said professional computers will decrease in price enough to enter the home market. He said 60 percent of all IBM PCs are used in the home. He said IBM will serve to standardize the industry in the home and business with the PC and an expected lower-end machine.

Lee Isgur, financial analyst at Paine Webber, disagreed saying IBM doesn't understand the home market and will get into trouble with the pricing of its low-end machines because the home market needs cheap software and hardware, which IBM will be unable to supply. He gave IBM "less than a year" in the home market, predicting that Atari and Coleco will do very well, with the latter selling 500,000 computers in the first year.

Smith also predicted that 256k chips will make their appearance in home computers by early next year. Jerry Erickson of Hewlett Packard said, however, that Smith may be a little premature. He explained that it currently is less expensive to string together four 64k chips than to use one 256k. He added that HP already has a series of chips in the 400k range.

Coleco's Adam system could drive down software prices.

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Peripherals proliferation — the CES game

A whole range of computers made their debut at McCormick's Place in Chicago at the Consumer Electronics Show (5—8th June), including a redesigned Atari XL range. Luc Sala sent this report.

After major US computer shows like NCC and Comdex, the real marketing challenge for a number of suppliers is to push their products in the general user and home electronics market-place. The Consumer Electronics Shows, in Las Vegas in Winter and Chicago in early June, provide a launching platform for home com-puters, video games, laser discs, audio and video equipment.

In Chicago, the retailers for this kind of product come to look for the new gimmicks, improved versions, better price/performance ratios and new marketing approaches. Because of the seasonal nature of purchasing in the home electronics field, the Christmas show is the main market window, with some follow-up software sales in the spring. The Summer CES in Chicago really decides what retailers are going to sell in December. What they order now makes or breaks a product.

Marketing approaches

Due to increased price competition in the field of home computers and video-game consoles in the US, the suppliers are more and more going to adopt mass merchandising techniques. With prices as low as $99 for the TI99/4A, prices under $100 for a VIC 20, a new TRS-Color Computer for just above that level, home computers are rapidly becoming rather uninteresting products for stores employing qualified personnel.

A computer shop cannot survive on the minimal margins left over for this kind of product. Furthermore, the software associated with these cheap computers is also coming down in price. Maybe this is due to the season, but nearly all stores and computer corners in the larger department stores offer immense discounts on software; 50 percent off on established quality products is not unusual.

So what route is left for both suppliers and distributing channels to make some money out of these products? They can either try to look for a niche in the market, or they go for all-out mass merchandise with promotional activities, different mark-up schemes, give-aways and even multi-level marketing structures (including non-professional marketing like Tupperware).

Where the big boys are

In Chicago it became clear that at least market leaders Commodore and Texas Instruments see the after-

market as being equally as important as their first sales of hardware. Neither company introduced new hardware products (TI even withdrew the TI 99/2A from the marketing scene), but extended its range of peripherals and software. TI is now officially warning the trade and the software boys that the TI 99/4A GROM program counter will now be used to keep out non-TI software. Unfortunately for TI, someone at the CES (Californian company Romox) was already showing a device to overcome the problem. Instead of using the ROM slot, the Romox design works via the printer I/O port.

Not yet a commercial product, but demonstrated to the press on the special Commodore Clipper at CES, was a program called Magic Desk. This is a poor man's integrated software package with mouse. Consisting of different ROM pack modules, the price per module will be in the $50—$100 range. The first module of the series contains a file manager and typing program and works with a cute pictorial menu consisting of a desk with files, typewriter, financial journal and even wastebasket. Although the demo still had some bugs and the reaction speed of the system was fairly low, the whole concept is certainly promising.

Games, games, games

Although the big games boom is over in the USA, and the market stabilizing (suppliers' estimate), or slightly declining (retailers' estimate), this didn't stop the games designers. More than 300 new games were announced at CES. It is amazing to see how much more quality and reaction speed can be obtained now with basically the same hardware as a few years ago. But amidst those hundreds of games only very few offer something really new or exciting. Most games are variations upon variations, and sometimes no better than poor imitations of such successes as Frogger and Donkey King.

The end of the games-only consoles like Atari's VCS is near, partly due to the disappearance of the price gap between consoles and home computers — the VCS now has a shop price of $70, the TI 99/2 at $90. The new consoles, like Colecovision and the Atari 5200 offer better quality, but at prices well above the home-computer level.

Although the industry tries to keep spirits high, there are rumours that Mattel, for example, has enormous stocks and will sell its M-series modules at cost price later this year.

And the introduction of the Aquarius by Mattel and the Coleco from Adam, together with Atari's VCS add-on Graduate, does not indicate that these suppliers expect to survive on their console business alone. In order to extend the lifecycle of the consoles somewhat, there are now products with better sound capability, voice activation, and with even better controls.

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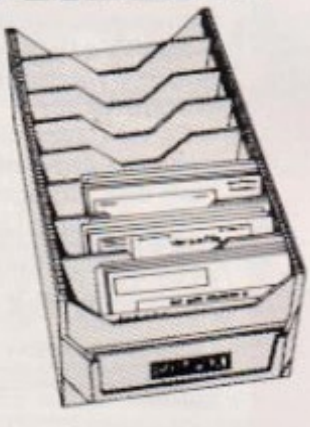

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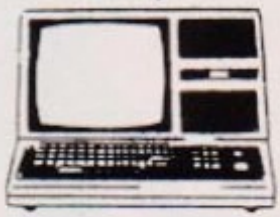

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APC welcomes correspondence from itr readers but we must warn that it tends to be one way! Address letters to: 'Communications', APC, P.O. Box 298, Clayton, Vic 3168.

48k System 80

I read Geoff Lohrere's article on System 80 expansion in Vol. 4 No. 4 of *APC* and found it most interesting. I had no trouble (after reading the article) in going from 16k to 23k, but found Mr Lohrere's article very vague about expanding to the full 48k. So I got off my backside and tried to work it out for myself. I did, and it works.

I have included a step-by-step guide to expanding the 16k System 80 to 48k. In no way do I wish to detract from Mr Lohrere's work — I think that prospective builders should read Mr Lohrere's article for the excellent theory background it gives.

People who do not feel technically minded enough to tackle the project may contact me at 15 Hockley Road, Eastwood or phone (02) 858 3912.

Russell Wild

Steps to Follow to Increase a 16k System to 48k

1. Piggyback the new set of 4116 RAMs, pin for pin, except pin 15, on top of the existing RAMs.
2. Using 7 small 1 inch lengths of wire, link up all the RAMs, using pin 15.
3. Piggyback another set of 4116 RAMs, pin for pin, except pin 15, on top of the above.
4. Using 7 small 1 inch lengths of wire, link up the top set of RAMs, using pin 15.
5. Piggyback a 74L532 IC on top of Z35, using pins 7 (ground) and 14 (plus 5 volts). In the following steps I will call this I.C Z35A. Pins 1 — 6 and 8 — 13 of Z35A should be bent parallel to the plane of the circuit board.
6. Connect pin 14 Z25 to pin 4 of Z35A.
7. Connect pin 4 of Z35A to pin 3 of Z36.
8. Connect pin 4 of Z36 to pin 10 of Z35A.
9. Connect pin 5 of Z35A to pin 9 of Z35A.
10. Connect pin 14 of Z37 to pin 2 of Z35A.
11. Connect pin 3 of Z35A to pin 5 of Z35A.
12. Connect pin 13 of Z25 to pin 1 of Z36.
13. Connect pin 2 of Z26 to pin 1 of Z35A.
14. Separate pins 4 and 5 of Z21. (Be careful of adjacent tracks. I used a Dremel tool here.)
15. Separate pins 1 and 2 of Z21.
16. Connect pin 6 of Z35A to pin 1 of Z21.
17. Connect pin 6 of Z35A to pin 15s of 2nd row of RAMs.
18. Connect pin 8 of Z35A to pin 4 of Z21.
19. Connect pin 8 of Z35A to pin 15, of 3rd row of RAMs.

Red faced

In the April 1983 edition of *APC*, my letter describing a correction for the APC Packer program *(APC*, August 1982) was published.

I find myself in the embarrassing position of having to present a correction to my correction. My sole excuse is that I transcribed the wrong section of my notes when I wrote the letter to *APC*.

The assembler listing of Packer is correct as published. My previous letter dealt with the Basic version of Packer.

In my letter, I described a problem with line 10 of the program. This line is intended to change the top-of-memory pointer within the TRS-80/System 80 so that a Basic program will not destroy Packer.

I said in my letter that the problem was that the MSB and LSB of the top-of-RAM pointer were associated with the wrong POKEs in line 10. That is still true.

However, even after the published values for the LSB and MSB are unchanged, the top-of-memory pointer is still set one byte too high.

The problem is that the top-of-memory pointer tells the System 80 (on which I run Packer) the location of the highest byte of RAM it *Can* use. If one uses the POKEs in my original letter, they tell Basic that it *Can* use location 32132, which happens to be the first byte of the Basic stack area and the first byte of Packer is corrupted.

So, to get the Basic version of Packer to work, top-of-RAM must be set lower than 32132. If line 10 of the program is set to read as shown, all problems are solved and the Basic version of Packer Will work!

```
10 POKE 16561,128: POKE
   16562,125
```

My apologies to *APC* and its readers for my error.

T. J. Day

Engineering calculator

I would like to purchase either a small computer or a programmable calculator capable of dealing with engineering problems such as pipe-sizing, heating and cooling loads, etc. I have no knowledge of computers, and hence would be looking for a machine easily mastered by the layman. What would you advise?

P Bagnall

Assuming that you just want the right answer fast, and are not concerned either with having a detailed printout, or with writing your own programs, then I personally think there is a lot to be said for a dedicated electronic calculator for your application. This would seem to be especially so in your case, as there would be no moving parts to get sand into them, and no need for a mains power supply, which might be subject to voltage variations, etc.

P L McIlmoyle

Track record

Over the last few months I've been trying to work out how a trackball works. I've talked to my physics teachers and they haven't any ideas on the subject. The only way I can think of is by using changing magnetic fields. Is this correct? If it isn't how do they work?

John Benfield

I confess, I have been intrigued by this too, and I don't know. However, let me suggest two feasible methods, and perhaps someone will write in and tell me if I am near the mark.

A trackball is a position controller similar to a joystick, except that you can rotate the ball continuously through as many degrees as you like by rubbing with the hand. So the problem is to resolve and measure the X and Y motions without being able to put a shaft through the ball. One way would be to have two small disks with their edges on the ball and mutually at right angles, so that one rotates for X motion and slips for Y, and vice-versa. The movement could be read by a shaft encoder, giving very low friction and direct digital output.

Another way would be to have a metal ball and five small solenoids with their poles forming the pattern of a cross at the ball's surface. The central pole would be energised with an AC bias, and the four surrounding poles would pick up equal signals with the ball still. If the ball moves, it will drag the eddy current pattern round and upset the signal balance. A differential amplifier, rectifier and a voltage frequency converter for each axis would give a pulse signal proportional to movement.

Len Warner

Oversight

I started reading with interest Mike Liardet's article on Microsoft's Multiplan *(APC* May 1983) and was greatly surprised to find that there was no mention of one of the first micros to adopt Multiplan, the Olivetti M20 (although using a different operating system). This is even more surprising when one recalls the fact that the M20 passed *APC's* benchmark tests with flying colours — evidence of this was produced by the *APC* benchmarks' summary in the November issue, when the Olivetti M20 was top of the list of 63 machines tested.

The M20 is also conspicuous in the absence of any reference to it, except when Olivetti or an independent dealer decides to place an advertisement in your otherwise informative magazine. I wonder why!

Brian Darmanin

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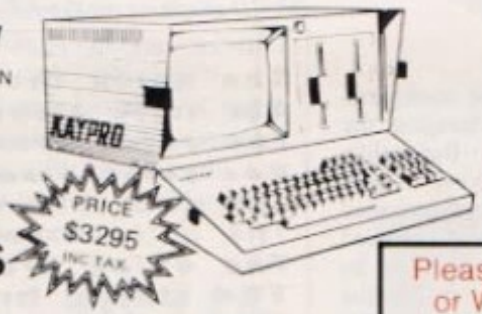

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CHECKOUT

EPSON FX-80

Has Epson produced another winner printer. Peter Rodwell gives his verdict.

Back in the early days of the micro business, one company dominated the low-cost dot matrix printer market — Centronics. So widespread were Centronics printers that the parallel interface used by that company became an industry standard, along with its name; the Centronics parallel interface is still called that although another company has long since taken over the lead: Epson.

The Epson MX series of printers rapidly gained a good reputation as solid, very reliable and quiet units which could be left to churn out hard copy for hours on end. They weren't particularly quick but, unlike some printers, they never had to stop to cool down in the middle of a long job and you could at least hold a telephone conversation in a normal voice with one working next to you.

The MX range underwent several refinements, ending up as a very versatile little printer with full bit-mapped graphics capability. By the time it was withdrawn, the MX mechanism and electronics could be found everywhere, not only in Epson's own packaging but in a huge variety of cases with all sorts of names on the label.

The MX range has now been replaced with two new models, the RX-80 and FX-80. This Checkout is of the latter, the RX-80 being a lower cost, traction feed only printer with fewer facilities and working at 100 characters per second compared to the 160cps of the more expensive model. At a recommended retail price of about $1273 (plus sales tax) (but it is already being discounted by some dealers), the FX-80 is likely to be a big seller while the RX-80, at around $915 (plus sales tax), will probably appeal to those with a tight budget.

The FX-80 is somewhat larger than its predecessor, especially in width. A quick look at the back of the machine reveals one reason for this — the power lead and interface connectors have both been moved clear of the paper, a very welcome improvement as both tended to foul the paper's free movement on the older models.

External controls remain the same as on the MX models: a rocker switch for mains power at one side and three square buttons on the top to the right, one to put the printer on or off line, one for form feed and one for line feed. These last two only work with the printer off line and there's a green LED indicator which lights up when the machine is on line. Three other LED indicators are provided, one for power, one to show the printer is ready and a red one to show when the paper has run out. This last event is accompanied by a series of bleeps from the printer, unless it has been sent a special control code by the computer to turn off the paper end detection facility. Like the MX series, the machine has a self-test facility which operates if you turn it on while pressing the line feed button and continues until you turn the machine off.

The FX-80 has both friction and pin feeds for paper, enabling you to use single sheets or continuous stationery. Feeding in continuous stationery is much easier than with the MX models. There's now a pin feed mechanism at the end of the roller rather than a separate unit and with the release lever slid forward, paper is slipped behind the roller and the roller then turned; the paper automatically engages on the pins and it's done. Simple though this procedure is, it has been provided at the expense of versatility: the machine can only use paper between 9½ and 10inches wide unless an optional tractor feeder is purchased, in which case it can handle paper from 4in to 9in.

Set-up

Like the MXs, the FX can be configured for various conditions by changing the settings of internal switches. But unlike the MX models, you don't have to take the machine apart to get at them: they are located under a small cover, released by a single screw, and can thus be changed even with the paper still in the printer, a great improvement. The switches give you the following options:

— column length, 80 or 132 columns, normally set to 80. Setting it to the 132 column mode puts the machine in condensed mode automatically;

— choice of zero being printed either as '0' or 'O' (it's normally '0');

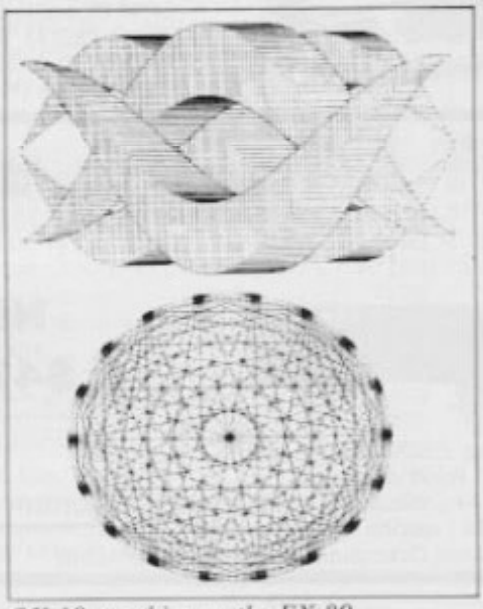
— paper end detector on or off, normally on;

— enable or disable the 2 kbyte buffer, normally disabled;

— emphasised or normal printing at power on, normally normal;

— and a choice of nine international character sets: US, French, German, British, Danish, Swedish, Italian, Spanish and Japanese. As these use ASCII symbols such as '[' and ']' for various national characters like the Spanish upside-down question mark, I can envisage some pretty weird C source code listings appearing all over Australia!

A second group of switches gives con-



QX-10 graphics on the FX-80

A combination of FX-80 and QX-10 produced these.

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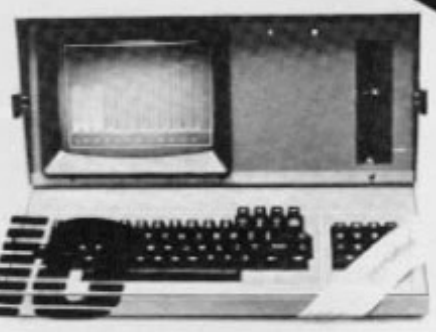

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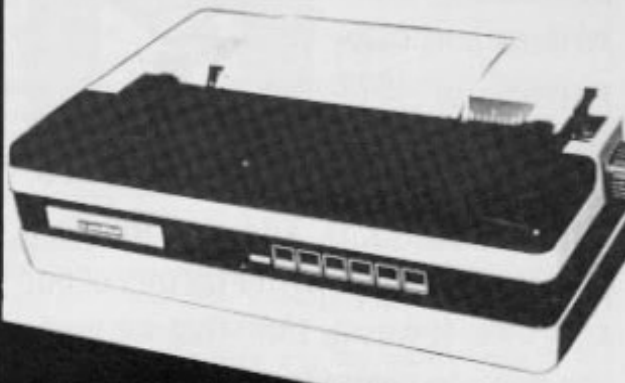

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SETTING THE STANDARD

trol over functions such as turning the buzzer off permanently, automatically performing a line feed on receipt of carriage return or not and automatically skipping over the paper perforation when there's less then an inch left on the page.

Character sets

The FX-80 has a tremendous range of built-in character sets, far more than any other printer in this price range which I have come across.

The normal font looks almost exactly like that of the MX range with only a couple of minor alterations as far as I could see. There are condensed (132 column) and enlarged (40 column) as well as enlarged condensed (68 column) sets, just like the MXs. But the FX also provides an elite face (12 characters per inch instead of the standard 10) and elite enlarged and in addition has a proportionally-spaced font. The standard font is also available in an alternate face, italics, with changeover being made through special control code sequences.

The proportionally-spaced font is very pleasant, especially as electing it automatically places the printer in emphasised mode, and it is quite acceptable for all but the most formal of letters (grovelling to the bank manager, etc). As far as I could establish, it actually has only two widths, one for 'thin' letters like 'i' and 'I' and one for everything else.

Generally speaking, it's possible to mix printing modes quite easily, producing, say, proportionally-spaced italics or emphasised large characters. This gives you tremendous versatility (provided your word processor can handle it, but of course there shouldn't be too much problem if you're using some other suitably configured software).

Graphics

A hefty section of the printer's thick, spiral bound manual is given over to its graphics capability. Again, a variety of modes are possible: 576, 640, 720 and 1920 horizontal dots, with variable line spacing to obtain just the effect required. Note that one mode gives the same horizontal dot resolution — 640 — as the Epson QX-10, Benchtested in the preceding pages, and naturally the two are completely compatible. Seizing this fact, I cheated to produce the graphics shown below by dumping from the QX-10's screen to the FX-80.

Of course a major advantage of the dot graphics is that you can define your own character sets and produce all sorts of fancy effects, although the FX-80 has such versatility in its built-in character sets that I'd be hard put to find a use for any more which would justify the effort of designing and programming my own fonts. Still, if you want to do so, the manual gives full instructions. The manual, by the way, is clearly and concisely written, with full details of how to set up the machine plus extensive examples, in standard Microsoft Basic, of how to send the character control codes. There are also complete diagrams of all the character sets and permutations possible on the machine.

```
This is the FX-80's standard font
This is normal but it's underlined
and here is the italics version of the standard font
This is the emphasised version of the standard font
This is double-strike printing
This is double-width
This is what the condensed face, giving 132 columns, is like
and it has an enlarged version, too
This is printed in the elite face - 12 chars per inch
This is proportionally spaced - it's automatically emphasised
The FX-80 can also handle superscripts and subscripts
```

Some of the FX-80's built-in fonts

Conclusions

The FX-80 has got to be another winner for Epson, even though a cheaper machine is being marketed — it wins on the massive range of facilities, which should be enough for anybody's uses. The only problem you might face is in interfacing it to your software; the range of facilities and the codes required to control them vary so much between manufacturers that it's extremely difficult for standard software packages to cater for all possibilities.

Although the FX-80 is slightly noisier than its predecessors, it is twice as fast and this makes a tremendous difference if you have lots of stuff to print out. As an all-round printer selling at a reasonable price, it definitely is worth seriously considering.

END

BENCHTEST

APPLE LISA

Robin Webster and Leslie Miner give their exclusive report on Lisa. Here they weigh up whether or not Apple has succeeded in its aim of providing an integrated office system for the single user.

Not all traditional computer users will be happy with the new Lisa Office System from Apple Computer.

It is an indication that something serious has happened in the industry when people get opinionated or unusually picky about the suspected shortcomings of a product.

As the following review indicates, the Lisa represents a vast improvement in the ways in which users interact and the results they achieve with conventional systems. At $10,000 Apple's new system is not low-cost, but it is powerful. While the hardware is state-of-the-art in complexity, everything else has been uniquely designed for one purpose: to simplify the interaction for the single-user. The ideal is that the machine, as one of its designers said, 'is finally cut from its roots in accounting and becomes primarily an extension of the user's ability to get results'.

With the mouse, a desktop interface, integrated software applications, and a high-resolution, multi-window display, the Lisa represents a new alternative: the office computer made as personal as possible.

In fact Apple has daringly and effectively cut across many perceived industry trends.

The feeling within Xerox, the company which did a lot of the conceptual work on window displays and icons with the Smalltalk software system and Star hardware, is reported as being, 'We blew it . . .'

The kind of response that Apple has had from its potential customers indicates an untapped demand for a Lisa-like machine. And since Apple is now ranked at 411 in the Fortune 500 (one of the youngest companies to attain the honour), it could be ideally placed to provide the right kind of computer solutions to its peer group.

In taking on John Scully as president and chief executive officer — replacing Mike Markkula, one of the co-founders — Apple has sharpened its marketing prowess, too. Scully, has already demonstrated his abilities by turning around the ailing international division of the Pepsi company, for which he was vice-president.

We had access to a Lisa for just a short time. Maybe Apple has gambled its corporate future on the roll of a dice, or maybe it has made a dramatic shift from being the company that started micro-computing with the Apple II, to the company that started it all over again with the Lisa.

SOFTWARE

This review of Lisa took place at Apple's Lisa division building located in Cupertino, California, in what had come to be known as the 'sneak room' — an area with six or so Lisas on permanent display to visiting Fortune 500 managers.

On entering the room, I placed some of my papers down on a table next to a Lisa which appeared to be switched off, and was surprised to see the screen suddenly glimmer. No keys had been pressed, the fact that I had inadvertently jostled the machine's mouse was enough to make it come to life.

Then the screen, sensing that no activity had occurred within a pre-set time, automatically dimmed. This is just a simple demonstration of Lisa's software capabilities.

The designers at Apple confessed that what they had held at the back of their minds was a 'vision' or central concept. This vision was the ideal user interface, around which a whole new machine would have to be built, possibly a whole new genre of machines. Indeed, it would probably turn out to be the very machine that they themselves would prefer to use.

The result of this work is a far better understanding (as far as Apple is concerned) of how people interact with computer systems, and notably, a Lisa-like machine. To make absolutely sure that they were on the right track, Lisa's designers arranged with the company's personnel department that all new recruits into the Lisa division should be asked to act as test subjects on the prototype machines. These recruits first indicated the level of computer experience they had, and were then let loose on a machine. Careful monitoring of their responses in specific situations gave the design team a wealth of information.

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The typical user interface (that is, the operating system command line interpreter or shell) nurtures a small group of people who view computing as a challenge — a bit like bronco-busting in fact. They succeed more by conquering the command line interpreter than by using it to achieve results.

But even understanding how a conventional system functions doesn't guarantee that you will always be able to predict how it will perform. Disk errors, system lock-outs, incoherent error messages can destroy the work of even the best user. There's an ever-present fear of losing important data; a lack of reliability. This is what the Lisa team set out to conquer.

Not only is it visually clear where the Lisa user's data has come from and what's being done to it, but there is virtually no fear that any information will be 'lost' in the system.

With features like 'Undo Last Command', it can only get as bad as watching Tom & Jerry ... after Tom is demolished in some way, you know that he'll reappear intact in the next frame.

Icons

Returning to the Lisa that automatically switched its screen on, let's examine what happens the moment a user begins to interact with the machine.

The first thing he sees is a blank screen except for a group of 'desktop' items that are at his disposal — a clock, calculator, clipboard, trash-can, and two special items called the 'ProFile' and 'Preferences' — see Figs 1 and 2.

The clock is used to set the system's time and date information; the calculator is actually represented on the Lisa screen as a full-function calculator and can be used as such; the clipboard is used for the temporary storage of information; while the trash-can is used as a hold area for unwanted files (the last item thrown into the trash-can can always be retrieved).

'ProFile', being the 5 Mbyte hard disk, is equivalent to a filing cabinet, while 'Preferences' is provided as a means of tailoring the Lisa'a capabilities to individual requirements.

These screen images are called icons. In addition other icons can be generated; for example, if you wish to put a new file onto your desktop from a floppy disk, then a floppy disk icon will appear on the screen, with the document name beneath it once everything is loaded.

Even at this stage, there are those who are critical of the fact that such icons are used to depict 'real' objects, and they are critical of the specific icons that have been chosen.

We think that this is beside the point because the icons could be modified and improved upon if necessary. The real question is: 'Are icons a better method of interacting with a system than straight keyboard entry and special function keys?' Moreover, are they useful, and specifically, are they useful to Apple's target users?

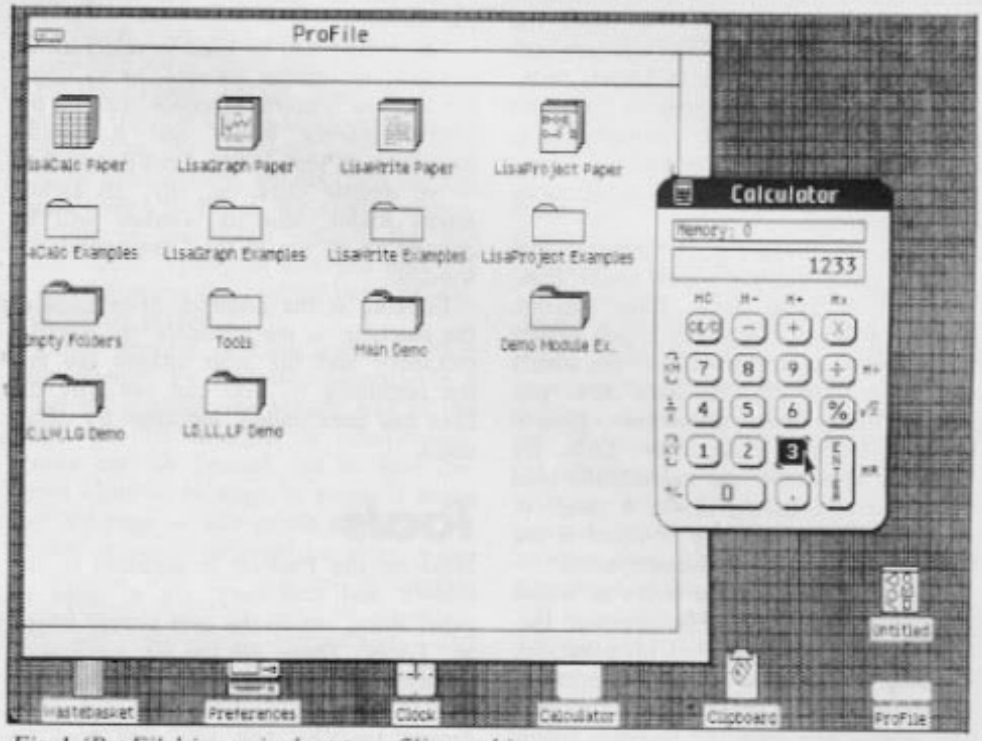


Fig 1 'ProFile' is equivalent to a filing cabinet.

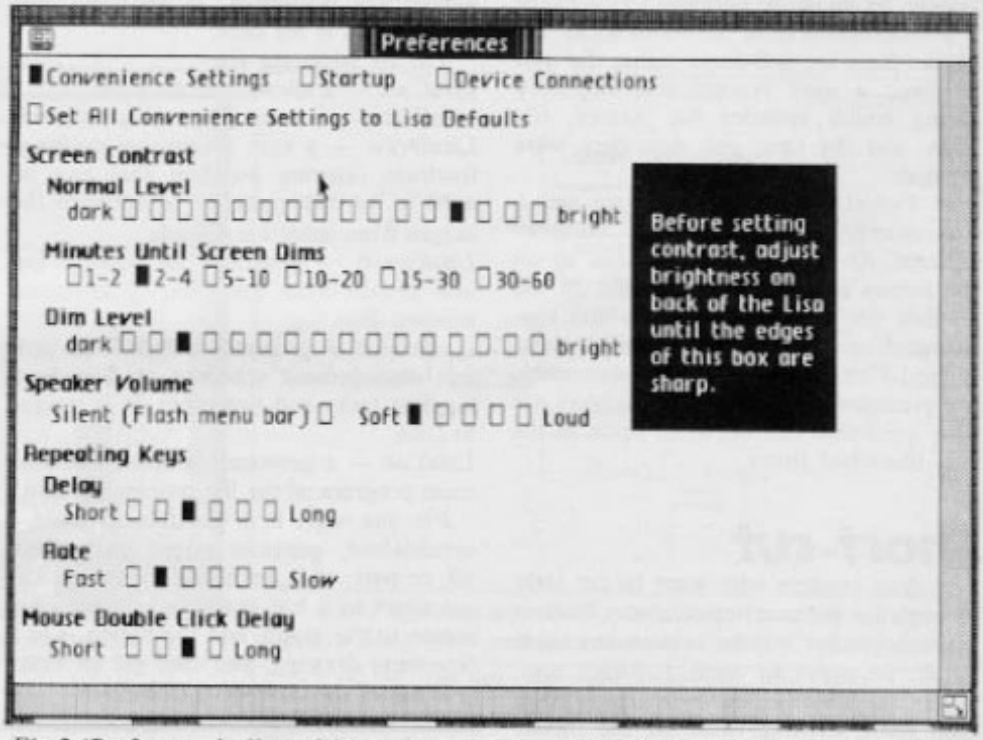


Fig 2 'Preferences' allows Lisa to be tailored to individual requirements.

What do you do with an icon? This is where the mouse comes in.

The Mouse

The mouse controls the screen cursor which can be moved directly to any icon. The icon can then be selected by pressing the mouse button once. Once selected, the icon changes into a negative image (that is, from a black outline on a white background to a white outline on a black background). The user can now act upon the icon by moving the mouse/cursor to a one-line menu bar across the top of the Lisa screen.

Menus

One-line system command menus are not new. The Lisa version seems to have some of the characteristics of the UCSD p-System menu. When you change from the top-level compile and execute menu on the p-System and go into the program edit level, the menu options change in

keeping with the mode. It's no use having the 'Compile' option while you are still using the screen editor, to create code. The Lisa menu does change as well, not in terms of the mode (because Lisa genuinely is a modeless system), but simply to keep track of the applications currently in use.

If you are using the spreadsheet tool you are given a menu which reads: File/Print, Edit, Type Style, Page Layout, Format, Protect, Calculate. If you simply start at your desk and wish to see what's stored on your ProFile hard disk, you select 'View' from a simpler general menu: File/Print, Edit, View, Disk. By selecting View from the menu while hold ing the mouse button down, a range of more specific options are revealed in the form of a pop-out or pull-down menu.

'View' gives you three ways in which you can display the ProFile contents: Pictorial, Alphabetical, Chronological. Keeping the mouse button depressed, you simply 'pull' the cursor down over the options and once the relevant one is backlit, let go of the button.

If 'Alphabetical' or 'Chronological' are chosen from the pull-down menu, the user is given a very recognisable directory listing which includes file names, file sizes, and the time and date they were created.

If 'Pictorial' is chosen, the user gets a first introduction to the Lisa's 'window' concept. An actual window opens up on the screen with the title ProFile. In the window are all the files on the disk represented pictorially as folders. New, unused files, seen as pads of stationery, are present too. The pads and folders are also icons and can be acted upon in the way described above.

Short-cut

For those readers who want to cut right through the menu selection route, there is a much quicker way to achieve the same result. In order to open a folder, say, within the ProFile, or even the ProFile icon itself, clicking twice on the mouse button will also open and close icons.

Once you are in the Profile window, suppose you want to look at a particular folder entitled 'Correspondence'. You again place the cursor on the folder, select it with one click, and then either click again or go to the command menu at the top of the screen to open it. A new window appears out of the Correspondence icon, and ends up overlapping the ProFile window — much as two documents would on a real desktop.

Note that although many windows — up to 20 or so — could be open on the desktop at one time, only one window can be active. If you want to look at a window lying beneath the currently active one, you must first select it with the cursor.

The mouse can be used to select either window, to change its size, or to scroll the window contents. Double click on the Correspondence folder and it shrinks back into its icon in the ProFile window — or double click on, say, an annual report folder, and its window will be opened up on top of the Correspondence window.

Looking at the graphics orientation of the machine — the windows, the desktop metaphor and the icon images are just the beginning — you can see why the Lisa has been called 'intuitive' for office users.

Tools

Held on the ProFile in addition to the folders and stationery are a range of other icons, which the user simply knows as 'Tools'. These are the six application programs, whose integration is a key feature of the Lisa system. To the user this means that he can use any tool on almost any document, at any time, just as he would at his desk.

The six packages are:-

LisaCalc — a speadsheet program.

LisaWrite — a word processing program.

LisaDraw — a very impressive drafting/freeform drawing program that can be used in its own right, or to enhance the output from other Lisa Tools.

LisaGraph — generates all popular format graphs from LisaCalc or keyboard entered data.

LisaProject — generates a PERT-like project management schedule or flowchart, juggling tasks and resources. It is unique to Lisa.

LisaList — a personal database management program of the list processing kind.

For the user, it is possible to build a spreadsheet, generate a pie chart from all, or part, of it, immediately change the pie chart to a bar graph, add a personal memo to the graph, edit the memo, add a free-hand drawing, and then get an exact printout of the composite document.

'Lisa will be considered successful if the user can accomplish something unaware of the complex underlying engineering'

In addition, while the Lisa user can move from one program to another with ease, he also uses — as much as possible — the same operations in each application. This reduces the amount of time that has to be devoted strictly to learning.

It's pretty clear from asking various people, that the name Lisa wasn't much more in the beginning than a project tag for Apple's personal office system. However, the company now allows the acronym to mean Local Integrated Software Architecture.

The following is a description of how we created quickly quite reasonable output illustrating some of the above programs — particularly LisaCalc, LisaGraph, LisaDraw, and LisaProject. Although these programs may not be the best in their fields, the fact that they all go to make up one integrated environment is of greater significance than a one-on-one comparison.

LisiCalc

First, we decided upon some fictitious data we could use as the raw input for a LisaCalc spreadsheet. Although this program can handle 255 rows by 255 columns (compared with Multiplan's 255 x 63), we decided on a more modestly sized matrix. The spreadsheet topic was projected sales figures for the Lisa, Apple III and the IIe over the 1983 to 1985 period.

In line with other spreadsheet systems, LisaCalc offers the user a range of cell formatting and formula creation/copying facilities. While the mouse can be used to select cells for data entry, the cursor control buttons on the numeric pad can prove just as handy. There are two nice features about this program. It shows which cells are being changed during a 'what if?' calculation by shading them grey. And if you want to format, say, a money value, the exact way it will appear is controlled by the contents of the 'Format' pull-down menu. So, if you want your dollar amounts to be preceded by a dollar sign, and show commas for thousands, you would use the mouse to select the '$1,235' option. If you wanted it to appear with cent amounts, you would choose the '$1234.56' option.

Special cell features include cell lock, circle missing values (this highlights those cells referenced by a formula but which contain no valid data), 'Undo' (can usually cancel the effects of the latest operation), and 'Revert To Previous Version' (this very useful feature can get you out of many sticky situations by dumping everything out and reloading the last saved version of a spreadsheet). Since LisaCalc can manipulate a 255 x 255 matrix, the multiple window feature — up to six horizontal or vertical splits can be made per spreadsheet — is also a necessity.

For the Lisa, we decided to show sales

increasing over the three year period from $100 million, through $400 million, and reaching $600 million in 1985. Figures for the Apple III were $250 million, $350 million, and $500 million, while for the Apple IIe sales jumped up from $700 million to $1000 million and then on to $1400 million. By entering a formula for the first column of data we obtained the total income figure of $1050 million for 1983. This formula, which merely added the amount of each product's sales in 1983 together, was then copied over to the 1984 and 1985 columns.

The next step in the procedure was to select the six sales cells (the total income figures were not included) from the spreadsheet and place them on the clipboard icon for temporary storage. This can be achieved by clicking on the relevant cells, and then using the COPY function available from the Edit menu.

LisaGraph

To put the LisaCalc data into LisaGraph, we had to open up the LisaGraph icon. Once this was open, we used the 'Paste' option from the Edit menu to transfer the LisaCalc sales information from the clipboard to the graph. Almost immediately, we obtained the bar graph shown in Fig 3. By simply choosing one of the menu options the bar graph could rapidly be changed into one of the following: line, mixed bar line, pie, and scatter graphs.

Other features of LisaGraph are that data changes are replotted instantly in a 'what if?' manner; the screen size of the graph can be enlarged or compressed; graphs can be printed out in four different sizes — ¼ page, ⅓ page, ½ page, and full-page — and graph areas can be shaded in many different patterns. Also, in keeping with the concept of integration, certain functions, such as the selection of numerous typestyles and combinations of typestyles for titles, Undo Last Command and Revert to Previous Version are ever-present.

At this point, we printed our LisaCalc/LisaGraph work out on a dot matrix printer and switched to LisaProject.

LisaProject

LisaProject enables a manager visually to map the progress of a project. Individual activity, or task boxes, are created by the user and linked to form a schedule of activities leading to a goal.

For review purposes, we decided to create a simple 'Apple Team Project' chart using somewhat makeshift data based on the Lisa project itself.

Every LisaProject chart has at least two 'milestones' (Start and End) which are displayed as circles. The specific activity boxes, such as the market research task and the connecting lines between them, are easy to draw with one movement of the mouse.

It is equally easy to add a box — like that marked 'training materials' — and to reduce the chart to a one-page display by selecting the relevant pull-down menu option from the 'Customise' command above (see Fig 4).

After each box is drawn a small cursor

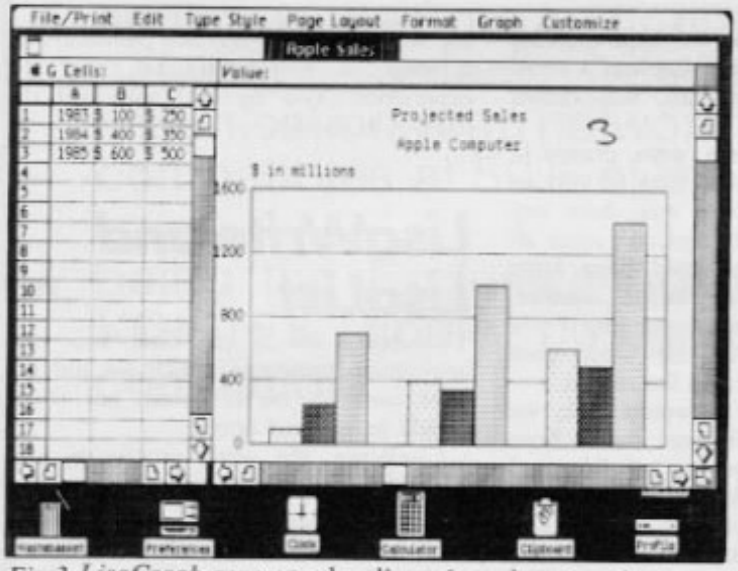


Fig 3 LisaGraph generates bar line, pie and scatter charts.

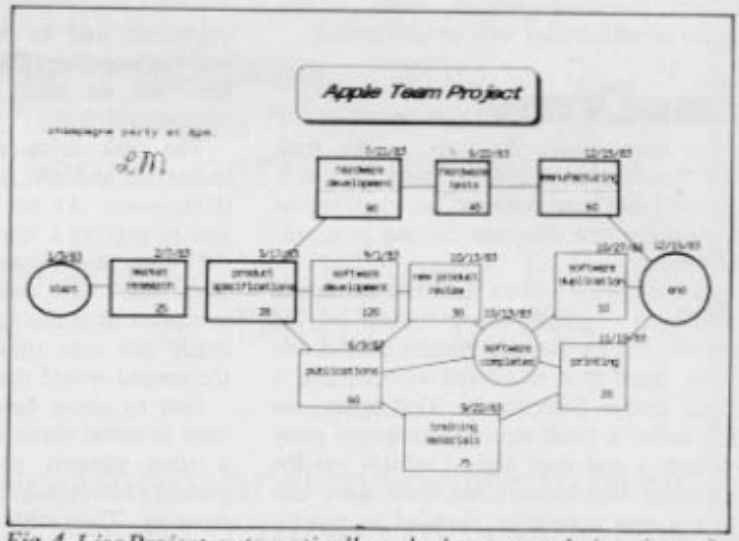


Fig 4 LisaProject automatically calculates completion dates for stages of the project and incorporates a 'what if?' facility.

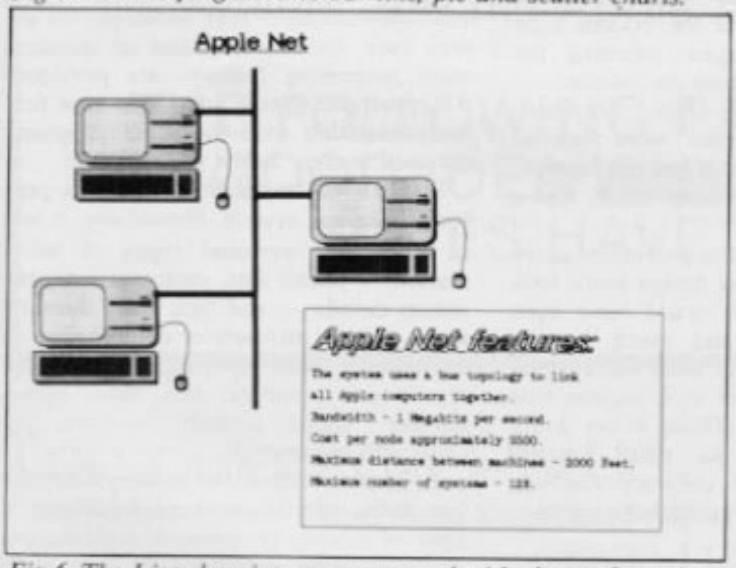


Fig 6 The Lisa drawing was composed with shapes from the palette, then shaded and cloned.

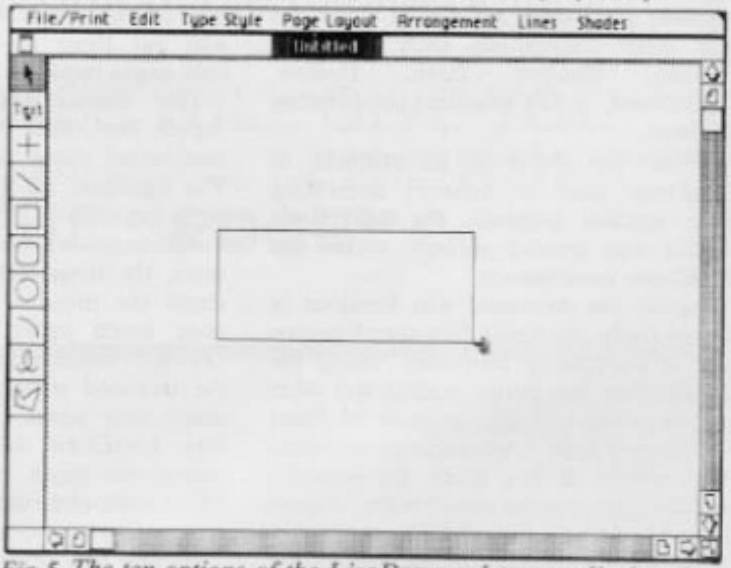


Fig 5 The ten options of the LisaDraw palette are displayed vertically on the left of the screen.

appears within it, signalling the user to insert text. This would be the name of the activity, its duration, and, perhaps, the particular staff member responsible for it. When we inserted the Start date within the left-most circle, LisaProject automatically calculated the completion dates for each activity and the End of project; it also highlighted the so-called Critical Path, the route along which any delays would delay the total project.

One of the major achievements of the Apple software designers is that they have brought the same 'what if?' scenario flexibility demonstrated in the LisaCalc and LisaGraph to LisaProject. Alter the data in any given activity box or boxes, and LisaProject will propagate this change through the chart.

This is not all. It is also possible for the user to visualise project tasks and resources in two other forms besides the schedule chart reproduced below.

There is a Task Chart and a Resource Chart; the latter is a kind of personnel availability calendar, looking a bit like those holiday charts used in offices. The former, while it resembles the Resource Chart, displays projects tasks in the order in which they will be performed.

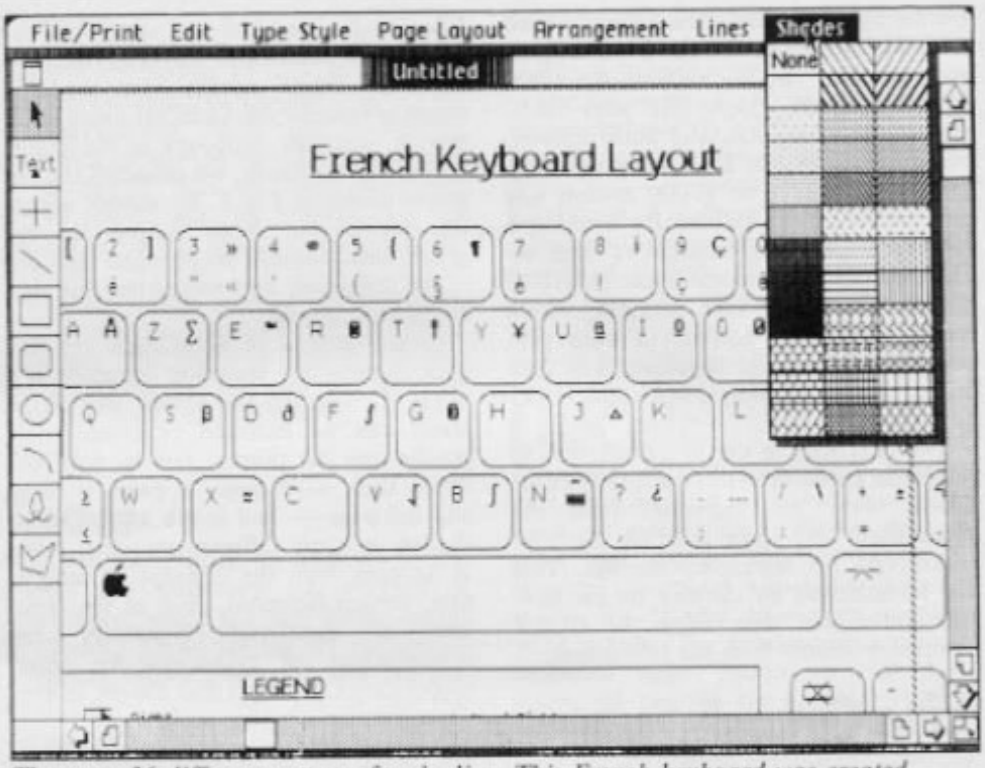
LisaDraw

Now here comes the fun ... We took our LisaProject schedule and pasted it into a LisaDraw window, so enabling us to enhance the diagram for use in a presentation.

A LisaDraw palette with ten options is displayed vertically down the left of the screen (Fig 5). Besides various shapes and lines, there is a free-hand symbol and a 'Text' option. Selecting the Text option, we first added a small memo (champagne party at 8pm) and then signed initials via the freehand line draw. We then gave the title a new typestyle, decided to reposition it, and put a box around it. Further enhancements to the text were always possible since there are eleven typestyles and other possibilities such as: Bold, Outline, Shadow, Italic, Hollow, Underlined, or any practical combination of these.

While the above is an example of LisaDraw used to enhance something from another program, the next illustration was created entirely within the LisaDraw environment.

Again, the document was fictitious in nature (only the Apple Net specifications box is completely accurate). Using the Text option, the memo heading and other text was entered onto a piece of blank LisaDraw paper — no attention was paid to typestyle at this point. By selecting various primitive, or ready-made, objects from the palette (a rounded corner rectangle for the system unit, another for the screen, a right-angled rectangle for the keyboard, and so on) the Lisa drawing was put together. The mouse was a small box, but its lead, or tail, was drawn freehand (Fig 6).



There are 36 different patterns for shading. This French keyboard was created with the palette; freehand drawing with the mouse is the hardest to master.

The disk drive slots were drawn in under 30 seconds using lines of various thicknesses. At no time was there any fear of making a terrible mistake since all the lines and boxes could have been squashed to make them smaller, stretched to make them larger, or, if you really got into trouble, the Undo Last Command would come to the rescue.

Just to show how it would look, we then selected three different shades from a total pattern selection of 36, and placed each in a different part of the Lisa drawing. Then, the original drawing was copied twice and the two LisaClones were positioned on the memo sheet.The box around the text at the bottom right was put there by again selecting the right-angle rectangle from the palette.

The titles 'Apple Net Features', 'Apple Net', and 'Memo' were then all customised using the typestyles option. The signature, on the other hand, was a bit more difficult.

Although we were the proverbial naive users, the main memo design work took about ten minutes (it could have been done much faster, and much better). Owing to unfamiliarity with the system, the freehand signature took maybe that much time again. There is no doubt that LisaDraw is the most visually impressive piece of software that an office computer user could hope to have at his or her disposal.

As any new Lisa user will find out, the hardest thing to master is freehand drawing with a mouse. 'It's like painting with a rock' as somebody said after the experience. You do eventually get the hang of it, though.

LisaWrite and LisaList

This brings us to the final two Lisa application programs which we did not have time to use in detail, but which should be covered briefly.

LisaWrite, the word processing program on Lisa, is probably the best 'what you see is what you get' editor around. The combination of the mouse and keyboard allows fast selection, editing and reformatting of text. Block moves are very easy, for example, and all standard word processing features are provided. All typestyle, editing and Undo type features available with the other programs are used to their fullest in LisaWrite.

LisaList is described as being a personal database system. Essentially, it lets a user input personal types of information — phone lists, customer lists, personnel details — and then sorts them by some specific attribute or combination of attributes. There are eight data field types: text, numbers, date, time, phone number, social security number, zip code, and money.

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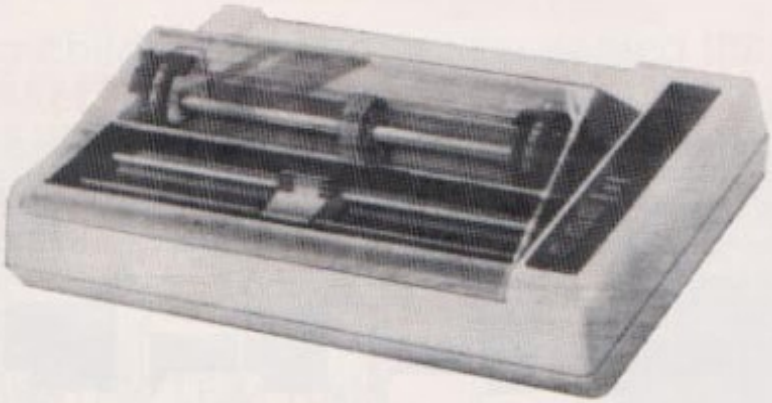

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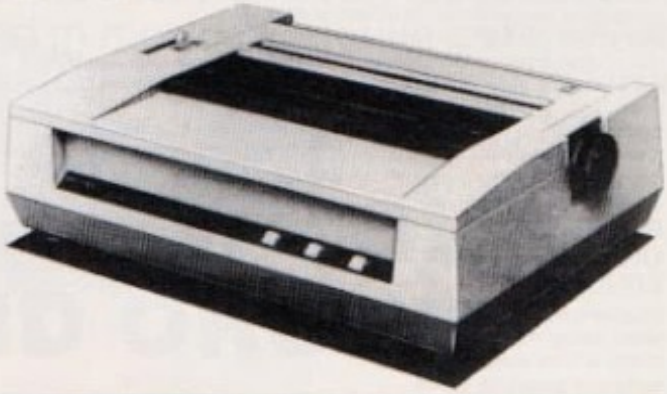

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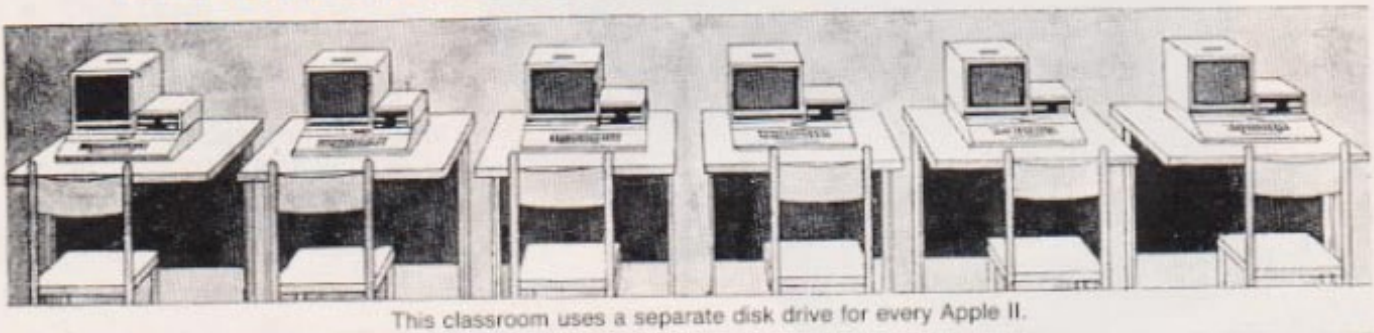
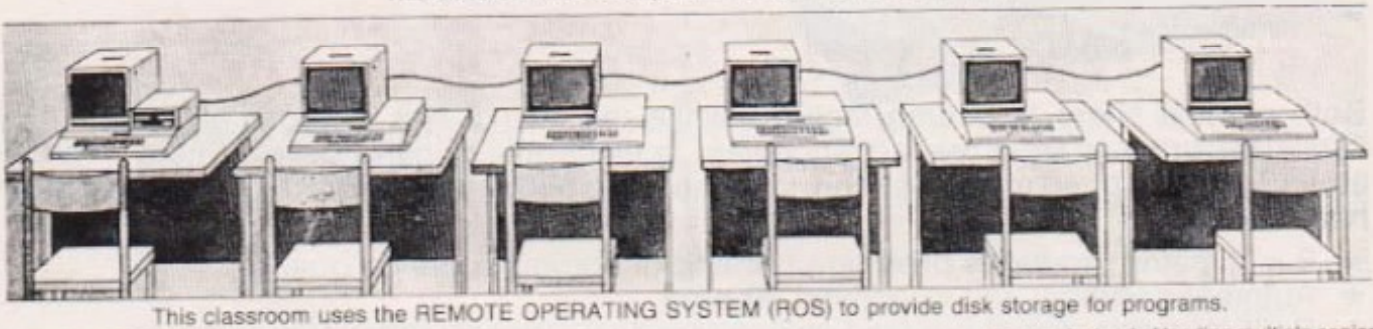


This classroom uses a separate disk drive for every Apple II.



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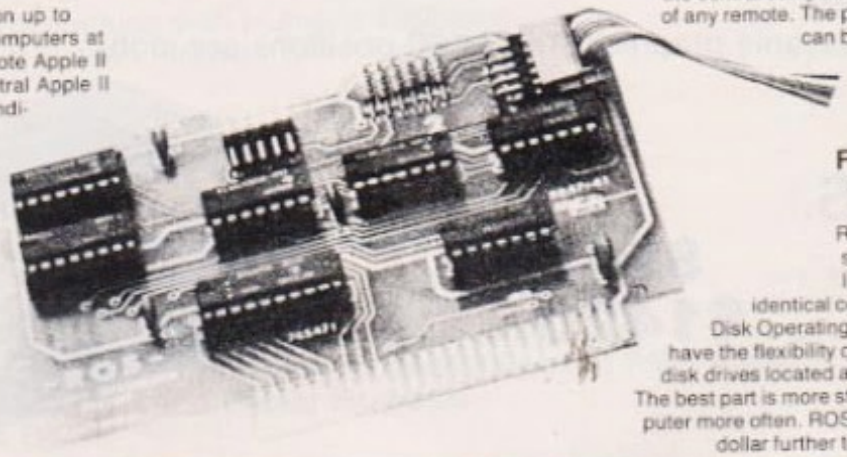

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APPLE LISA

bytes (say, a 6000 x 100 character list) of data.

The main point about all of these integrated software programs is that they are designed to be understandable. They are not primarily designed for specialist tasks, but to make people feel comfortable rather than hesitant in their everyday office work.

The icons, windows and error messages (which appear as large road signs) are common to all programs, and are symbols of a physical world to which people can relate. The supposition is that people want to feel in total control of a concrete (rather than an abstract) manipulation of data for their concrete, real-world, projects.

As one of the designers told us, Lisa will be considered successful if the user can accomplish something without being aware of the underlying complex engineering that went into making the product reliable.

Lisa communications

Since the corporate office structure tends to be distributed both in a local and remote sense, Apple has had to devise a method of linking its Lisa equipment up into networks while at the same time keeping additional customer costs to the minimum.

The first communications product to come out on the Lisa will be Lisa Terminal. It will be another Software Tool and, as such, will be accessible through its own individual icon and tear-off stationery pad. LisaTerminal will provide TTY, Digital Equipment VT52 and DEC VT100 terminal emulation capabilities. The first release will not be able to handle sophisticated Lisa/host computer interactions; the uploading and downloading of text created in LisaWrite or LisaCalc is likely to be the major initial component.

Sometime later this year various IBM emulation programs will be released, putting the Lisa into an entirely different kind of ball park. There will be 3270/3271 Systems Network Architecture (SNA) support, 3780 Remote Job Entry support, and 3278 terminal emulation.

In a deal with Cullinet, formerly Cullinane, Apple will also be able to offer that company's Information Database product. This will allow Lisa users to top information stored on IBM mainframes in Cullinet's IDMS/R relational database product.

Also due for release this year is Apple Net — a low-cost, low-speed (1 Megabits per second) local area network system that can be installed at a cost of approximately $500 per user connection, or node. This will link all of Apple's products — the Apple IIe, Apple III, and Lisa — together. It features the Carrier Sense, Multiple Access/Collision Detection (CSMA/CD) transmission protocol as used on the Ethernet system.

Up to 128 Apple machines can be supported on an Apple Net network which may use up to 2000 feet of coaxial cable.

For those who want something more, Apple has arranged a deal with US company 3Com whereby 3Com will supply interface boxes that will tie Apple equipment into an Ethernet network (which has a 10 Megabit per second transmission capability).

The changing Lisa cursor

One nice touch about the Desktop Manager

Dialogue boxes (error messages)

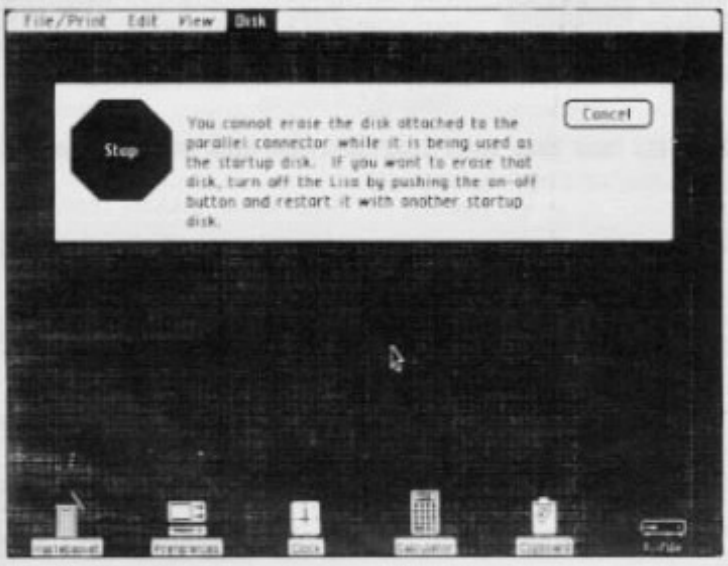
Typical error messages, as you know and hate them, can be a pain to deal with. This is either because they are of the 'XYXXE/2345.B, Diskerr. . .' type or they are crushingly blunt: 'Fatal error on system disk. . .'

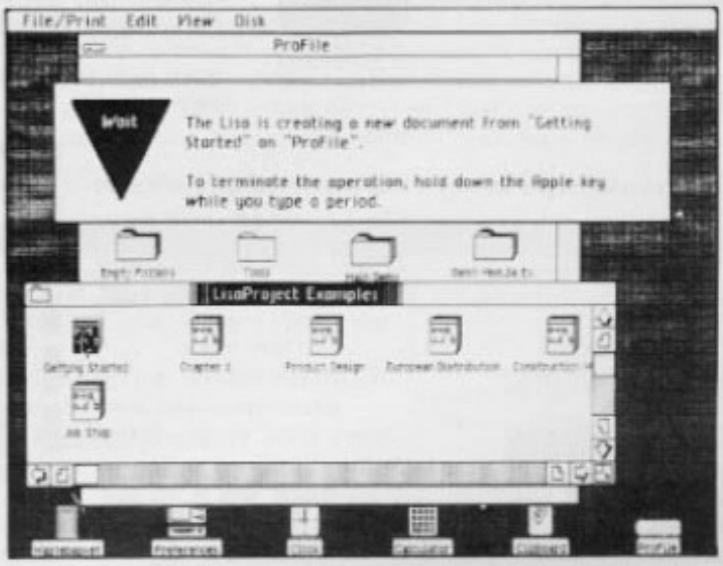
If you are lucky, the manufacturer of the machine or the software vendor will have moved one step ahead by basing error codes on a numbering system. So, if you have a disk error, the system generates a particular code number and you look in the manual to see what action should be taken.

The Lisa, we think is way ahead in this field. Instead of error messages *per se*, the Desktop Manager communicates problems and warnings to users by the means of dialogue boxes. These dialogue boxes make use of familiar road sign shapes, so they are both visually obvious and unambiguous.

The messages included in the boxes do more to calm the user than quicken the pulse. The writing style is very casual, yet precise, and the boxes are big enough to allow complete paragraphs of text, the dialogue road sign, and a menu selection area for the user. Cancelling a dialogue box cancels the command that brought it forth; selecting whatever other options may be offered will have a similarly logical effect.

Not once during the many hours we spent on the Lisa did anything catastrophic happen to data we were working on. Unlike the general type of error message, the Lisa version does not elbow aside your work just to make itself known.





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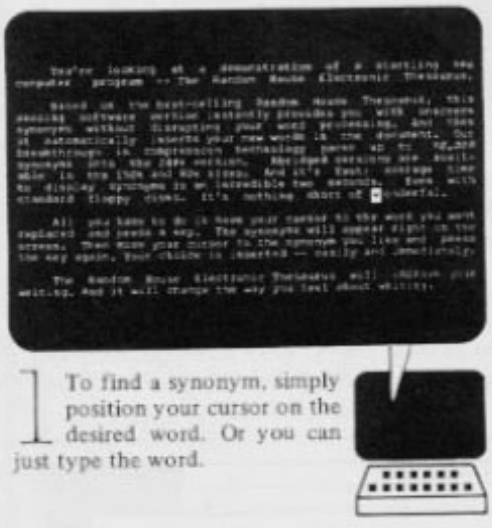
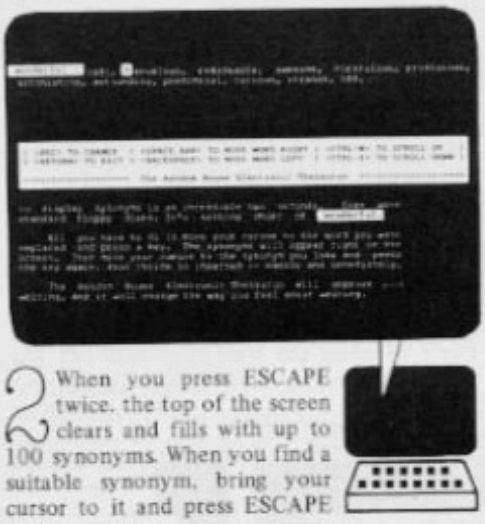


1 To find a synonym, simply position your cursor on the desired word. Or you can just type the word.



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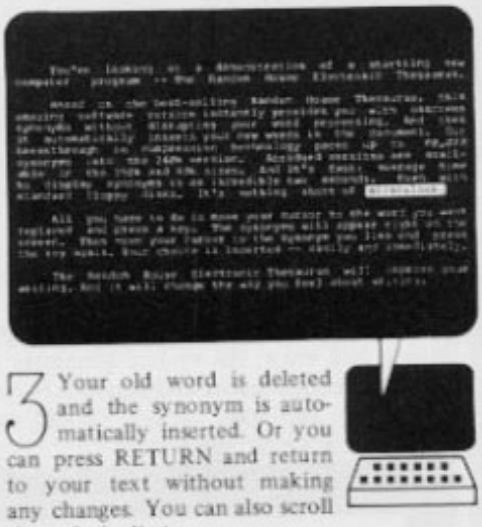

3 Your old word is deleted and the synonym is automatically inserted. Or you can press RETURN and return to your text without making any changes. You can also scroll through the listings.

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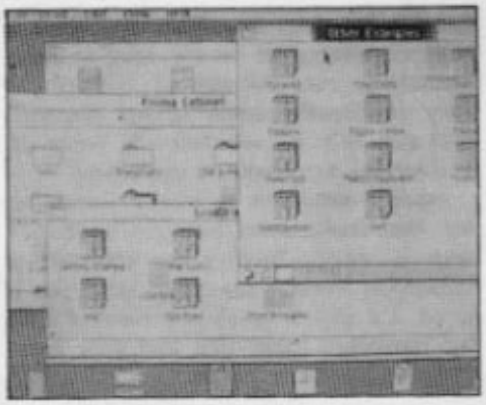
APPLE LISA

system on Lisa is that it has been programmed to take account of what might at first seem to be a trivial display aspect.

Although the main cursor is always shown as a slightly inclined arrow (↖), there are in fact six other cursor styles the user will discover. Within the matrix of a LisaCalc spreadsheet the cursor becomes a hollow 'plus' sign (⌖); in LisaWrite it becomes an I-beam(×) to allow the user to carry out precise selections, such as a full point or inter-character space, during editing work; in LisaDraw it takes on the shape of very small crosshairs (+) and the grab-hand shown in *Fig 5*. While the Lisa is doing a processing task that will take more than a few seconds, it also displays an hour-glass symbol, informing the user that it is busy.

Clear instructions.



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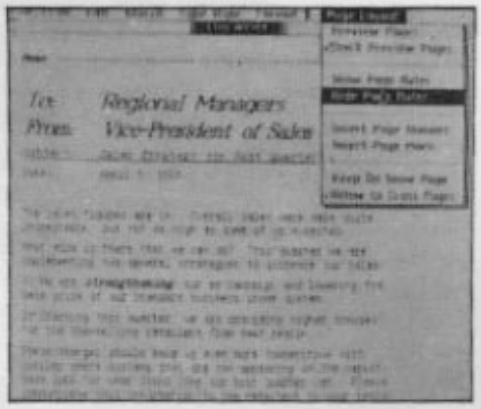

Laying out a memo.

The Application Developer's Toolkit

If the Lisa depends on any one thing in particular, it is the Application Developer's Toolkit (ADT) — the key method by which independent software companies will be able to create applications that make full use of the Lisa's mouse/screen/Desktop Manager.

The ADT has been under development for the last nine months and, is now undergoing tests. The project was headed up by Larry Tesler, a key man in the overall Lisa project who originally worked on the Star system at Xerox. He has the honour of being one of the people who showed Apple staff members, including chairman Steve Jobs, the Star's abilities, an event which was to lead to a $50 million, three-year project that came up with Lisa.

Independent software is already being put onto the Lisa; Xenix is expected to be available this month and CP/M-68k shortly thereafter. But it will not make full use of the Lisa's Desktop Manager. The user will get some fancy graphics, but not the cut and paste type of operations.

What the ADT does is to give the software designer direct access to a framework Desktop Manager — windows can be displayed as a matter of course, but the interactions possible and the types of data they will contain is left open. Essentially, the programmer fills the empty Desktop Manager with his own data control code. The ADT is a kind of Software Workshop. Problems like, 'how do you best represent an accounts receivable package with an icon?' are still not completely answered, though.

Apple research has shown that traditionally trained software people can take six months to get up to speed in terms of writing code for the Lisa, so the ADT will obviously be of benefit here. To make sure that they are not too strained, though, the ADT project workers have actually gone as far as extending the Pascal language so that classes of objects can be more easily referred to, but the code is still recognisably Pascal. Apple's Pascal with extensions is called Clascal and will most probably be made available as a separate product, outside of the ADT, at some future date.

As an added incentive to interested software companies, Apple is also offering selected organisations significant discounts on the Lisa (with a maximum of two machines per company) plus hotline support. Response has been high and machines are being shipped out. Companies like Digital Research and Microsoft have had machines for quite a while.

Apple states definitely that it does not want to get into the operating system or software development market. 'Six years from now there will be the same six applications from Apple and hundreds developed by independents' said one manager.

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APPLE LISA

HARDWARE

Reviewing the Lisa in terms of what its hardware looks like and can do is rather misleading since there is no one part of the system which can be described as truly stand-alone. The integrated Desktop Manager software/the high-resolution screen/the mouse/the so-called Software Tools, and the CPU all work together in a highly coordinated manner. To force a distinction between 'the hardware' and 'the software' really overlooks the purpose of an integrated user environment.

At the very least, though, a description of the hardware will give you an idea of what it takes to make such a 'new wave' machine perform.

First of all, there are a couple of things to point out.

There is no such thing as a 'standard' Lisa in the conventional use of the phrase. Look at most computer manufacturers price lists and you will come across this mythical machine.

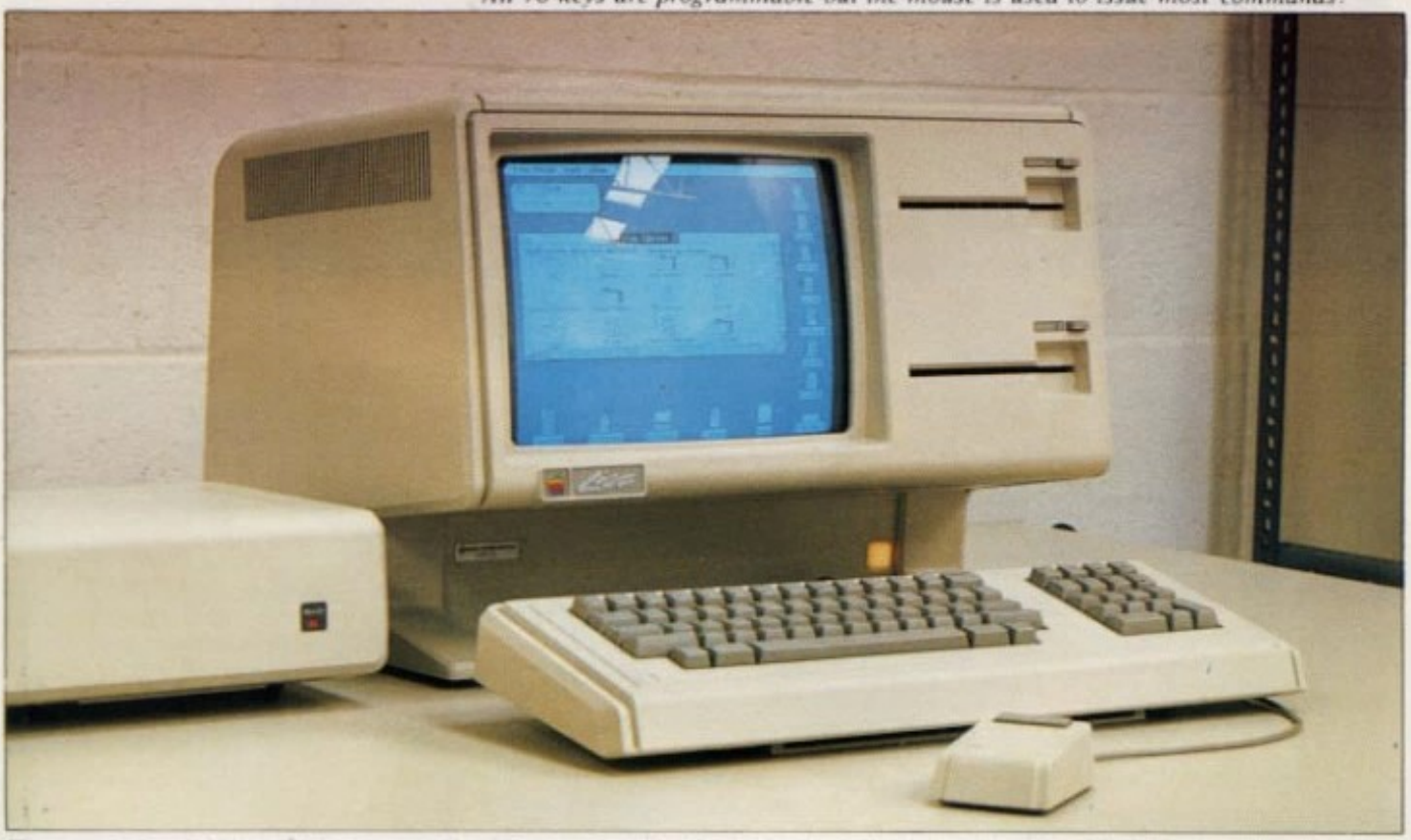
It always comes with too little main (RAM) memory; there probably isn't any disk storage included but, if there is, it will most likely be one drive; the video display will only provide the user with the simplest level of character generation; and, generally, no software will be present — except that locked in to boot ROM.

By the time you have purchased enough 'option' cards to make the thing do more or less what you want, the standard machine price has long receded into the distance and you really have made a capital investment. (Apple is a major offender here.)

This marketing approach, while comfortable for many manufacturers, tends to start customers off on the road to being something akin to system builders — they continually come across obstacles that can only be overcome by going out and buying more add-on equipment.

Such a situation is totally unsuitable for the professional/business customer, who is simply looking for methods of improving working practices. With this in mind, I'll give a quick overview of what the hardware looks like and then move on to specifics.

All 76 keys are programmable but the mouse is used to issue most commands.



The system unit is compact, incorporating 12in screen on the left and storage for the keyboard underneath.

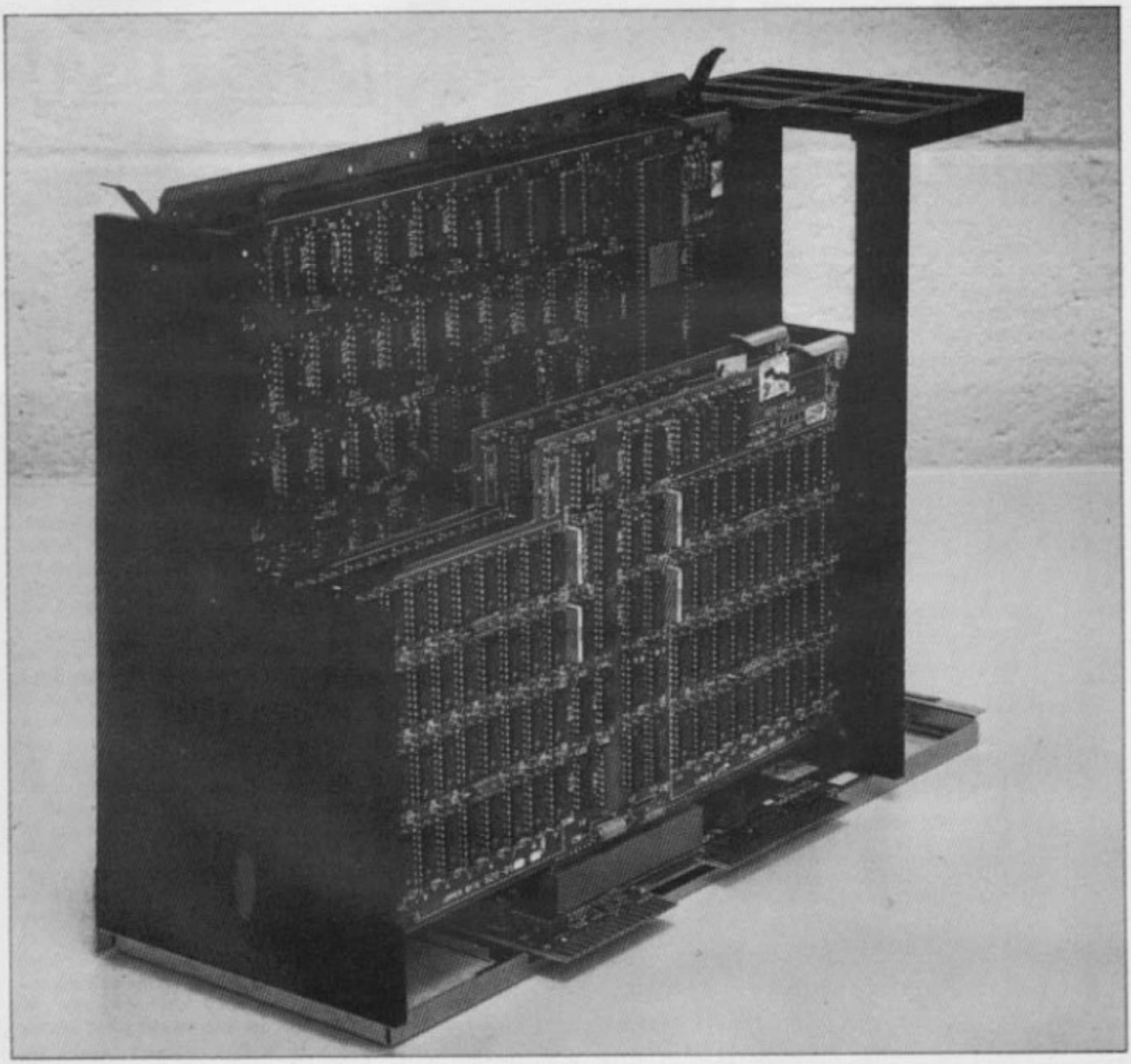
For $9995 a customer gets a complete Lisa system. This consists of the six integrated Lisa programs; the system box containing a 12in video display, the 68000 CPU, 1 Mbyte of RAM, and two of the Apple designed floppy disk drives; a 5 Mbyte ProFile hard disk; an IBM Selectric style keyboard; and, of course, the mouse.

The System Unit: Lisa's case is made of moulded plastic and, while pleasingly compact, is smaller than one might imagine from photos. The 12in video screen is placed over on the left, while the two floppy drives are immediately over to the right. A nice touch is the hollowed-out area underneath the display and drives. Since the mouse is used for a majority of file and data manipulation tasks, this is used as a storage bay for the now under-used keyboard. Tucked almost out of sight to the right of this bay is the Lisa's shut-down key. Shut-down rather than on/off switch because the Lisa is designed to ensure that all open files are closed (that is, returned to their relevant folders) before powering-down. This is a very powerful example of the interdependence between Lisa hardware and software.

One might imagine that because there is nothing but heavy disk drives and video equipment towards the front of the system unit, the Lisa might have a tendency to tip forwards. Apple designers overcame the problem by placing a couple of Sphinx-like paws on either side of the keyboard bay. Cooling vents are situated around the top, back and sides of the casing. All I/O connections are sited along the lower back.

Display

Having seen high-resolution systems such as the Three Rivers/ICL Perq and Apollo Domain, it wasn't too surprising to see a 720 x 364 bit-mapped video display which did a marvellous job of impersonating a piece of paper. The surprise is that it is now available on a commercial office product, using more or less standard chip technology, offering a set of six integrated software programs for under $10,000. Apple managed to keep the hardware costs lower than they might have been by deciding to use a 12in (half-page) screen format rather than the giant full-page (1024 x 900 pixel, or thereabouts) monitors supported by the



A user can completely dismantle a Lisa into serviceable modules.

Perq and similar devices. Also, since the screen is bit-mapped (each addressable picture element, or dot, can be represented by one or more bits in a reserved sector of memory), the smaller screen requires less attention from the CPU. The Lisa team decided not to use a graphics chip to handle the screen display (because they felt it might actually slow things down . . .) so the Motorola 68000 CPU currently timeshares cycles between main processing and the video memory map processing.

Mouse

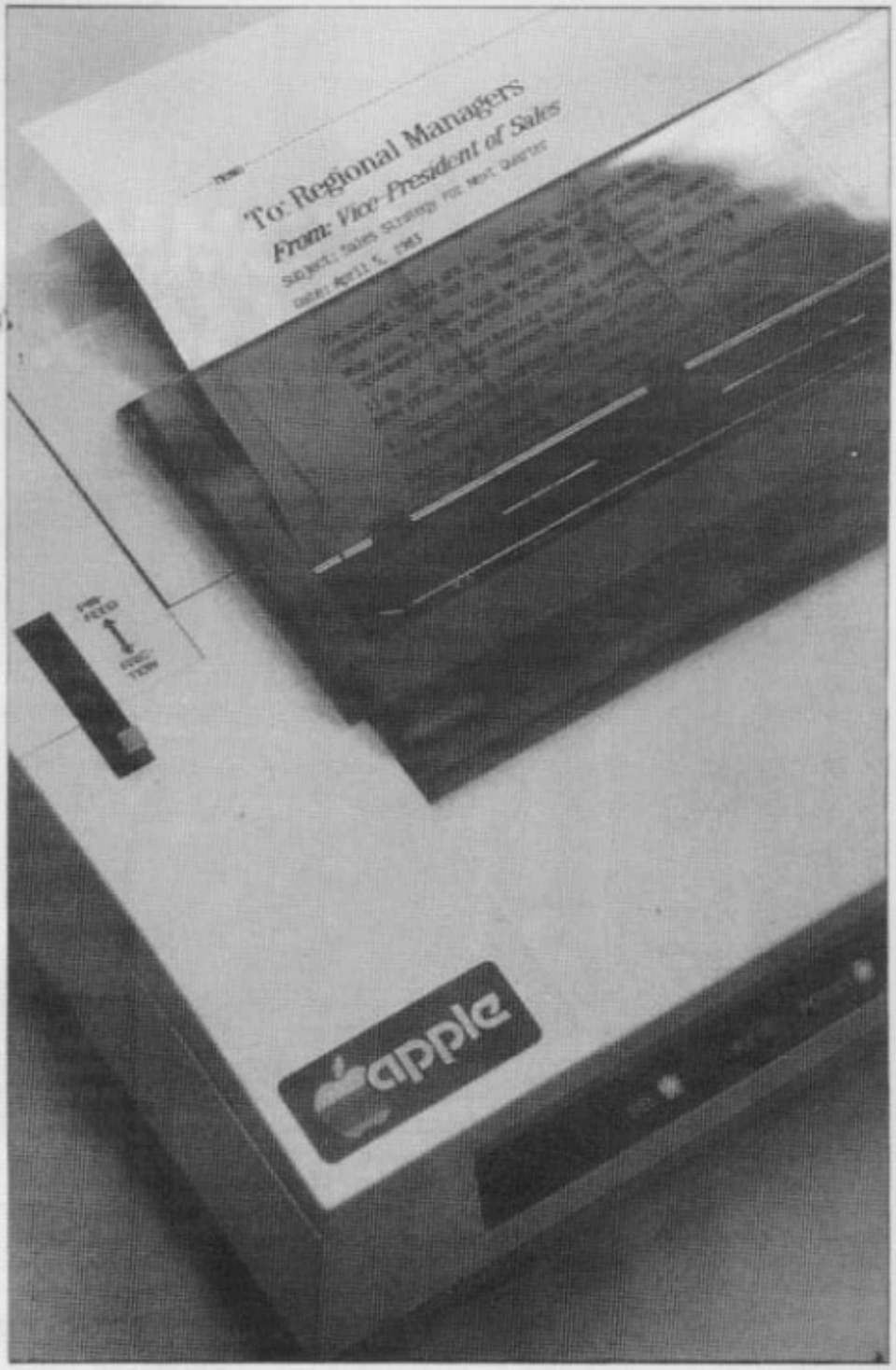
A pointing device has now replaced keyboard input as the prime method of issuing commands to a system (see box for a discussion of mouse technology). Apple has trademarked the phrase Graphics Mouse Technology, which might suggest to some that it is the first company to come up with a successful version of the device. This is not absolutely true. There have been many previous mice — some that were like enormous flywheels and just kept going in one direction. There are mice of various sizes, colours and complexity, including the three-button

'Like a jet engine, it can't turn a car into an aeroplane'

'Rolls-Royce' of mice made by a US company called Hawley. At the recent West Coast Computer Faire, a recent entrant — with just two buttons —could be seen controlling editing functions on an IBM PC. What Apple has done is to streamline the device, going for reliability and ease of use. While manipulating the palm-sized mouse is simple, its integration with the Lisa software (something which does not have to be obvious to the user) is very complex. Not just any mouse will do — end users should be wary of advertisements and mouse manufacturers' suggestions of what their product can do. Like a jet engine, it can't turn a car into an aeroplane.

Keyboard

The Lisa keyboard is a standard, Selectric style version with 76 keys — all of them are programmable. Since the mouse has been given the main burden of issuing commands and manipulating objects and data, the keyboard does not come with row upon row of special function 'headstones'. To the left of the keyboard is the main section of the qwerty and multi-character keys (special symbols such as omega, mu, epsilon and pi, and other unusual characters are selected by



Printers

It's nice to see that Apple has made the poor man's printer — the dot matrix system — respectable. To get the high-quality graphics printouts reproduced in this review, Apple had to inform the Japanese printer company, C Itoh, that its printer *could* produce the required quality. The printer, which now has a ROM chip customising it to the Lisa, 'paints' a piece of paper with dots. In low-resolution mode, the output is quite good; in high-resolution mode the output is of presentation quality. Most of the screen dumps reproduced in these examples were done in the low-resolution mode.

Reluctant to leave well alone, Apple decided that the Lisa user must have the option of a letter-quality daisy wheel printer as well — but it had to be able to do graphics. To achieve this, Apple created a completely new 130-spoke print wheel for a printer from Qume. It will reproduce all the special symbols, including foreign variations, and allow a single printout to combine various typestyles (such as standard mixed with bold and italics). Graphics output, using special dot symbol spokes, can cope with Lisa screen dumps, but they are not really as good as the dot matrix version.

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the correct use of the shift key). To the right is an 18-key numeric pad which has the four left/right/up/down cursor control markings sharing key-top space with the '+', '/', '*', and '-' symbols. Although Apple decided against straight, one-punch, function keys, it is possible for the more experienced user to generate a wide range of special effect codes from the keyboard. For example, at certain stages while using LisaDraw it is possible to erase selected portions of an object by pressing the 'Apple' key (it has an Apple logo on it) and the 'Clear' key, rather than selecting the object with the mouse and then going to one of the pull-down menus to select a similar procedure. Both the keyboard and mouse are controlled by a COPS processor on the I/O board.

That's the quick overview; now we should turn our attention to more specific aspects of the Lisa hardware.

Inside

Getting into the machine is no problem since there is both a back and front cover. No special tools are needed for their removal. This design philosophy has been carried right through to the point where a user can completely dismantle a Lisa into its serviceable modules — the twin-disk unit, circuit board carrying frame, power supply, and even single boards — in a matter of minutes (for the full implications of this, see 'Conclusion'). The only non-user accessible unit is the high-voltage video circuitry and monitor.

Inside the machine to the left there are three empty expansion slots. Currently, the indication is that Apple will not rush to fill these, rather, it will encourage independent hardware vendors to offer their products. From the hardware engineers' point of view, the expansion slots provide a very simple means of attaching all sorts of devices to the Lisa. Simple, because the slots provide add-on cards direct memory access (DMA) instead of routing signals via the CPU.

Apple's only current exception to the 'no add-on cards' rule is a parallel interface board ($195) which is needed to help manage the generation of high-quality out put on a specially redesigned dot matrix printer from the Japanese company C Itoh. While this does take up one of the three expansion slots, Apple is working on a serial version of the matrix printer which will use one of the two RS232 ports on the Lisa.

All circuits boards, expansion slots, and even the I/O connections, are held in a specially designed slip-out carriage. This board holder is a novel method of securely retaining a lot of hardware in its place, while at the same time making access extremely easy.

Since the holder is only connected to the main system box by gold-plated edge connectors, simply tugging it towards you makes it glide out smoothly. If you ever ripped yourself to pieces trying to remove a board from an old terminal (the soldered side was usually loaded with razor-sharp objects right where you had to grip it), or ever found out too late that you had put the CPU board into the wrong slot, you'll appreciate what Apple has done for the user in this area. Every board has been supplied with colour-coded grips and unique edge connector layouts so that it is impossible to damage yourself or a board.

Although I mentioned earlier that the Lisa has a shutdown button, the machine is never completely off. A battery pack located on the I/O board maintains the system in a kind of slumber, waiting for some one to come along and press a key to reactivate it. This is rather like the temporary display blanking that some calculators use to conserve on energy while retaining numbers to be eventually used in a calculation.

'Apple designers were aware, even at the theory stage, that a fairly powerful processor would be required'

Motorola 68000

Having conceived a complex software environment for the user, Apple designers were aware, even at the theory stage, that a fairly powerful processor would be required to cope with the kind of activity that would be required of the Lisa.

There are a couple of reasons why the Motorola 68000 was chosen.

This 32/16-bit chip (almost all its internal CPU registers are 32-bit while the external data paths, along which data is fetched and sent back out, have a 16-bit transmission capacity) has been the choice of many specialist multi-user system builders for the last few years. Only recently has it been receiving the kind of general attention it warrants.

Sage Computer Technology chose the chip as a powerplant for the Sage II. It is also the featured chip in the Corvus Concept, the Tandy TRS-80 Model 16, the Fortune 32:16, the Wicat and the somewhat intriguing IBM 9000 scientific system.

Apple adopted the 68000 because it was the best advanced chip available in sufficient quantities at the time the Lisa project began (1979).

Early samples were used for prototyping, but it was not until Motorola could give assurances that 5 Mhz versions would be available in production quantities that Apple made the commitment.

While offering the power of a true 16-bit chip, assisted by its 32-bit internal structure, the 68000 couldn't give Apple's software designers one much-needed break. Sitting inside the Lisa is about 2.5 Mbytes of object code which makes up the Desktop Manager system. Add to this the code which makes up the various Software Tools — LisaCalc, LisaWrite, LisaDraw, LisaGraph, LisaList, LisaProject range in size from 200k to 400k — and you have an enormous problem shifting that number of bytes around in a reasonably professional manner.

Memory management facilities developed by Apple for the 68000 make the software handling task much simpler because it offers the ability to relocate blocks of code in memory — virtual memory in fact. To quote the Lisa specification sheet, the memory management system on the machine allows for the 'segmentation (of memory) into 128 variable-length blocks dynamically controlled by memory map table'. That's 16 Mbytes of virtual memory.

In addition to having an Apple-added virtual memory facility, the Lisa can do multi-tasking and lock out bad memory cells. While one job is being printed, a user can go ahead and use the LisaCalc program, or whatever. If memory errors occur, the system will not halt all processing until repairs take place. Rather, the parity checking system will steer all operations away from the faulty sector(s) and so allow Lisa to continue processing.

Diagnostics

Keeping with recent industry trends, the Lisa comes with built-in diagnostics that go into action when the machine is fully powered up. The user is given a set of visual symbols denoting which piece of the system Lisa is currently testing, and, if everything goes well, tick-marks appear in each symbol field. There is a full 64k of diagnostic code held in ROM (remember, that's the size of many standard personal computer main memories) and if the display is not working, the Lisa emits specific groups of tones from its internal speaker that can be understood easily by a user.

Noise

Noise can be a problem in an office environment and, as many personal computer users would testify, their machines are not always as quiet as they might be.

The biggest traditional culprits in this area are the cooling fan and the disk drives. This first problem was overcome in the Lisa by devising a passive, or convection, cooling system. Since warm air rises, the designers arranged for all the main circuit boards to be held upright in a special carrier frame. As the boards begin to generate heat, it is taken in by the surrounding air which then escapes through vents positioned at the top, back and sides of the casing.

It seems to work well as there were no signs of internal overheating during the review sessions. Nor did it get perceptibly warmer around the machines.

The second potential source of noise, the disk drives, never had to be dealt with. The 5 Mbyte ProFile disk (which was originally built for the reasonably successful Apple III) has always operated with a minimum decibel output. Most of the Lisas have ProFile placed conveniently out of the way on the main system unit. Although this is not a prerequisite, it certainly reduces space requirements on a desk.

Disks

Most floppy disk drives are worth just a quick look to see if all the bits and pieces are there and how much storage they provide. If you're really lucky, you might even find out that the machine you're thinking of buying can read disks of different formats.

In the case of the Lisa's drives, it's worth devoting more time, since by standards, they are excellent.

While the ProFile gives 5 Mbytes of storage — a common enough amount by today's standards if you look at computers like the IBM XT, ACT Sirius 1, and Wang Personal Computer which come with, or can be configured to have, 10 Mbyte drives — the two floppy drives cope with 860k formatted (1.4 Mbytes unformatted) storage each. Therefore the total removable storage is over 1.7 Mbytes ...

Here's how Apple managed to create such a dense packing of data on a 5¼in disk.

Traditional double-sided disks rotate at about 300rpm and store somewhere in the region of 200k to 400k — a notable exception to the rule being the 600k+ drives of the Sirius 1. The Sirius 1 uses multi-speed drives that can spin standard disks at up to 350rpm when necessary.

Apple decided that rather than stay with commercially available drives,

APPLE LISA

which didn't offer the kind of functionality or reliability the Lisa demanded, a totally new unit using a totally new 5¼in disk would have to be built.

A Synertek 6504, which is not too far off from the 6502 chip that has kept the Apple II running and running, is dedicated to each of the Lisa drives, acting as smart interfaces with the main system. One of the jobs the 6504 has is to vary the speed of the drive in keeping with the position of the track it is reading or writing so that data is laid down in a regular density of 10,000 bits/65.4 tracks per inch.

Since ordinary drives rotate at one speed at all times, regardless of where the recording head is located, data is more densely packed on the tracks closer to the disk centre (where the disk surface is travelling more slowly than at the outer edge) and relatively sparsely elsewhere.

The internal set-up of the Lisa drive is also very different from other double-sided units. Rather than having both heads positioned so that the disk media is pinched between them, increasing wear, the Apple drives have offset heads and special opposing pressure pads that access the disk surface through two cut-outs in the disk jacket. In the early development days of the Lisa project, having such unique disks was a definite advantage because even if a prototype machine had been stolen, illegally borrowed, or whatever, the fact that virtually all disks were kept safely locked up meant that no harm could be done.

Now that the Lisa is ready for the market, one wonders what kind of production arrangements Apple has made. Certainly the electronics are held on one small internal circuit board, and there are only a few moving parts. One is the teflon-coated metal ball which partially protrudes out of the bottom of the mouse casing. There are also the rollers, placed at right angles to each other, which translate mouse movements into x/y coordinates. The rollers touch the teflon-coated ball and move in accordance with it. Depending upon the skill of the user, such mouse-controlled movements can be made highly accurate — it doesn't take much time to be able to pick out a specific pixel with the cursor. Since the office environment poses a lot of potential hazards to mouse mechanisms — cigarette ash, abrasive paper fibres from lots of paper shuffling, and even the left-over debris from eat-in lunches abound — Apple has made its product user-serviceable. By unscrewing a black plastic retaining ring, the teflon ball can be tipped out and both it, and the mouse insides, given a clean-up.

During this review, we found the mouse to be a truly natural method of interaction. The only problems were freehand drawing in the LisaDraw program and the fact that you had to keep your desktop neat — something managers may find difficult.

The Mouse

The difference between the traditional keyboard and a mouse is essentially the difference between sending morse code signals down a wire or using a telephone. While the telegraph and telephone achieve more or less the same result, the speed of interaction, and what might be called the 'fluidity' of communication, are just not comparable.

People first interacted with computers via teletypewriters — electromechanical devices that generated printed text either from an attached keyboard or in response to computer output. So it is not unnatural that they should have become used to dealing with line by line printouts that were issued in true typewriter fashion. If they wanted to leave blank lines on a printout they had to hit the 'line feed' key the required number of times. If they wanted to write something only at the end of a line, they might use the space bar, or tab key, to move the print-head over to the right.

Things remained pretty much the same even when paper was replaced by cathode ray tubes (CRTs, VDUs, or whatever you like to call them) as the prime method of displaying user input and computer output. The print head was replaced by a flashing or solid cursor (an underline, or solid square), but the user could still only move around the screen in discrete up/down/left/right movements. Cursor addressing, a facility made more accessible by the higher-level languages, was used but this was handled strictly at the program level.

The mouse unlocks the cursor from its straight-line existence and instead gives the user total control of its positioning. Connected to a computer by a thin cable (the tail), the mouse consists of a palm-sized package of electronics and mechanical/electrical/optical equipment which converts analog movements (drawing of a circle, for example) into digital signals. These digital signals are than acted upon by the relevant onboard processor, and a circle appears on the display.

Apple's mouse is probably one of the simplest to use. Where others come with up to three control buttons, Apple's has only one for all actions. The multi-button mice have a sense of function keys about them — you push this one to do action number one, then you push the other to do action number two. This is because they are generally used with far simpler software than that supplied with the Lisa. The Apple mouse demands only that a user follow the simple rule: if you press the button twice to open one icon, you do exactly the same for another icon, independent of the program or stage you are at; if you want to select something from the pull-down menus you always click the button once after the required option is backlit.

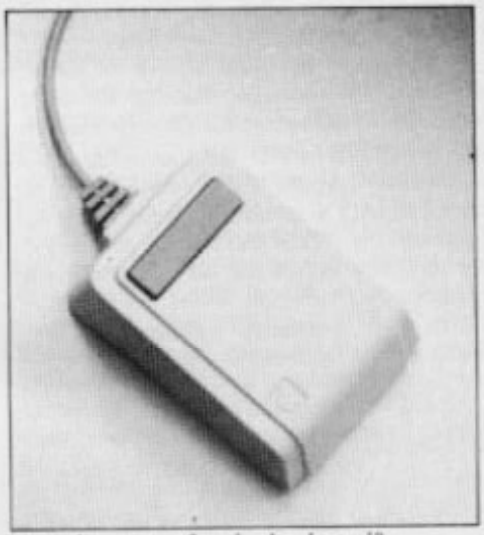
Of course, there are times when the mouse becomes clumsy or redundant and that's why there are still cursor control and special escape keys/key sequences on the Lisa keyboard.

Lisa's engineers are sometimes criticised for selecting the mouse rather than other quick data input devices — notably the trackball, touch-screen and light-pen.

They point out that the trackball (which can be thought of as an upside-down mouse) requires two quite distinct operations. First you use your fingers to roll the cursor control ball as is necessary, then you have to reach over and press a command button. The mouse user can both move the device and press a button at the same time, so maintaining smooth movements.

The touch-screen and light-pen both have the limitation that the user must first identify the location that has to be touched, and then a physical movement has to be made to identify or select an object. Delay and arm fatigue can be a problem here. Also, touch screens do get fingermarked and light-pens have a limited resolution. If there are two option boxes placed very close together on the screen the pen might only be able to straddle them, and not deal with them as two distinct objects.

The Lisa mouse is simply built. All the



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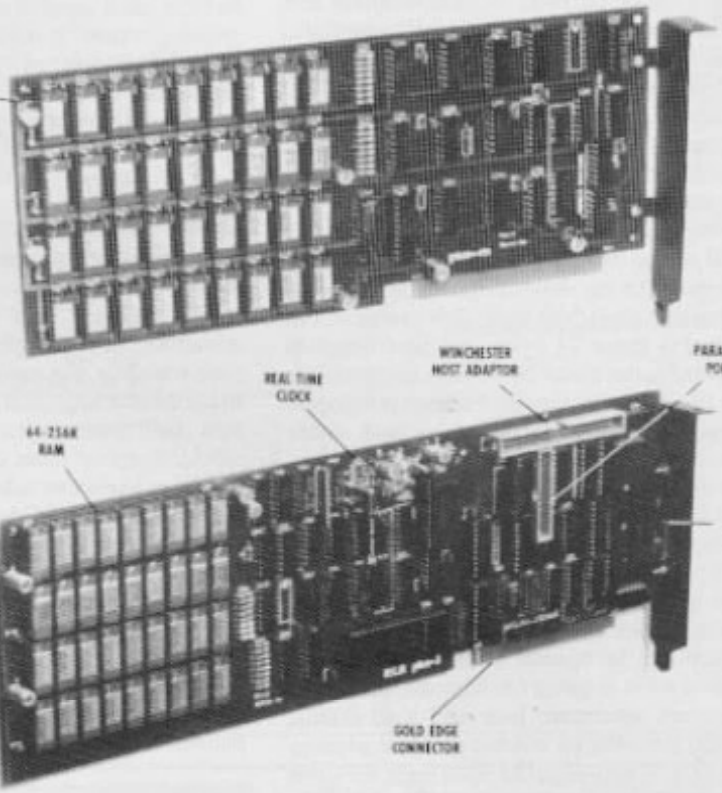

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tainly, at the time of this review, no one at the company could give me any details on pricing, etc.

Security

We're not yet finished with the disks, because there are two remaining features that must be covered — data integrity and data protection by means of automatic disk retention.

Files stored on a disk are located by means of a directory set up on a particular grouping of tracks. If this map-like data should be corrupted in some way — either by software or system failure — it is not always possible to recover all the lost data held on the disk. The Lisa drives, however, are made to lay down a special block of 24 bytes per each 512 byte disk sector. Contained in these 24 bytes is a description of which file the block belongs to and where in the file it should appear. Further pointers to disk space allocation are also held within files themselves and in the main directory. Inevitably, some information will be lost but it will have to be precipitated by something fairly catastrophic.

If you've read something about the Lisa you will already know that its disk drives do not have the conventional flip-down doors which can be opened at any time, regardless of what is going on. Instead, the drives have an automatic lock and load feature made possible by automatic 'disk present' sensors. If you want the disks back for some reason, you cannot just yank them out. To the right of each drive there is a disk request button which signals to the CPU that you want to remove a disk.

Before anything else is done, the Desktop Manager checks to see what files are open and then sets about closing them. Once everything is cleared from the desktop the disks are automatically ejected.

Having visited an office shortly after somebody lost 20 pages of WordStar text by removing the disks and resetting the system without doing the hallowed ^KD, I think there are many people out there who would consider the wait a reasonable price to pay as an insurance against going into a sudden state of speechless shock at losing an afternoon's hard work. And, anyway, what are you going to do with the disk if all your work hasn't been saved on it?

Documentation

During the review, provisional documentation only was available for use — the exception being a proof copy of the LisaDraw user's manual. The provisional material was more than adequate, but the LisaDraw manual — in fact it was more like a commercially published book — was probably the best.

It was properly typeset on good quality paper and there were many photographs and high quality prints of the Lisa and its display to provide visual backup. Contents and page number information was also included. If all the documentation is of this quality, there won't be many complaints.

In addition to the manuals, Apple has written LisaGuide, an interactive guide on using the Lisa. It is quite a major achievement in itself since it avoids being condescending where it easily could be so. It makes full use of the display's high-resolution and the mouse, so helping novices quickly through the acclimatisation process.

Service

Apple is offering various levels of service for the Lisa.

The ordinary user will be able to take advantage of the Apple Care Carry-In service whereby the machine is handed to a local dealer who will swap out the faulty part and replace it. Dealers will carry stocks to cover most component failures.

Bigger users can take out a contract with Apple whereby RCA will send a service person to the site.

At the top end, Apple will provide in-house training so that Fortune 500 users can do all but the most major repairs themselves.

There is also a hot-line direct support service permanently available by telephone.

Discounts

Against the high single unit price of the Lisa, Apple is setting a series of discounts for customers prepared to sign 12-month contracts.

If you are prepared to show a definite interest in buying a few machines over the next 12 months then you can gain a 10 per cent reduction in the cost price per machine.

A customer which will commit to buying 275-549 units in the coming year can obtain 15 per cent discount. For 550-999 units the discount increases to 18 per cent.

At the top end, 1000 definite orders will yield a 20 per cent discount rising to 28 per cent for even greater volumes. International companies can gain these price reductions on a worldwide basis.

Conclusions

Really to get an idea of what has happened, you mustn't compare the Lisa directly with other machines such as the IBM PC, the DEC Professional, or the Sirius 1. If you do the sums, they actually show that the Lisa is competitive in terms of price, and totally unapproachable in terms of integration (once all storage, software and necessary add-on boards have been accounted for).

Certainly, the recent announcement that Digital Research would be aiding and abet-

Technical Specifications

CPU	32/16-bit Motorola 68000 running at 5MHz.
Other Processors:	SCC chip in keyboard and NatSemi COPS on I/O board to handle keyboard and mouse.
RAM:	Presently 2 x 512k boards or the option of 2 x 1 Mbyte boards — to be introduced shortly — that will fit in the same slots.
Diagnostic ROM:	64k start-up diagnostic code checks out disks, memory, etc. Capable of generating audio backup if the display fails.
Display:	Crisp, black on white background, video generation. 12 inch diagonal, 720 x 364 pixels, bit-mapped in upper area of RAM memory.
Keyboard:	IBM Selectric style, 76 keys (no straight function keys) including numeric pad.
Mouse:	One button, see and point operation. Accurate for cursor positioning down to individual pixels.
Floppy disk storage:	Two 860k, 5¼in, floppy drives integral to system unit. Unique twin access windows in disk envelope because of offset drive heads.
Hard disk storage:	1 x 5 Mbyte ProFile hard disk, as orginally designed for the Apple III. More than one can be connected.
I/O ports:	Two RS232 ports, one parallel interface port.
Expansion slots:	Three empty slots are available.
System Software:	Desktop Manager operating environment, and six Lisa specific application programs: LisaCalc, LisaList, LisaWrite, LisaProject, LisaDraw, and LisaGraph. Others, including LisaTerminal, will follow.
Languages:	Basic Plus, Cobol, Pascal. Others are under development, incuding the Smalltalk language/environment.
Printers:	Dot Matrix graphic printer (parallel) and letter quality daisy wheel (serial) printers.

APPLE LISA

ting Visicorp in implementing the mouse-controlled, window-oriented VisiOn product in the CP/M environment is significant. So too, is the fact that IBM, DEC and Texas Instruments have all said they will support the VisiOn package on their relative machines.

Microsoft, with its MultiTool word processing system, has also adopted the mouse as a viable alternative to laborious key-board commands. The product has windows, and is modelled after the company's Multiplan spreadsheet program.

Both packages will be moderately priced — a few hundred dollars each — and this will obviously meet a vast number of users' needs. But consider that we're talking about different leagues here.

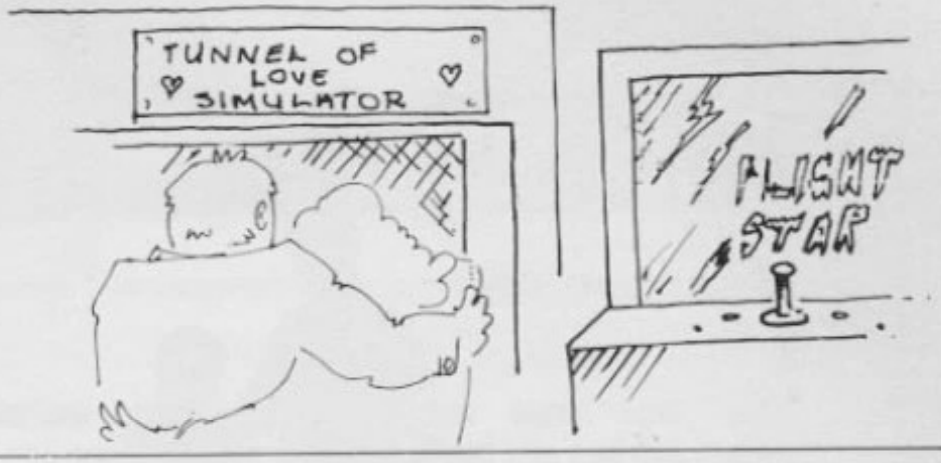
VisiOn and other similar products waiting in the wings, run on a range of manufacturers' machines that have not been optimally designed for such products. The keyboards are still the unhappy mixture of qwerty and dp functions; the mice are add-ons rather than a fundamental part of the computer's design philosophy; reliability in the software may not be mirrored by reliability in the hardware.

In summary, the hardware/software division is still maintained. Obviously, events in the next six months are going to provide some answers to such thoughts — but our feeling is that there is room in the market for both approaches.

Prices

Lisa: $9995 (Australian price around $12,000) — includes main unit, 1Mbyte of RAM, display, system/applications software, keyboard, mouse, and 5 Mbyte ProFile hard disk unit.

Dot Matrix Printer:	$695
Daisy-wheel printer:	$2100
Languages:	
Basic Plus:	$395
Pascal:	$595
Cobol:	$795



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CP/M™ COMPATIBILITY BUILT-IN	YES	NO	NO
MEMORY: RAM (RANDOM ACCESS MEMORY) BUILT-IN	32K	48K	64K
EXPANDABLE TO:	256K	NO	NO

Manufacturers Suggested List Price as of April 1, 1983. CP/M is a registered trademark of Digital Research. Microsoft is a registered trademark of Microsoft Corp. Coleco is a trademark of Coleco Industries.

At the winter National Consumer Electronics Show, Creative Computing Magazine evaluated personal computers at practically every price level. Among them all there was one computer they reviewed as "astonishing". The new Spectravideo SV-318. The personal computer that can meet the needs of everyone in your family. It outthinks, outperforms, outplays its competition ... for under $500. Compared to Atari 800 or Commodore 64, the SV-318 has more built-in intelligence (ROM) to let you do more. Built-in super extended Microsoft™ Basic language, the industry standard, makes it truly programmable. Built-in CP/M compatibility means access to over 3,000 of the most used business software programs. A built-in cursor control joystick makes editing easy and plays great arcade quality video games. (An optional adapter can plug you into the fabulous world of Coleco™ games.) Spectravideo also delivers a low-priced and complete line of peripheral accessories today. Unlike some of our competitors, whose peripherals are always "coming soon". It takes an outstanding computer to outclass our competition. At under $500 nothing else even comes close. Today, discover the Spectravideo SV-318.

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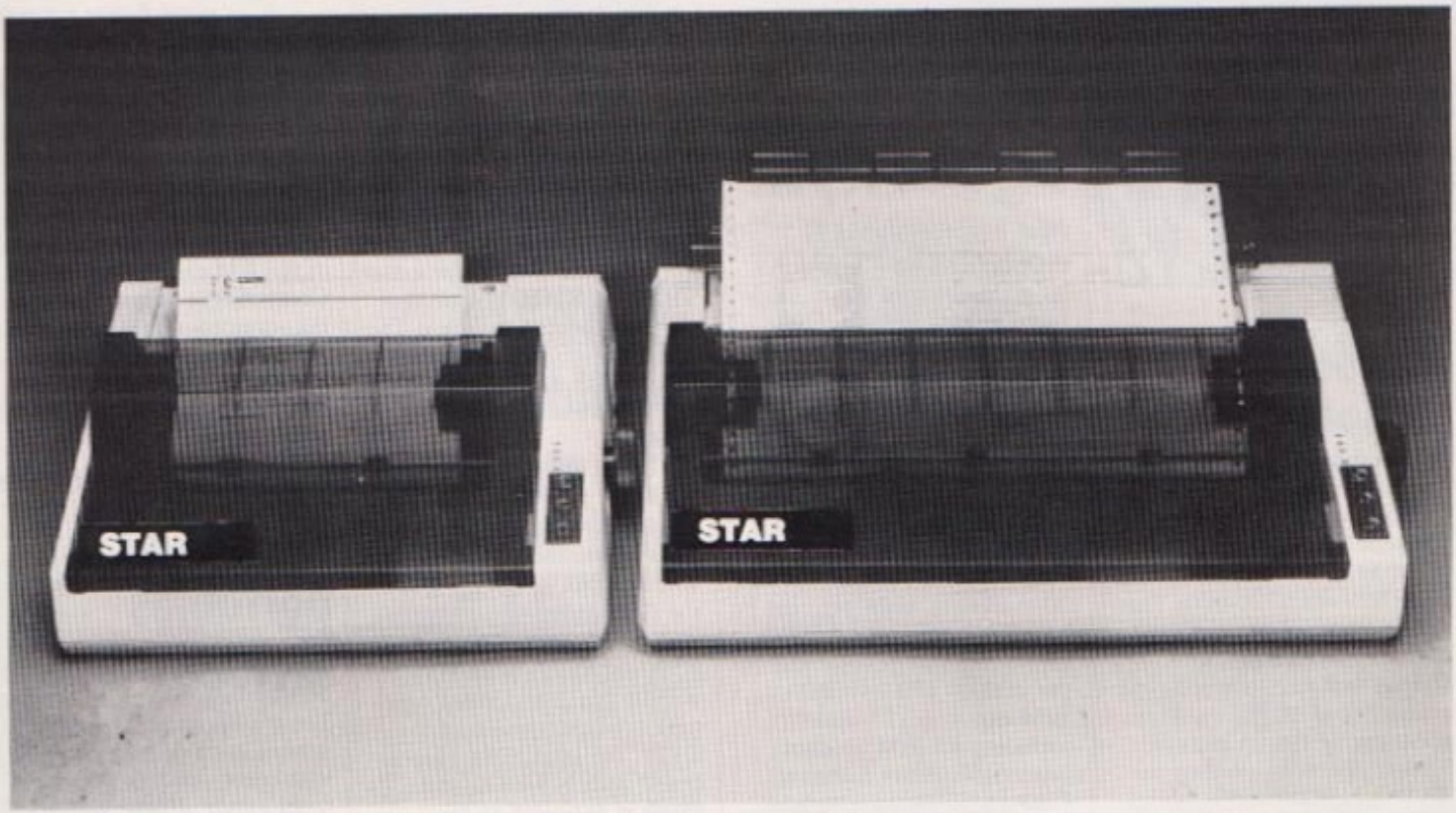

The STAR DP 500 series of low speed matrix printers combines high quality printing with a host of operating features and remarkably low ownership cost. Utilizing a bi-directional, logic seeking mechanism the DP 500 series operates at 100 cps. The Model 510 prints 80 characters/line at 10 cpi on paper widths up to 10 inches and the wide carriage Model 515 prints 136 characters/line on paper widths up to 15 inches. Both double width and compressed print mode are provided enabling line lengths of between 40 and 233 characters to be produced.

Utilizing a 9 x 9 matrix the DP 500 Series prints the full 96 ASCII character set with descenders. In addition, proportional spacing and italic character sets are provided as standard together with a 64 special character set. The correspondence quality mode provides near letter quality printing at reduced throughput speed. High resolution bit image graphics are provided as well as 32 character block graphics set.

The DP 500 Series mechanism supports as standard sprocket, friction and single sheet paper feed. Vertical forms control is provided plus horizontal and vertical tabulation.

Parallel Centronics compatible interface is standard on the DP 500 Series with Serial RS 232 and Curent Loop optionally available. The serial interface operates at speeds up to 9600 bps and incorporates a 2K buffer with Xon/Xoff and ETX/ACK protocols.

Control codes on the DP 500 series are fully *Epson compatible.

DP 500 Series Features

- 100 cps Bi-directional Printing
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- Full 96 ASCII Set with Descenders
- Bit Image and Block Graphics
- Correspondence Quality Printing
- Proportional Spacing and Italic Character Sets
- Double Width and Compressed Print
- Sprocket, Friction and Single Sheet Paper Feed
- Horizontal and Vertical Tabulation
- Super and Subscript Printing
- Epson Compatible Control Codes
- High Speed Serial and Parallel Interfaces

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YANKEE DOODLES

Sol Libes presents his monthly batch of juicy snippets from the Big Apple.

Random rumours

Rumours persist that IBM will soon announce its 'peanut' 16-bit portable computer, with flat panel display, 64 or 128k of RAM and an expected price between $700-900. The unit is expected to be offered to mass merchandisers. . . IBM is said to be studying the possibility of adding the Pick operating system to its repertoire of operating systems for the PC. . . Microsoft is reportedly close to releasing its word processor package and is beta testing a user shell for its MS-DOS to integrate its Multiplan and word processor packages in much the same manner as Lotus 123 and VisiOn. . . In the meantime rumour has it that VisiOn deliveries have been pushed back to August/September.

Random news bits

Microsoft has introduced a $195 mouse device (made in Japan) with demo software. . . CBS has formed a division to publish personal computer software. . . Bill Synes, the chief designer of the IBM PC and an 18-year IBM veteran, has left IBM to join Franklin Computer (an Apple look-alike maker). . . Cannon Inc, Tokyo, a major supplier of calculators to the US, will shortly begin shipping personal computers. . . California Software Products Inc, Santa Ana, CA, has released a package that enables the PC to run IBM System/34 applications soft-without modification. They call it 'Baby/34'.

Big blue report

IBM has reorganised its marketing of the PC and XT by giving its own direct sales force greater latitude. Discounts offered by IBM salespeople have been increased and they are now being permitted to accept orders on individual units (previously they were limited to accepting orders for 20 or more units). IBM itself is offering discounts of five per cent on 3-10 machines, eight per cent on 11-19, 12 per cent on 20-49, 16 per cent on 50-149 and 20 per cent on 150-249 units. IBM now has 770 dealers including 40 IBM product centers, 45 Sears Business Centers, 330 Computerland outlets, 350 independent retailers and nine value-added dealers.

Microsoft to offer Xenix via retailers

Xenix, the Microsoft implementation of Unix disk operating systems for microcomputers has until now only been available as a product bundled with a hardware system. Microsoft will now be selling a simplified version through computer stores. Initially a version for the Apple Lisa will be offered to be followed with an IBM PC version. It will include a hardware card which must be installed into the machine.

Commodore shipping new computers

Commodore has made initial shipments of three new micros to dealers: the B500, C128 and PET 64. Two more machines — the trans-portable SX100 and a Z8000-based 16-bit Lisa-like system — are expected within 90 days. The SX100 is expected to have a 5in screen and retail for under $1000. A $1500 colour version is expected to follow.The Z8000 machine is expected to sell for less than $3000 and will include monitor and 896k of RAM.

The C128 (at $795) uses the 6509 processor, has a 40 character-wide screen, supports full colour and is expandable to 896k of RAM. It is the first Commodore machine with a true RS232 port. The B500 (at $895) is an 80-column black and white business oriented version of the C128. An Intel 8088 plug-in board with MS-DOS and CP/M-86 is expected as an option. The PET 64 is designed for educational use and will sell for $695.

Two more business-oriented machines (B700 and BX700) are expected later. The BX700 is expected to have three processors: the 6509, Z80 and 8088, with the ability to switch back and forth between them. Also expected is a machine to be called the 'Executive 64' which will include 128k of RAM and bundled software.

Electronic software delivery

As if computer stores were not having enough competition in selling software from bookstores, they are now getting competition from radio, cable and timesharing companies. These companies have introduced electronic delivery of software (currently mostly games). PlayCable, a joint venture of Mattel Inc and General Instrument Corp, is currently sending video game software to cable TV subscribers in three cities. National Public Radio has received permission from the Federal Communications Commission to broadcast software in an unused portion of the FM radio band. And CompuServe Inc, a timesharing service for personal computer users, has initiated a service whereby users can download software and have it billed to their charge card.

Notebook portables arrive

The true portable computer market is off to a fast start with notebook-sized products from Tandy, Epson and NEC. IBM (see 'Random rumours' section) is expected to enter shortly as is Commodore, Osborne and Apple. Commodore, which announced the HHC-4 hand-held computer back in Janaury has announced that it has cancelled the project. The unit was to have had a 24 character LCD display and other features now considered too limiting in this new emerging market.

Tandy is expected to be the front-runner in this market for this year. Tandy expects to sell 100,000 portables (100 million dollars worth) this year alone. NEC, with a unit very similar to the Tandy unit, is expected to be second with Epson third. Epson is expected to introduce a new Z-80 based unit with 80-column display this summer to replace their current unit. Prices should start dropping by Christmas.

The portable computer market appears to be the first segment of the personal computer market in which the Japanese will assume a prominent position.

YANKEE DOODLES

Home computers — a marketing game

The home computer market is behaving in a manner akin to the calculator field of the early 70s with prices dropping monthly. Home computers are no longer being sold by independent computer stores but rather are the staple of mass merchandisers and catalog sales organisations. The thing that is expected to save computer makers from pricing themselves out of business is the aftermarket for products such as peripherals and software.

Timex/Sinclair, Texas Instruments and Commodore are in a neck-and-neck price race, with Atari running a close fourth. The Timex 1000 (Sinclair ZX81) can now be purchased on sale for under $40, the VIC 20 for under $85 and the Atari 400 for under $100. And there are rumours that we may see the VIC 20 go as low as $29.95 and the Commodore 64 as low as $199 by Christmas. The Commodore 64 is currently selling for as low as $288 (including a $100 rebate), which is half of what it was selling for last September. The Atari 800 is now selling for $388 (with a $100 rebate).

Atari is going through a reorganisation, moving manufacturing to the Far East to reduce cost and going into the chip manufacturing business to integrate vertically in an attempt to remain in the race. Tandy, despite the selling of over 300,000 colour computers, is now a distant fifth in the field and will most likely drop further back as game makers such as Mattel and Coleco step up their marketing efforts.

One drop-out already is the decision of TI to drop its new 99/2 computer, after test marketing the unit for under $100. The basic problem is that the current 99/4 computer is now selling for under $100.

The desk-top microcomputer market has also been the scene of price slashing. In response to IBM's 15 per cent decrease in the price of the PC, Apple cut 20 per cent from the Apple III, Texas Instruments cut 15 per cent from its Professional, Xerox cut the price of the 820-II by 26 per cent and Zenith cut its Z-100 price by 12 per cent.

Book publishers move into computer book publishing

Doubleday, one of the largest book publishers in the country, recently gave an author a $1.3 million advance (a new record) on a book to be titled *The Whole Software Catalog*. Virtually every major book publisher now has a computer book division and computer books are staples in almost every book store. Several of the book publishers have also begun software publishing operations as more and more book stores have begun to carry software on their shelves.

Zilog to release Z800

Zilog has finally officially released the Z800 microprocessor, although samples will not be available until the fall. Production is expected in the first quarter of 1984. The Z800 is a greatly enhanced Z80 — Zilog claims five times greater performance. The Z800 will include a memory manager (for up to 16 Mbytes), DMA controller, counter/timers, serial I/O, 256 byte cache memory, interrupt controller, four additional addressing modes, four additional registers (including a second stack pointer) and memory refresh logic. It has a clock rate of 10-25 Mhz (Z80 current maximum is 8 Mhz).

The added functions include instructions for hardware multiply/divide, 16-bit arithmetic, 16-bit load, system/user calls (for multiuser/multitasking) and test/set (for multiprocessing). A floating point math co-processor (Z8070) was also announced. The Z800 will come in four versions (see below).

The 8-bit I/O versions interface directly with Z80 peripheral chips while the 16-bit I/O versions work with Z8000 family of devices and have about twice the throughput. The 40 pin devices will omit circuitry such as serial I/O and DMA controller.

Prices

	I/O	Pins	Address Lines	Price in $
Z8108	8 bit	40	19	40
Z8116	16 bit	40	19	48
Z8208	8 bit	64	24	60
Z8216	16 bit	64	24	72

FCC fines microcomputer makers

Forty four manufacturers of personal computers and electronic games have been notified by the Federal Communications Commission that their equipment does not comply with FCC standards on radio frequency interference (RFI). Of 317 devices checked, the FCC found that almost 30 per cent were in violation.

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THE BIG SQUEEZE

It was a hot summer night and the heat was on in more ways than one. I reached over and flicked on the power. The screen went green and blinked READY. Time to get busy. Just then the phone rang.

"Andrews," it barked, "have you come up with those figures yet?

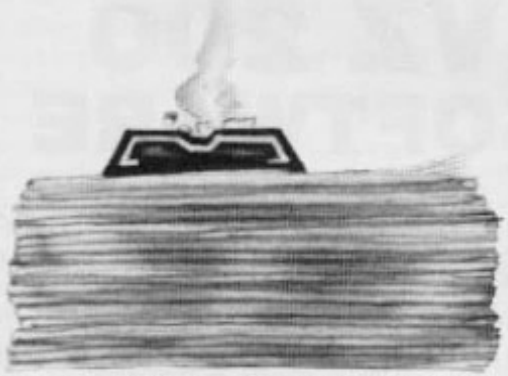
"Take it easy," I said. "I'm on the case."

"Andrews, you won't have the fingers to *grip* a bloody case if you don't deliver the goods. Nobody messes with the firm.

"OK, OK," I whined. "Just give me 'til tomorrow morning . . ."

There was a grunt and then just the purr of a dialling tone. My hands were sweaty and it wasn't from the sweet and sour pork I'd had for lunch. I poured a shot of bourbon and rummaged for the July issue of Australian Personal Computer. There was an article on sub-routines in the January issue which might save me several hours of number-crunching. Now where was that issue?"

Ten minutes later the first pricklings of panic ran up my spine. It had vanished. If only I'd ordered a Mark II *APC* Binder to keep the copies in. Already I could imagine the roaring whine of the chain saw . . . maybe they'd only take a *few* fingers. . .



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VZ 200 PROGRAMMING

Mere human playthings

David Tebbutt considers the likeliest contender for the next dominant species on earth, and it's not going to be the dolphins or spiders.

The world is going to be taken over by computers. Human beings are simply going to become tools of these machines as they play their vast power games. And whose fault will it be? Ours for letting it happen.

I am reminded of those days during the war when scientists were working flat out to find ways of making a workable atomic bomb before Hitler could. Individual participants in the project forgot or couldn't foresee the terrible consequences of such a weapon. No effort or resource was spared to find ways of filtering adequate quantities of the uranium isotope from highly corrosive uranium hexafluoride gas. Scientists worked night and day to find the optimum way of throwing two non-critical lumps of the stuff together so that the combined mass would be critical. Then in the New Mexico desert, the first atomic bomb (Fat Man) was detonated. Three weeks later, the centre of Hiroshima lay in ruins and many scientists who had enjoyed the earlier challenges of the atomic programme found themselves feeling pretty guilty. I remember as a child being thrilled by films of atom bomb tests. The public was pretty well unaware of the dangers of exploding atomic weapons in the atmosphere. And so it is today. We are on the verge of creating a brand new threat to humanity and hardly anyone, including those closely involved, is aware it's happening.

We are heading towards a computer takeover of the world. Most of us rather arrogantly feel we're just too clever and that computers will never be able to do the things even a single human brain can do. I rather suspect that people thought similar thoughts when steam engines were first invented. They were rather cumbersome affairs which would never catch on because they were too large, uncontrollable and downright dangerous. Of course the designs improved, the size was reduced and they became quite reliable and popular. Imagine the reaction of the public when they saw the Wright brothers' plane. How could they possibly envisage the jet travel which is so commonplace today. In exactly the same way, we are nigh on incapable of seeing where this computer industry will lead us. We can make a few intelligent guesses though.

First of all, the human brain transmits information at 120 metres per second which is pretty slow compared with the internal speed of a computer. The human mind comprises a whole bunch of parallel processors and it has replicated memory all over the place. There's no reason why computers shouldn't work this way too. Computers will be faster and more reliable when it comes to recalling information and they have the benefit of being able to talk to other computers all over the world via the telephone system. Already they can make and answer calls themselves. In effect the international telephone system and all the computers attached to it could form a single vast distributed computer.

We already trust computers to help with our decision making. Linear programming for example would be a very tedious process without computers. With them it's a cinch and we're very inclined to act on the information calculated by the machine. Political decisions are made with the help of computer models. In fact in every walk of life, computers are necessarily becoming involved simply because life is becoming too complex for human brains to cope in a timely fashion. Once we make the software building blocks which are known to work, we can give these to the computer and it can decide appropriate ways to blend them together to solve different application problems. Including perhaps, the application of writing better computer programs and building blocks. Once they're off on this track, there will be no stopping them. Give the human range of senses plus a few extras (infrared vision and ultrasonic hearing for example) and you have the making of a machine which can easily outstrip a human being.

Wars could be fought electronically as each country's super computers thrashed out their differences. The computers would spit out recommendations (orders really) to its human handmaidens. We would have to trust the machines, we'd have no choice. If you were told that World War 3 would start unless a certain person was assassinated or a certain building was blown up what would you do? Would you have any choice? Such is the future for the human race. I offer no solutions. It will probably happen. We will be replaced as the dominant species on this planet. We are creating our own replacements and, like the atom-splitting scientists, we have only the remotest grasp of the irreversible changes we are making to the world.

MICRO CHESS

GRAND MASTER

Tony Harrington provides an insight into the seemingly magical effect of a chess computer (soon to be released in Australia), which mysteriously moves its own pieces.

For your true chess enthusiast, once the game has well begun the best that can be said about the materials, with which the game is played, is that they should cause as little of a distraction as possible. A chess board that draws attention to itself by its fluorescent colouring or any other oddity is simply an irritant. Similarly, an ornamental chess set modelled on the Chinese Mandarins of the tenth century might be a wonder in a showcase, but a pain in the neck to play with.

Much the same is true of chess computers. Once the game is under way, it really does not matter how the computer signals its move, so long as it does so clearly and concisely. Like most chess players, I've got used to the quiet flashing of a couple of LED lights, accompanied by a demure 'beep' whenever the machine has found its move.

So when I was given the opportunity to look at the Milton Bradley machine, called the 'Grand Master', I had my doubts. The marvellous feature of this machine, I was told, is that it moves the piece itself. It has a reasonable program, but that is almost beside the point — the point was that progress had been made in the direction of the magical.

The usefulness of a machine that could literally make its own moves was not clear to me. Why should it be a significant advance on existing machines which simply sit there, lighting up their LEDs in a friendly sort of way and waiting patiently for you to do the decent thing by them?

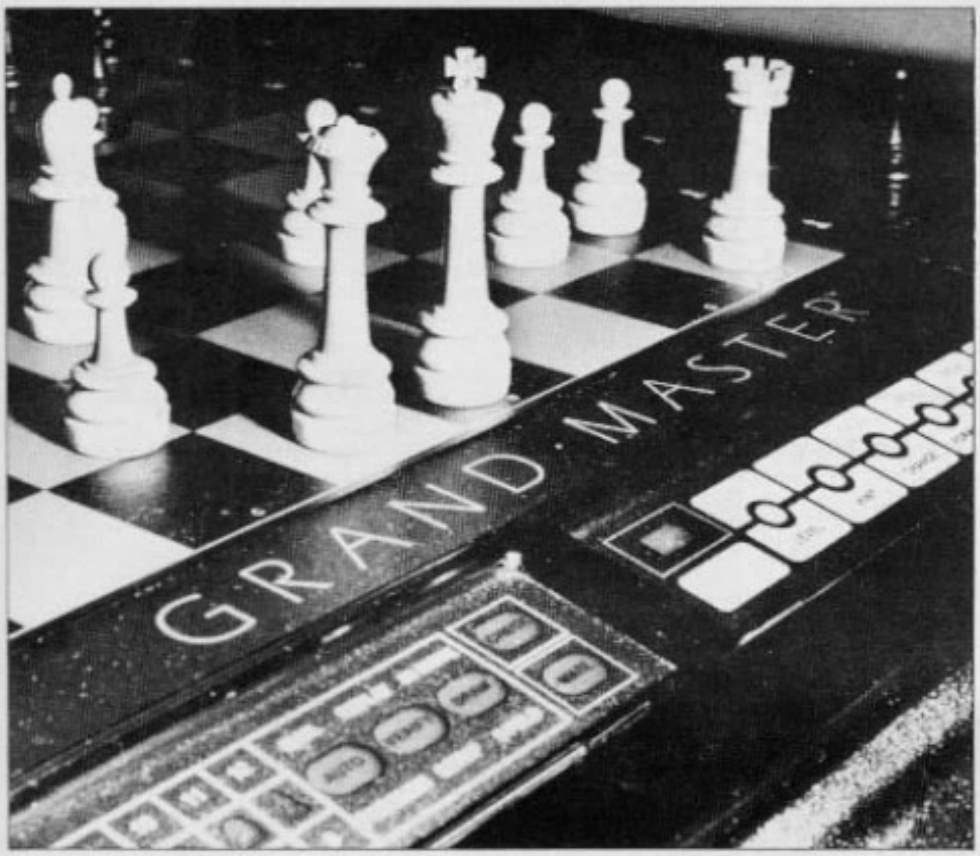
I sat down before the Grand Master with some scepticism. Following the great — and now almost forgotten Bobby Fisher's dictum — I opened with the king's pawn. What followed is hard to describe. A motor started into life, rather audibly, and Black's king pawn slid firmly out to e5 and stopped. So did the motor, and I was left in a deepening silence to think about my next move.

I brought the king's knight out to f3. The motor rasped into action and Black's pawn on f7 slid a fraction of an inch to one side. For a moment I thought the machine had slipped a gear, or sprung a solenoid or something. Then its knight moved majestically through the gap created between the pawns on f7 and g7 to take up its station on f6. 'What about the touch move rule?' I said to my absent opponent. But then, no-one had touched a piece, so I suppose it didn't apply. A pity, I hate playing against the Petroff.

More surprising things were to come a few moves later when I took Black's pawn on d5 with my e pawn. There were several possibilities for Black, and I was brooding over a few of them when my e pawn, now on d5, suddenly sidled off the board and stood out of play. I was left staring at the blank square and wondering what it was going to recapture with. The pause could only have been a half second or so, but it produced a distinctly odd feeling.

The game itself was not particularly memorable, but it was interesting in its own right. As it developed it began to seem more like a game of chess than the circus performance it had seemed at the beginning. As a marketing gimmick, I think that Milton Bradley has hit on something rather special. My only hope is that the company doesn't put a voice chip in the blasted thing, or you may as well call the neighbour over and play a human being.

Now for the origins of the machine. Milton Bradley rang up Intelligent Software in June 1981 while David Levy and his colleagues were still hard at work on programs for SciSys. According to Levy, whoever spoke to him simply said that he wanted some advice on chess computers. They phoned from the States and



A side view of the 'Grand Master'.

Beware that you do not lose the substance by grasping at the shadow

Even Aesop would have been confronted by confusion. Coming from the Fifth Century BC, the average newsagent would seem like one enormous fable factory. Row after row of micro-computer magazines, all filled with conflicting opinions. Each, in its own way, claiming to be the fount of all knowledge.

He would soon deduce, as many have already discovered, that reading the wrong magazines is no better than chasing shadows. The truth, he would conclude, is often hidden, as indeed are the shadows in the darkness.

Of course, he would have to admit that some micro-computing magazines are, in their own way, very good indeed. But many, he would soon realise, are but pale and imprecise imitations of the genuine article.

Careful reading would convince him that for complete, comprehensive and authoritative coverage, there really is no substitute for *APC*.

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asked Levy to go and see them at their East Longmeadow, Massachusetts offices.

'When I arrived they showed me into a room and, after asking me to sign the traditional non-disclosure agreement, they put a machine on the table, switched it on, and a pawn moved — as if by magic — from e2 to e4 — without any human intervention or any visible, physical device for making it move. I was fascinated,' Levy said.

This was the idea they wanted to develop: that is, they wanted the mechanism that had just moved the pawn developed to the point where it would be reliable enough to be used in a consumer product. And they wanted a chess program that would work with this mechanism.'

Levy phoned the technical director of Intelligent Software from Milton Bradley's offices and told his colleague about this new machine. After a brief huddle, they decided that this was very much the sort of project they wanted to get involved in. In Levy's words: 'It was the most exciting chess product that we had been faced with and we could not resist the challenge.'

All the chess programming that Levy and Intelligent Software had previously been involved with had been straightforward software programming. This was the first time that they had to get involved with electro-mechanical technology.

Despite this, they undertook to write the chess program and the software to control the electro-magnetic system which moved the pieces. Levy reckons that when he was first shown the machine it worked to the point where it was possible to demonstrate the idea, but there was still quite a way to go before it could be turned into a reliable product which would stand up to the rigours of life in the average home.

So how does the machine move its pieces? The idea is basically simple. There is a solenoid (an electro-magnet) underneath the playing surface. This is connected to a mechanism which moves on two axes, consisting of two metal bars. The one can move down the length of the board, while the other moves down the width of the board.

The solenoid is fixed onto the one axis and is constrained to move by the other axis so that it is always at the centre of the cross-hairs formed by the intersection of the two axes. The bars are controlled by two belts (with teeth), which go round two wheels (also with teeth). A photosensitive device counts how many teeth on each of the wheels move past a certain point. So by counting how many fractions of a turn each wheel has made, the program is able to tell exactly where the solenoid is located under the chess board.

Each piece has a permanent magnet in its base, and when the Phantom wants to move, it first moves the solenoid to the exact position of the piece on the board (all the pieces are of course tracked by the program). It switches on, detects that there is indeed a piece on that square, and then moves to the target square — 'dragging' the chess piece with it.

In the case of captures, it first moves the captured piece from its square to a place at the side of the board, off the playing surface, set aside for it. The surface of the board is a touch sensitive surface, much like that of the Sensory Nine. When the player captures one of the computer's pieces, that piece has to be placed at the side of the board as well, and there is a symbol for every piece set out in two lines on the right and left hand sides of the chess board.

One of the quirks that fascinated me was the fussiness of the machine. Each time I captured one of its pieces and put it down on its square, there was the audible sound of its motor starting up as the solenoid rushed over to check that I had placed the piece correctly on the square appointed for it. According to Levy, if I had put the knight down on a square reserved for a queen, the machine would have immediately moved it — by the shortest possible route (no inefficiency here, please) — to the right square.

As with the Sensory Nine, when the player makes a move, it is necessary to press down lightly on the square of the piece that you are moving and on the square that you are moving to. Levy reckons that the program has an approximate rating of 1550. This is considerably weaker than that of La Regence, Intelligent Software's own machine, released last December (which has an estimated rating of 1750).

The explanation for this is that La Regence was designed after the Grand Master, and with a more leisurely research and development period. Levy's brief was to produce a program stronger than the Sargon 2 running on the Apple computer. The processor involved was the 6502A processor with 2k of RAM and 16k of ROM.

'The rating of 1550', he said, 'comes from 40 games played against the Sensory Nine and the Sargon 2.5, both of which were chosen as adversaries because they have already been rated by the United States Chess Foundation. Thirty games against rated players or rated machines are enough to get a statistically reliable result,' Levy said. 'We played 40 in order to gain even greater confidence.'

'We had never done anything using electro-mechanical devices before. When we first discussed the machine in the company's offices, I was asked how long I thought the job would take. More specifically, I was asked if we could do the work within five months. When I phoned our technical director I didn't tell him the time period Milton Bradley was considering. I just asked him how long he thought it would take. He said: 'five months . . .'

My guess is that with Intelligent Software already marketing a machine with a stronger program than the Milton Bradley machine, it won't be too long before the Grand Master gets a program worthy of its mechanical dexterity.

Games section

White: Fidelity Sensory 9 (level 3); Black: Grand Master (level 10); Pirc Defence: Notes by David Levy.

1	e2-e4	d7-d6
2	d2-d4	Ng8-f6
3	Nb1-c3	g7-g6
4	f2-f4	Nb8-c6
5	Bf1-b5	

(Unusual and rather pointless. The pin on Black's knight is of no consequence and the bishop would be better placed on almost any other square.)

5	. . .	a7-a6
6	Bb5xc6+	b7xc6

(Black has an isolated pawn (a6) and doubled pawns (c7 and c6) but despite having made these concessions in its pawn structure, the Grand Master actually has the better long-term prospects. This is partly because White has ceded bishop for knight; partly because of the attacking prospects along the b-file; and partly because White's impressive looking pawn centre might eventually prove vulnerable to pressure.)

7	Ng1-f3	Bf8-g7
8	0-0	0-0
9	Bc1-d2	

(A poor square for the bishop, but 9 Bc1-e3 accomplishes nothing after 9. . .Nf6-g4. Perhaps White should have tried 9 h2-h3 and 10 Bc1-e3.)

9	. . .	Ra8-b8
10	Ra1-b1	Bc8-e6
11	Qd1-e2	

(Otherwise . . .Be6-c4 might be embarrassing, and now White threatens 12 Qe2xa6.)

11	. . .	Rb8-b6
12	e4-e5	Nf6-g4
13	h2-h3	Ng4-h6
14	Nf3-g5	Be6-f5
15	Bd2-e3?	

(Too slow. I would have tried 15 g2-g4, when 15. . .Bf5xc2 16 Rb1-c1 Rb6xb2 17 Bd2-e3 wins a piece (17. . .Bc2-d3 is best met by 18 Qe2xb2 Bd3xf1 19 Rc1xf1, rather than 18 Qe2xd3 d6xe5 19 f4xe5 Bg7xe5!).

Since Black cannot capture on c2 after 15 g2-g4, play might continue 15. . .Bf5-d7 16 Qe2-f2, with an eventual Qf2-h4 and f4-f5, attacking Black's king.

The move played in the game hands the initiative to Black.)

15	. . .	Qd8-b8
16	g2-g4	Bf5-d7
17	e5xd6?	

(A serious positional error. White weakens itself on the a1-h8 diagonal. Better would have been 17 Nc3-d1, followed by Qe2-f2 and Qf2-h4.)

17	. . .	e7xd6

(More dynamic than the obvious looking 17. . .c7xd6. Black now has the possibility of play along the e-file.)

18	Nc3-a4	

(Putting the knight offside. White's only chances lie on the K-side, so again 18 Nc3-d1 was called for.)

18	. . .	Rb6-b5
19	c2-c4	RB5-a5
20	Na4-c3	Rf8-e8
21	b2-b4	

(Further weakening White's position.)

21	. . .	Ra5-a3
22	Qe2-b2?	

(22 Qe2-d2 was essential.)

22	. . .	Re8xe3!

(A simple combination which wins material.)

23	Qb2xa3	Bg7xd4

(The point. As a result of the numerous threats created by the discovered check (if Black moves the rook from e3), White has no time to defend the c3 knight.)

24	Kg1-h1	Re3xc3
25	Qa3xa6	Bd7-c8!

(Winning another pawn, since 26 Qa6xc6 loses the queen to 26. . .Bc8-b7.)

26	Qa6-a4	Rc3xc4

(Black has a significant material advantage (two bishops and a pawn for a rook), and its king is much safer than White's, so the result of the game is hardly in doubt.)

27	Rf1-e1	Bc8-d7
28	Re1-e7	Qb8-d8
29	Re7-e4	

(If 29 Rb1-e1 Bd4-c3, threatening . . .Bc3xe1, . . .Rd4xb4 and . . .Rd4xf4.)

29	. . .	f7-f5
30	Qa4-a6	d6-d5
31	Ng5-e6	Bd7xe6
32	Re4xe6	f5xg4
33	Rb1-e1	

(Threatening to win Black's queen by 34 Re6-e8+.)

33	. . .	Kg8-f7
34	f4-f5	Nh6-f5
35	h3xg4	Qd8-h4+
36	Kh1-g2	Qh4-f2+
37	Kg2-h3	Qf2-g3 mate

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DOT

Australian Personal Computer

WE HAVEN'T LEFT ANYTHING OUT

DOT is a totally integrated compact computer system for office, field, or home use. It is portable, powerful, reliable and efficient.

INTEGRATED HARDWARE

As a self contained unit, DOT supplies all the computing components you need. You can concentrate on putting DOT to work for you immediately, instead of worrying about purchasing and integrating components.

- ☐ a powerful, 16-bit microprocessor
- ☐ dual floppy diskette storage
- ☐ easy to read video display with bit map graphics
- ☐ easy to use keyboard
- ☐ built-in communications capabilities
- ☐ quiet, reliable printer.

SOFTWARE TOO

To complement this hardware, DOT also includes the systems software necessary to use a wide range of commercially available application packages, and develop new applications:

- ☐ application packages for spreadsheets, word processing, scheduling, financial analysis,

and a host of other professional activities that are ready to run on the DOT.
- ☐ software development and productivity tools, including a variety of popular language compilers, application generators, and systems software.

BOTTOM-LINE BENEFITS

The DOT's integration of hardware and software offers capabilities that are directly translatable into bottom-line benefits for you:

- ☐ savings in time and effort — with DOT, you can realize the benefits of owning a personal computer immediately; you don't have to shop for and integrate a number of separate components. Everything you need is already packaged in one integral unit. Plug it in and start to work
- ☐ increased productivity — saves time and effort on jobs now done manually. Instead of spending time to prepare and calculate data, you can devote more time to analysis and decision making
- ☐ affordable computing power — the price of the DOT allows you to allocate computer time and recources to tasks previously considered not economically suited for execution by a computer
- ☐ increased accessibility to computing power — you can use DOT not only as a standalone personal computer but also access a world of computing resources including timesharing services and data bases
- ☐ increased flexibility — wherever your job takes you, you can bring along the computing functionality previously restricted to a desk or office environment

A History of Portable Computing Innovations

Since 1969, Computer Devices has supplied compact, portable terminal/printer systems.

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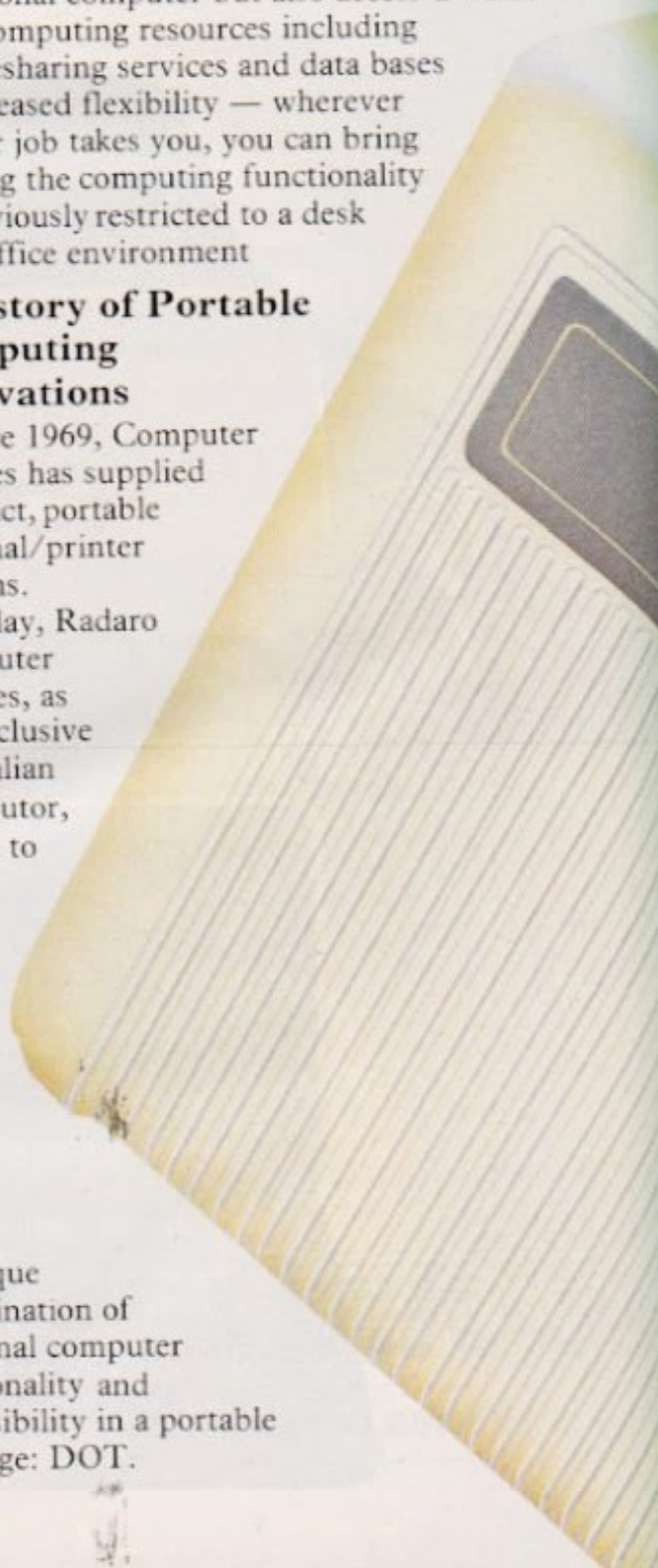

a unique combination of personal computer funtionality and accessibility in a portable package: DOT.


DOT

Computer Devices

REET, MELBOURNE. 3000

Australian Personal Computer

HARDWARE OVERVIEW

DOT provides maximum personal computing power in a compact, affordable package with a powerful microprocessor, mass storage, keyboard and video display console communications and integral printer.

MICROPROCESSOR

The DOT is based on a powerful 16-bit Intel 8088 microprocessor chip and provides:

- ☐ advanced 16-bit power for high performance in a compact package
- ☐ an internal time of day clock/calendar
- ☐ 128K bytes of main memory (minimum)
- ☐ 32K bytes of video display RAM (standard)
- ☐ optional additional memory allowing up to 256K bytes on a single board, and up to 768 bytes with an additional expander board.

MASS STORAGE

The DOT offers single or dual disk drives that use high capacity, high speed, 3½ inch floppy diskettes for data storage.

The DOT is configured with: two 282K byte floppy diskettes(formatted).

KEYBOARD AND VIDEO DISPLAY CONSOLE

The keyboard and video console for the DOT, like all DOT components, work together to provide an easy to use and comfortable interface between the operator and the computer. The keyboard provides a familiar means of communication with the DOT.

- ☐ familiar typewriter style layout with cursor and numeric keypads
- ☐ ten soft function keys
- ☐ full 256, character set (includes many international characters).

The video display console meets the requirements of compact packaging while fulfilling the operators need for an easy-to-view, flexible display. The console offers:

- ☐ 5 x 9 inch monochrome screen for easy operator viewing
- ☐ high resolution video display with bit map graphics and standard screen character modes of: 132 x 25, 132 x 16, 80 x 25, 80 x 16, 40 x 25, 40 x 16
- ☐ selectable screen graphics modes:
  IBM modes: 320 x 200
  640 x 200
  DOT modes: 1024 x 254.

COMMUNICATIONS

The DOT not only supplies a complete, self contained unit with all the personal computer components a professional, manager, or small businessman requires, it also provides the communications capabilities they need to integrate the DOT with an assortment of networks, data bases, and on-line services.

Communications capabilities include:

- ☐ IBM 3270 and 3780 Bi-sync protocols supported
- ☐ two communications (RS- 232) ports
- ☐ DEC VT 100/52 emulation available
- ☐ supports synchronised and A-synchronous. Bi-syncronous proctocol also supported.

HIGH SPEED PRINTER

Computer Devices has always sold compact, reliable, quiet printers as integral parts of their portable data terminal/printer units.

The DOT incorporates all the features and benefits that Computer Devices has introduced in its printers during those years.

The DOT high speed printer offers the following features:

- ☐ thermal printing for quiet, reliable operation
- ☐ 160 cps bidirectional printing
- ☐ 1 x 11 dot printhead for letters that look like letters, with true descenders
- ☐ selectable 80 or 132 column format. Useful for financial and statistical applications where a wide format is a necessity
- ☐ integral graphic capability for quality charts, plots, etc.

CONFIGURATIONS

Configurations offer a choice of 128K or 256K main memory (running MS DOS), with or without an integral printer. All configurations include a high resolution bit map graphic display, disk drives, a detachable keyboard, two option slots, and a 90 day warranty as standard features.

In addition, the DOT can be equipped with expanded memory (to 768K), integral communications capabilities, a parallel port, and professional application software.

The DOT can also be configured with a Zilog, Z80, 8- bit processor for access to software running under CP/M (tm) 2.2.

To complement the best personal hardware, DOT uses advanced personal computer software. DOT offers access to a wide range of application software, as well as proven, transportable system software and software development and productivity tools.

APPLICATION SOFTWARE

For a personal computer to be truly valuable to the business and industrial professional, application software must be available to run on it.

SOFTWARE OVERVIEW

With DOT, the user can access compatible applications software from a variety of vendors for a range of applications.

These include:

- spreadsheet calculation applications Multiplan™ from Microsoft
- word processing applications Volkswriter™ from Lifetree Software Inc.
  Wordstar™ from Micropro
- filer/indexer applications Record Manager™ from DATAMENSION CORPORATION.
  Project Manager™ from DATAMENSION CORPORATION (Critical Path Analysis)
- scheduler applications Time Manager™ from DATAMENSION CORPORATION
- accounting applications — including a wide range of Australian accounting packages
- three dimensional financial modelling applications Report Manager™ from DATAMENSION CORPORATION
- relational data base/report writer applications D Base II™ Management system
- program/application generator PEARL 3 Program Generator™ from PEARLSOFT a division of Relational System, International Corp.
- terminal emulation applications Asychronous Bisynchronous.

This assortment of packages enables the DOT to play an immediate role in helping business professionals be more productive and efficient.

SYSTEM SOFTWARE

DOT is equipped with MS-DOS™ a widely used, proven, true 16-bit operating system.

MS-DOS provides easy access to personal computing power for novice and expert users.

For novice users, DOT's operating system and self-help features mean they won't be lost, confused or frustrated.

The DOT system software helps novice users apply the power of a personal computer to their particular area of professional expertise without becoming computer programmers.

For example, business professionals can use DOT and Microsoft's Multiplan software to format a spreadsheet and stipulate the calculations to be performed in simple, English language commands.

For expert users and systems developers, MS-DOS offers the following features:

- no limits on file or disk size
- fast, efficient file structure
- relocatable macro assembler
- time/date stamp
- resident debugger and editing template.

DOT languages and software developers' tools include the following:

- Microsoft —
  - GW-BASIC™
  - MS-BASIC Compiler
  - MS-FORTRAN™
  - MS-COBOL
  - MS-PASCAL™
  - MS-MACRO ASSEMBLER™

PRODUCT DOCUMENTATION

To make sure that DOT users have all the information they need, Computer Devices supplies a comprehensive documentation package.

That package covers a wide range of topics, including start-up and shut-down, entering information, using commands, file creation, housekeeping, application and system software selection, editing procedures, hardware specifications, and diagnostics.

Each DOT configuration purchased comes with a documentation kit. That kit includes the following manuals:

- Meet your DOT: An Introduction to Your DOT Computer
- Your DOT File Cabinet
- DOT Guide to Software Selection
- Business and Fun with BASIC
- MS-DOS Users Guide
- MS BASIC Users Manual

The documentation is clear, concise, and straightforward so that users, whether novice or expert, are able to find the information they need quickly and easily.

The documentation offers a total view of the DOT.

ACCESS TO A WORLD OF COMPUTER DEVICES

With the DOT's communications capabilities a user can take advantage of considerable timesharing computing and data acquisition resources. These resources include: program development, access to a multitude of data bases and information services, as well as consultation and training services.

For example a business professional could access a number of financial data bases for information on historical stock data, commodity news, newspaper financial reports, financial advice, information finances for major companies, or even personal financial records.

The user could acquire information first thing in the morning on-line, use the DOT's personal computing power to manipulate the information during the day. In this way, the user combines the capabilities of a personal computer and a timesharing resource to provide the computing power he or she needs.

CUSTOMER SERVICE

At Radaro, customer support doesn't end at the point of sale.

Radaro Computer Devices have established an enviable reputation for sales and service expertise.

This reputation is reinforced by the appointment of Radaro Computer Devices as the sole Australian distributor of the amazing DOT computer.

Radaro has not undertaken this responsibility lightly, before committing to the task they conducted an extensive evaluation of the DOT computer, it's software back-up and it's suitability for the Australian market.

At the head office in Melbourne there is a trained team of specialists on hand to answer customer queries and to solve any operational problems.

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DOT

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PORTABLE

In the last two years, the micro industry has been excited by two main classes of machine. The first class was the era of the portable, when Adam Osborne decided that what most micro enthusiasts and small businessmen really wanted was to carry their hardware around under DC9 seats. The second class of machine was really no different from most other decent computers on the market, except that they sported really impressive badges on their labels, such as DEC and IBM — thereby heralding the advent of microcomputers into the realm of "respectable" computing. Carrying on this fine tradition of innovation comes the DOT — a PC compatible portable computer which, incidentally, is very difficult to say quickly!

Cynicism aside, the DOT really is quite a machine. It claims a certain amount of IBM PC compatibility (to be examined later), but does not over-play the point. The DOT measures up very well in its own right, and any degree of PC compatibility can be looked on as a bonus rather than a major feature.

In fact, the DOT may turn out to be a very successful combination of features. Many large companies have begun to invest in micros only since the big names entered the market, and many of the micros owned by these companies *are* going home at the weekend — if only due to their high demand during the week. Several of the large companies around town are running 6am to 10pm rosters on their machines. Hence a machine with both IBMishness and portability could spark a great deal of interest.

Hardware

The DOT comes in a rather neat package of hardware about the size of the traditional Osborne 1, weighing in at around 28 pounds.

Our demonstration model included two 3½ inch Sony standard floppy disk drives, providing 287k of storage each. This was my first exposure to 3½ inch floppies, and they seem very practical, robust and speedy. The system also included an 80/132 column thermal printer mounted on the top of the case which provided quiet and efficient printing while not causing screen "jitters" or disk errors.

The DOT runs a 16 bit 8088 CPU and supports a standard 128k of memory which is expandable up to 756k without the need for external expansion interfaces.

The keyboard has 90 keys arranged in a slightly different layout from the IBM and with slightly different legends, although not sufficiently different to present a barrier to an IBM experienced user. This is actually an important point to consider when looking at IBM compatibles, as many users may be swapping from one machine to another and preferably should not require retraining in their basic keyboard skills. The keyboard feels a little soft but is still quite usable and quite fast. The key repeat facility uses the "increasing speed" system, whereby the key repeats more quickly the longer you hold it down.

The DOT's screen is 5 by 9 inches,

OT

OMPUTER

significantly larger than most other portables, and an external monitor port is provided if you really need it. In its standard screen format of 25 lines by 80 columns, the text is extremely readable — much more so than the "newsprint" size found on the Osborne. The DOS MODE command can be used to change screen format to 40 or 132 columns and/or 16 lines. I found the 132 x 25 format fairly difficult to read, as this reduced the characters to about Osborne size. Even at this high screen density, however, the characters were still well formed and quite clear. The machine also supports two graphics modes, the IBM standard 640 x 200 pixels, and an extended 1056 x 2248.

The MODE command can also be used to change the printer format from 80 to 132 columns, and to 6, 5, 4 or 3 lines per inch (done by spacing the lines, not making the print larger). The screen dump facility automatically sets the printer format to match the current screen format.

The screen takes up about half the total width of the DOT, and it is this extra width that has resulted in a good quality display. The keyboard is detachable and is connected to the rear of the main unit by one of those "just too short" cables. Internally, the machine is laid out quite neatly and should be fairly robust when you transport it. I should point out that it is really a very neat trick to cram a printer, power supply, disk drives, screen and cpu into the same box without each one creating electrical interference with the others, and the DOT manages this extremely well. There is absolutely no sign of screen flicker during printing or disk accesses, and neither is the machine packed full of shielding.

Only time will tell, but the 3½ inch floppies appear much better matched to the rigors of transportability than the best of the old 5 inch drives, and I have heard many stories of problems with the first generation of portable computers and their disk reliability. I believe that this situation should be much improved in the DOT due to its 3½ inch drives.

The DOT contains four expansion slots, two of which are used on the standard machines. An extra 128k may be installed simply by fully populating the existing memory board, and then two additional 256k boards may be added to bring the total RAM to 768k. Alternatively, other boards such as an IEEE or Centronics interface may be installed. I have been told that the expansion slots are pin compatible with the IBM, and that any IBM board 10¾ inches in length (or less) should run in the DOT quite happily. The wise thing to do, of course, is to try before purchasing.

Included as standard on the DOT are two serial I/O ports and an external monitor port. The rear of the unit also provides sockets for power and the keyboard and contrast and brightness controls. Additionally, a reset button is located on the rear of the unit which, in my opinion, is greatly lacking on the IBM.

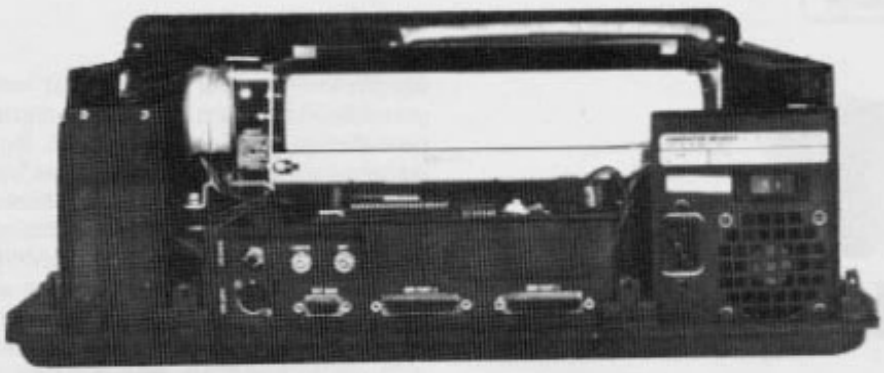
A hard disk mounted externally to the main unit is currently available, but this would rather spoil the transportability of

the system since hard disks are rather delicate items. Rumour has it that an internal hard disk sourced by a very big name in computers may soon be available.

Software

Unlike the IBM, the DOT does not provide a Basic in ROM. This seems like sound thinking to me, as almost no one runs the IBM ROM Basic and very few software packages make use of ROM Basic subroutines — it just sits there taking up some 36k of address space. This means that packages which make extensive use of memory for data storage (as most do) will have a little bit extra on the DOT.

It seems that some software must be supplied free with the DOT, but at the time of writing the details had not been decided, so it could be worthwhile contacting the Australian agents for details.



The Dot's back-side showing two serial ports, reset button and VDU controls including provision for an external monitor.

The system supplied to us ran MS-DOS, and version 2.2 of MS-DOS should be available by the time you read this. The standard MS disk Basic was also provided, and GW extended Basic should be available shortly and will take the form of a shiny new version. Most of Microsoft's system software is available for the DOT, including assemeblers, Fortran, Pascal and Cobol. Since this software is the same on the DOT as on any other machine, it is not worth examining in detail.

Other software supplied to us was good old Multiplan, a word processor Volkswriter and a suite of four packages from Datamension and Record Manager, Report Manager, Project Manager and Time Manager. I could not help feeling that the scope and usefulness of these four was somewhat limited, as was the user-friendliness. However, if you do have a need for PERT charting and CPM (not the operating system), then it could be worthwhile having a look at them.

Aha! you exclaim, as the DOT is IBM compatible, there should be oodles of software just waiting to be run. Well . . .

Compatibility

Just how compatible is compatible? There are many machines around at the moment claiming IBM compatibility when really all they do is run the same operating system. The DOT is not one of these.

Firstly, the DOT cannot read IBM disks. The reason for this is quite simple: they don't fit! The IBM uses 5¼ inch floppies whereas the DOT runs 3½ inch disks.

Actually, this is not such a great problem, as Radaro (the Australian agents) offer a conversion service based on an IBM PC and a DOT to convert floppy disks for you. The effectiveness of this technique on copy protected software remains to be seen. Radaro

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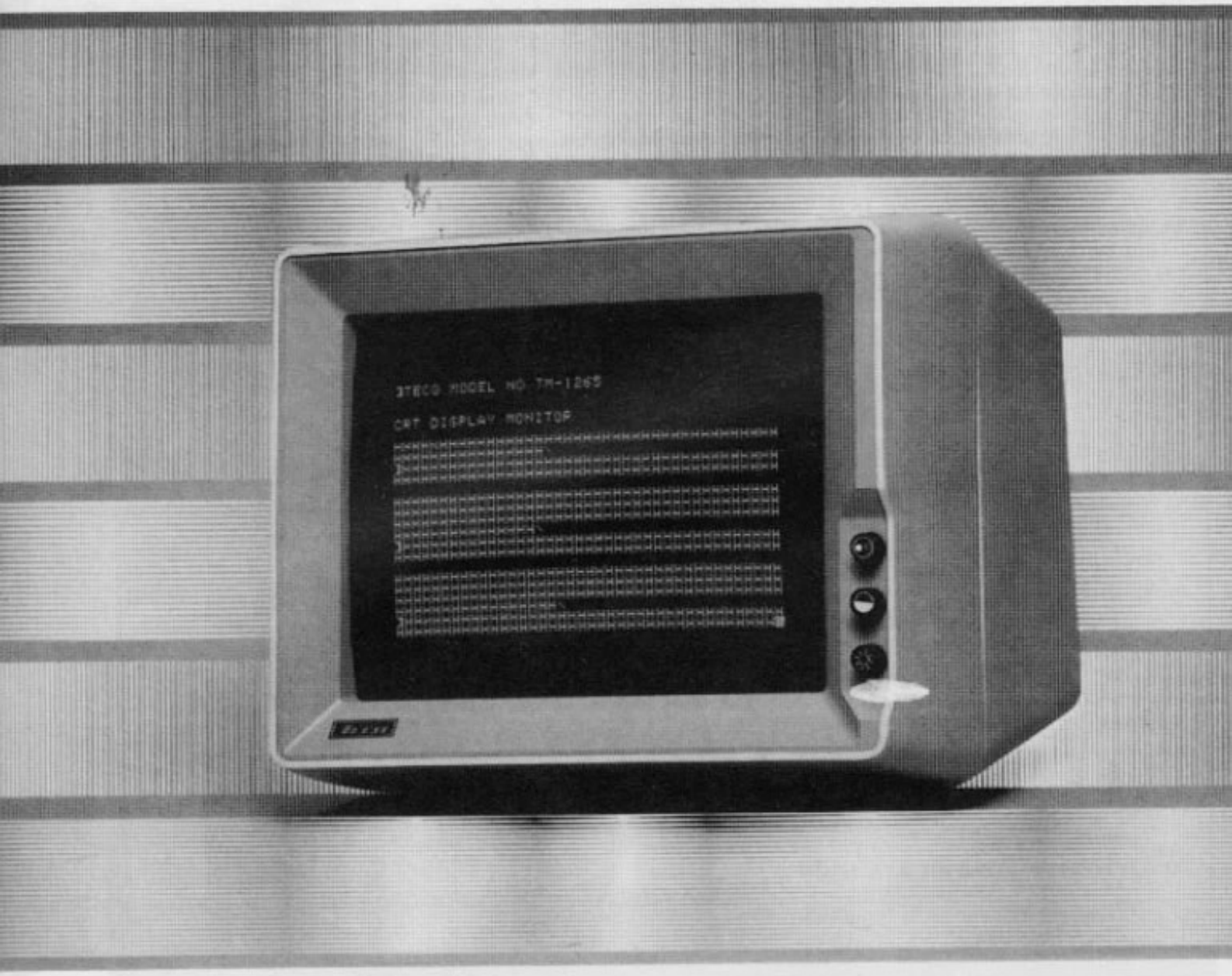

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claims to have downloaded IBM versions of Multiplan, Wordstar and dBase II without any complications and claims also, that they run correctly on the DOT without modification. If this is the case, then you should have no shortage of software for the DOT. The usual rule applies — if compatibility is one of your main attractions to the DOT, then take along some IBM software and get them to convert it before your eyes. The copy of Multiplan supplied with our system was a DOT version, with its own DOT Multiplan manuals.

How much of the IBM software can you expect to run on the DOT? Well, the DOT contains a reasonably different operating system nucleus, so any software that makes use of the OS nucleus routines probably will not work. The only way to tell if this is the case is to try it. Similarly, any software that bypasses the operating system completely and hence becomes device dependent probably will not work. Fortunately, most software writers recognise the existence of IBM work-alike machines and therefore attempt to avoid nucleus calls to direct device I/O.

Conclusion: ask to see it run.

Documentation

The documentation supplied with the DOT is quite good. The first manual to read is "Meet Your DOT", a friendly little item which introduces the various components of the system and explains which buttons do what. This includes a brief but adequate section on "setting up" which is, incidentally, a breeze. The manual also has small introductory sections on DOS, Basic and Communciations, and is scattered with tasteful and amusing cartoons to keep the atmosphere light.

A second manual called "Software

The Dot keyboard

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CROSS-FIGURES

For those among you who were unable to come up with all the answers for our Cross Figures Puzzles last month, here are the solutions.

Solution 'Cross figure puzzles'

1	8	2
0	■	8
7	4	9

The clue for A-down is redundant.

5	6	7
2	■	7
9	8	7

All four clues are needed.

3	6	1
2	■	9
7	2	9

The clue for B-down is redundant.

Solution 'Theatre' clue

The year was 1576 (see library ref. books!). A-ac must be between 1000 and 1999. So C-dn (twice A-ac) must be between 2000 and 3998, ie, C-dn begins with 2 or 3. But 1st digit of C-dn is also last digit of A-ac, and C-dn is twice A-ac, so twice that digit must give a 6 for the last digit of C-dn: 2 x 2 = 4 no; 2 x 3 = 6. OK! So first digit of C-dn is 3, and C-dn is between 3000 and 3999.

1			2-3
	5	■	
	■	7	
			6

So A-ac (half of C-dn) must be at least 1500, ie, 2nd digit of A-ac is 5, 6, 7, 8 or 9. Now let's look at the clue for A-dn: 5 x 5 = 25, so last digit of A-dn is 5. *Remember that 2nd digit of A-dn must be same as 1st digit of D-ac.* Now some calculator work . . . Set 55 in calculator as first trial value of B-dn. Try values of D-ac starting at 15:

1	5-9	■	3
■	5	■	■
■	■	7	■
5	■	■	6

D-ac * 5
xB-dn * 5-9 5
A-dn 1 * * 5

55 x 15 = 825 too small
55 x 25 = 1375 no
55 x 35 = 1925 no
55 x 45 = 2475 too big — try 65

65 x 15 = 975 too small
65 x 25 = 1625 no
65 x 35 = 2275 too big — try 75

75 x 15 = 1125 yes! But check *all* values:

75 x 25 = 1875 no
75 x 35 = 2625 too big. Try 85 and 95: no, no.

1	7	■	3
1	5	■	■
2	■	7	■
5	■	■	6

So only one possibility: 75 x 15 = 1125

The digits of A-ac total 19. We have 1, 7 and 3, adding up to 11. So remaining digit must be 8, giving A-ac as 1783. So C-dn (twice 1783) is 3566. That gives 76 for E-ac, and the square of 76 is 5776, giving F-ac. And that's it!

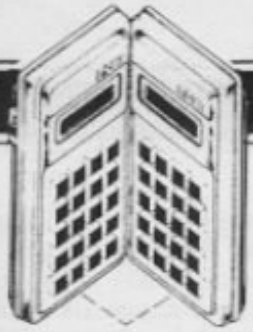
1	7	8	3
1	5	■	5
2	■	7	6
5	7	7	6

To find solution without knowing the actual 'theatre year' (the first digit must be 1, of course!), you need a list of squares (from calculator or maths table) and determination! Clue for A-ac is important. Happy hunting.

Solution 'Common factor'

5	5	8	6
4	■	4	9
8	3	■	7
1	8	6	2

Four of nine clues are redundant.



SHARPER DEFINITIONS

Amanda Parfitt takes a closer PEEK at the Sharp PC 1500

The Sharp PC 1500 has six function keys referred to as F1 to F6 which the user can define in the RESERVE mode. These may be set for frequently used keywords or statements. By use of a selection key, each function key can represent three separate statements, the level of key selection being indicated by a I, II or III flag at the top of the display. Associated with each of the three levels of function key definition is a descriptor of up to 26 characters which can serve as a reminder of the purpose of the six keys at that level. The user has only to press the RCL key to be reminded of these definitions.

The definition of these keys may need to be changed to suit a particular program, but unfortunately these definitions are not passed to cassette by the CSAVE command. Consequently, the poor user has to spend several minutes manually redefining these keys after loading the new program.

The description below not only shows how you can incorporate function key definition into your programs, but also illustrates the procedure with a general purpose program which can be tailored to your needs.

The key to the problem lies in the 188 bytes that the machine uses for storing the three reminders (each up to 26 characters) and the 18 definitions. These bytes are described in Fig 1. In order that each of the 18 statements or keywords can be distinguished, a start byte is associated with each definition. On pressing a function key its reference byte is compared with each byte in the definition space (14422-14531) until the correct start byte is found. Then the succeeding bytes are brought into the keyboard buffer until a different start byte is reached. Fig 2 describes the values of these start bytes. For those of you with orderly minds the level II and III values do look as though they have been switched. This definition space is filled in the order that key functions are defined, so that start bytes may not appear in the order shown in Fig 2.

To put all this information to use, one has simply to do a little judicious POKEing within the particular program and thus define the function keys. There are many ways of doing this depending on the application. Fig 3 shows a general purpose program which should be CSAVEd as it is but adjusted once CLOADed for particular applications.

The array A$ represents the three character string reminders (of up to 26

Reserve Definition Memory Map

Location (decimal)	Purpose
14344-14369	RCL I 26 Character Reminder
14370-14395	RCL II 26 Character Reminder
14396-14421	RCL III 26 Character Reminder
14422-14531	Remaining space for definitions

Fig 1

Start Byte Values (decimal)

	Level I	Level II	Level III
F1	1	17	9
F2	2	18	10
F3	3	19	11
F4	4	20	12
F5	5	21	13
F6	6	22	14

Fig 2

PROGRAM LISTING

```
 5:REM Reserve Key Definitions by
   Amanda Parfitt
10:DIM A$(2)*26
15:REM A$ holds the 3 levels of reminder
20:A$(0)="****|***|***|***|***|*****"
25:REM A$(0) is set up it represents RCL I
30:A$(1)="****|***|***|***|***|*****"
35:REM A$(1) is set up it represents RCL II
40:A$(2)="****|***|***|***|***|*****"
45:REM A$(2) is set up it represents
   RCL III
50:FOR J=0 TO 25
55:REM Now we POKE in the RCL values
60:POKE J+14344,ASC MID$(A$(0),J+1,1)
70:POKE J+14370,ASC MID$(A$(1),J+1,1)
80:POKE J+14396,ASC MID$(A$(2),J+1,1)
90:NEXT J
100:DIM B$(1)*55
105:REM B$ holds the statements etc for
    reserve keys
110:B$(0)="::::::::::::::::::::::::::::::
    ::::::::::::::::::::::::::"
115:REM Note the : is used to separate
    statements
120:B$(1)="::::::::::::::::::::::::::::::
    ::::::::::::::::::::::::::"
130:R=0
135:REM POKE the reserve key definitions
140:FOR J=0 TO 1
150:FOR K=0 TO 54
160:P=14422+K+J*54
170:POKE P,ASC MID$(B$(J),K+1,1)
175:REM Check for the : delimiator
180:IF PEEK P=58 THEN GOSUB 2000
190:NEXT K
200:NEXT J
210:END
2000:R=R+1
2005:REM R holds the decimal value of the
     internal delimiator
2010:IF R=7 THEN LET R=17
2020:IF R=23 THEN LET R=9
2030:POKE P,R
2040:RETURN
```

EXAMPLE

```
 20:A$(0)=" RUN X1= Y1= X2= Y2= LINE "
 30:A$(1)=" STATUS...0...1...2...3   "
 40:A$(2)="COL0...1...2...3  LST LPRT "
110:B$(0)=":R.0:X1=:Y1=:X2=:Y2=:LINE
    (X1,Y1)-(X2,Y2)::STA.00:STA."
120:B$(1)="10:STA.20:STA.30:COL.00:
    COL.10:COL.20:COL.30:LL.0:LP.::"
```

characters) and the array B$ represents the functions to be defined. Dummy values have been assigned to both of these arrays up to the maximum capacity allowed for each. Using the editing facilities of the PC 1500 on these assignment lines one can replace the dummy values by those required for your application.

The small letter l in each of the three strings of A$ divides the 26 character display into the appropriate areas for F1 to F6 so that the reminders appear over the relevant function keys. If you are not quite with me at this stage RUN the program as it is and press the RCL key to see what I mean.

When putting values into B$ you must ensure that the first character of B$(0) is a colon: and then use other colons to separate the functions or statements that you are defining. B$(1) is a continuation of the first string B$(0), so do not worry if you are only halfway through a definition at the end of B$(0). The functions should be entered in the order F1 to F6 for level I, II and then III ending with F6 level III. Remember that you only have enough space for your definitions as there are dummy variables. If you run out of space look carefully at the functions or statements that you are defining and see if these can be abbreviated, for example, R is the short form of RUN.

This simple routine can be part of a larger program and hence will be passed on by CSAVE as required. There are other uses for these 188 bytes of course, perhaps as additional protected memory space.

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BACK ISSUES SERVICE

We've completely revised our back issues to be more descriptive of the contents of each particular article in available issues, and hardware and software Benchtests are now given priority and listed first. Occasionally an issue which was previously listed as not available may come into stock through returns from our distributor, so if you're looking for a particular issue, keep an eye on these pages.

Volume 1 No 4, 1980
Benchtests: Hewlett Packard's HP85, Texas Instruments TI 99/4/Gateways to Logic Part 1: Teaching others about micros/Face to Face, Part 1: Life at the man-machine interface/Adding a different family of chip to your micro/Random numbers — and how to generate them/Computer Games, Part 4: David Levy on speeding up tree searching/Book review: Alvin Toffler's "The Third Wave"/The Complete Pascal, Part 4: Data types, arrays and sets/Programs: 3D Noughts and Crosses (TRS-80), PET Back-gammon.

Volume1 No 6, 1980
Benchtests: Commodore 8032, SuperBrain/Overview of chess machines and micro programs/Writing machine independent Basic programs/Printer review/Programs: Lunar Lander (TRS-80), PET Fighter Pilot, Apple Plotting, LPrint to Print utility (TRS-80), ZX80 Breakout, Graph (TRS-80).

Volume 1 No 7, 1980
Checkout:Super 80 hi-res board/Robotics discussed/Three micro tournaments reviewed/Computer Games: "Guessing the odds" in game programming/APC-80: First ever installment/The Complete Pascal, Part 6: Records and Files/Speeding up TRS-80 pocket computer programs/Free format dialogues at the man-machine interface/Programs: TRS-80 Tarot, PET Bloobers, PEEK and POKE for Apple Pascal, PET Demolition, Superboard Bug Bypass, String Function (Microsoft Basic), Several Sorts (Microsoft Basic).

Volume 1 No 8, 1981
Benchtest: Atari 400 and 800/Benchmark timings for machines tested up to this issue/Developing a business program, Part 1/The Complete Pascal, Part 7: Procedures and Functions/Gateways to Logic, Part 3: How Computers Think/APC-80: single keyword entry/A look at a US company specialising in helping the handicapped/Formatted dialogues at the man-machine interface/Programs: Reading 'System' tapes into the System 80, Monster Multiplier (Apple II), Read-write routines without error (PET), Program formatter (for programs stored in ASCII).

Volume 1 No 9, 1981
Checkout: "The Last One" program generator/Multi-User Systems, Part 1: Introduction/Computer Games: Bluffing and psychology/Disks and disk drives explained/Recovering from a data tape disaster/Developing a business program, Part 1/APC-80: String execution and block moves/Introduction to machine language/Gateways to Logic, Part 4: Binary arithmetic/Ultrafast tape storage for the Superboard/The Complete Pascal, Part 8: "Top-down" design of large scale text formatting programs/Review of the Forth language/Programs: TRS-80 Target Practice, TRS-80 Four in a Row, PET Anagram, PET Obstacle Course, Minefield (TRS-80).

Volume 1 No 12, 1981
Benchtest: Bigboard/Multi-user Benchtest: MVT Famos & WP Benchtest: Magic Wand/How printers work/Mainframe chess programs/Gateways to Logic, Part 5.2: Electronic Logic/TRS-80 Tiny Basic Compiler/What's Where in OSI ROM/Profile: Nigel Shepherd of Commodore/Building Parliament House with a micro/Solar System simulation/"Quarter-box" graphics on a PET/Single Key Keyword entry for the Superboard II, Part 2 (end)/Programs: PERT Replace, TRS-80 Demon Hunts, PET Chords, ZX80 Sliding Letters.

Volume 2 No 2, 1981
HP-85 Reviewed/EDF at the Spastic Centre of NSW/TRS-80 Tiny Compiler on larger memory machines/APC-80: Bill Anderson of ADE/Facing the Future by Barry Jones/User-defined formatting on the Apple/Improving the Superboard II/PET utility for replicating cassette files/Relocating OSI Basic-in-ROM/Programs: Bigboard Real Time Clock, APC-80 Alien Invasion, PET Radio Technician Course.

Volume 2 No 3, 1981
Checkout: Sinclair ZX81/APC-80: Recovering lost programs, JUMP command (allows a GOTO "numeric expression")/Building a Bigboard/Keystroke reduction for EDTASM users/Sanders Printer reviewed/Profile of BS Microcomp/CP/M explained by Rodney Zaks/The rapid bubble sort for the Apple/Encryption for any Microsoft Basic/An imagined 6502 "Dream Machine" specs/Vectors explained on the Challenger 1P/Programs: TRS-80 flashing cursor and non-destructive backspace, Treasure Hunt (PET).

Volume 2 No 4, 1981
Benchtest: VIC-20, Tandy TRS-80 III/TRS-80 Monitor software compared/Computer Games: Backgammon on micros/Tree access routines explained/Gateways to Logic, Part 8: Peripherals/How Computers Communicate, Part 1: What is I/O?/Profile Gary Blom of the Computer Company/Part 1 of 2: Defining program specification needs/6502 Assembler in Basic/Wordpower wordprocessor program for the PET/Programs: PET Arithmetic Test, Apple Mondrian.

Volume 2 No 5, 1981
Benchtest: IBM Personal Computer, NEC PC8000/WP Benchtest: Spellbinder/Gate array design and firmware modules: an upcoming generation of chips/Winchester hard disks explained by Rodney Zaks/Computer Games: Poker on micros/Gateways to Logic, Part 9 (end): Typical teaching projects/Artificial Intelligence/How Computers Communicate, Part 2: The I/O Bus/Storing alpha-numeric records under CP/M/Part 2 of 2: Defining program specification needs/Apple "booby trap" documented/Make PET disassembled pro-grams more readable/Explaining the WAIT function for OSI and PET machines/Putting a bell tone onto the Superboard/Programs: TRS-80 Sailing Simulation, ZX80 Eldorado, PET Gomoku.

Volume 3 No1, 1982
Benchtest: Tandy TRS-80 Color/Checkouts: Hitachi Peach, Sharp's Microtranslator, BBC Proton/Profile of Rodney Zaks/Sorting alphanumeric codes from disk to disk/Computer games:GO-MOKU on micros/Generating Patterns with a computer, Part 3: The parallel interface/Review of Forth Language/A neat way to describe programs quickly and logically/Speech Synthesis for the TRS-80s, System 80s, Part 1/Cassette utility for System 80 on Eprom/An easy route to shape tables for the Apple/Rubik Cube Simulation for the Apple/How to implement "Turtle" graphics on an Apple/Programs: Get Simulation (Apple), Bug Bug (TRS-80), Cryptography (Microsoft Basic).

Volume 3 No 2, 1982
Checkout: Apple III/Fitting a smooth curve to complex data plots/Speech synthesis for TRS-80s, System 80s, Part 2/"Bridge" on micros/Relocating assembly language programs/Binary sort explained/Programmable rhythm generator project for PET/Large number calculations on micros/Basic interpreters explained/Checkout: ZX81 printer/APC-80 overview and debounce routine/Storing arrays on tape/Frames of Reference, Part 1: A DP manager's guide to micros/How Computers Communicate, Part 4: The IEEE interface/Overview of micro-computer databases/Programs: TRS-80 Alien Seabattle.

Volume 3 No 3, 1982
Benchtest: Hewlett Packard HP-125/WP Benchtest: Scripsit 2.0/Checkout: Dick Smith Votrax Type 'N Talk, The Australian Beginner's Videotext overview/Frames of Reference, Part 2: Hardware and Software Suppliers/Profile: Jim Warren of the West Coast Computer Faire/How Computers Communicate Part 5: The BCD Interface/Installing hi-res on the TRS-80/Bridge playing program reviewed/Programs: Galacti-Cube (3D Maze in fairly "standard" Basic), PET Fantasy, ZX80 Labyrinth, PET Juggle.

Volume 3 No 4, 1982
Benchtests: Osborne 01, Micro Bee/APC-80: Command mode syntax error recovery/How Computers Communicate Part 6: The RS232 interface/80 x 24 display controller project/Preview of the Commodore 64/Atari 400 games reviewed/Profile: Adam Osborne/ANS Basic's features/Solving the hidden surface problem in 3D graphics/Frames of Reference, Part 3: Micros in mainframe company/Hewlett Packard's networking capability/Programs: TRS-80 Reaction Timing, ZX81 Graphplot, PET Cheese, Superboard Spin-Fighter, TRS-80 Extra.

Volume 3 No 5, 1982
Benchtests: Texas Instruments TI 99/4A, Xerox 820/Database Benchtest: FMS-80/TRS-80 Model 1 games reviewed/Frames of Reference, Part 4: Software standards/How Computers Communicate, Part 7: Interrupts in micro systems/How to use 3D graphics/Equation solving program/80 x 24 display controller project, Part 2/"Logo" Overview/Printer survey/Casio's calculator printer/Programs: TRS-80 Double Precision Maths and Trig, Apple 3D Maze,Atari Suites for Kids, Apple Air Flight.

Volume 3 No 6, 1982
Benchtests: Sinclair ZX Spectrum, Sirius 1/Database Benchtest: dBase II/7th West Coast (micro-computer Faire)/Checkout: F-10 Daisywheel.

printer, Arlin Expandaboard/How Computers Communicate, Part 8: Direct memory access/Frames of Reference, Part 5: Buying micro hardware in a DP department/Self learning program/80 x 24 display controller project, Part 3 (end)/How to get more on Apple disks/Lisp — an artificial intelligence language/VIC-20 games reviewed/Implementing CP/M system calls from Microsoft Basic/APC Subset (first on new monthly column for assembler language routines)/Programs: TRS-80 Invader, PET Mini-animate, VIC-20 Trail-blazer, ZX81 Book Index, Weebug Monitor (TRS-80), VIC-20 Large Characters.

Volume 3 No 7, 1982
Benchtests: Sharp MZ80B, Monroe OC 8820/Checkout: Sharp PC1500, The Micro-Professor/Apple II games reviewed/APC-80: Various PEEKs and POKEs explained/Reversing images on computer screens/Frames of Reference, Part 6: Putting your micro to work/How Computers Communicate, Part 9: Character codes/Educational arcade-type game/Programs: ZX81 Hypocycloids, TRS-80 Track, PET Doc, TRS-80 Screen Dump, PET Boxes, Atari Earth.

Volume 3 No 8, 1982
Benchtest: Sord M23/Checkout: TI-83, Sony SMC-70/NCC Show Report/Sirius Graphics/Advanced graphics techniques/UCSD p-System overview, Part 1/IBM PC users talk/Taxonomic classification on an Apple/How Computers Communicate, Part 10: The software of I/O/Abbreviated execution version of APC-80/RS232 overview, Part 1/Checkout: Apple II Screenwriter/Programs: TRS-80 Quadrangle, PET Mopup, Randomization Tests (ZX81).

Volume 3 No 9,1982
Benchtest: ICL Personal Computer/Checkout: E40/CP/M data compression utility, Daisywriter printer, HP 13C & 120 calculators/BBC micro graphics capability/Best of APC's cartoons/How to use Benchmarks/Logo Program (Microsoft Basic/Computer generated textures/RS232 overview, Part 2 (end)/UCSD p-System overview, Part 2/Memory-saving utility for Apple/How Computers Communicate, Part 11: Interrupts and buffers/Programs: System 80 Extended Basic, Apple Trees, ZX81 Alphabetising, PET File Companion, PET German Game.

Volume 3 No 10, 1982
Benchtests: Hewlett Packard HP-86, National Panasonic JB3000/Checkout: Sharp PC-1211/UCSD p-System overview, Part 3 (end)/How to implement 3D graphics on a micro/CP/M-86 vs MS-DOS: Relative merits of these 16-bit operating systems discussed/Designing your own database/Monitor for TRS-80/System 80/File searching method/"Laws of Form" — a novel form of logic/How Computers Communicate, Part 12 (end)/Benchmarking high level languages/Programs: TRS-80 Cardshuffler, PET Knockout, PET Trains.

Volume 3 No 11, 1982
Benchtests: Hewlett Packard HP75C, Kaypro II, DEC Rainbow/Programs for the HP41C and Casio fx702p/Algebra checking program/More on MS-DOS vs CP/M-86/Predictions in the micro industry/Clock/calendar card for the Apple II, Part 1/Benchmarks summary/Programs: Apple II Piano Computer, Moon Module (Apple II, correction in Vol 4 No 1), Walls (Atari, correction in Vol 3 No 12).

Volume 3 No 12, 1982
Benchtests: Epson HX-20/Database Benchtest: Cardbox/Checkout: E.T. Atari game, 80 column cards/Comparison of micro databases/Intelligence test for computers/Apple II clock card, Part 2 (end)/"Ada" language overview/Tiny printing on a Centronics 739/Arithmetic program for the Sharp PC1211/Programs: TI 99/4A Teepee Textpro, PET Firebird, Atari Colour Selector.

Volume 4 No 1, 1983
Benchtests: Jupiter Ace/NEC/APC Manhunt competition/Tokyo Data Show/"Forth" Benchmarks/The perils of micro-addiction/Charles Babbage, the man who almost invented the first computer/"Expert Systems" —advice and intelligible explanation of its decisions/Warnier/Orr: Program design technique/Pro-grams: PET Search and Rescue, VIC Connect-4, Atari Character Set Mover.

Volume 4 No 2, 1983
Benchtests: Sharp PC1251/Database Benchtest: Hi Data/Micros as best friends/A major boost to the standards of 'user friendliness'/Computing can be a health hazard/"Expert Systems" — part two: appraisal of 'intelligent' computers/Networks Part 1/The Logo Turtle checked-out/Getting the most from the BBC's graphics/Are home computers just a passing fad?/The Prestige vs The human micro chess/Programs: Apple Character Plotter, System Tape Copier (TRS-80/System 80).

Volume 4 No 3, 1983
Benchtest: Corvus Concept, IBM 9000/Checkout: IBM PC vs Columbia MPC, IBM vs Hitachi Success/Visi-On and Apple's Lisa compared/Visi-On: Visicorp's new general purpose program/CP/M '83: The first software product exhibition/Transforming unused RAM into pseudo disk drives/Pascal Benchmarks/Eprom/RAM board for the TRS-80/System 80/Direct graphics entry for the TRS-80/System 80/Networks: Part 2/The Consumer Electronics Show review in Las Vegas/Portable Computer World/Hexadecimal madness/Programs: Atari Animation.

Volume 4 No 4, 1983
Benchtest: Dick Smith VZ-200/Spread Sheet evaluations: Part 1/Checkout: 1st APC Show/A look at 'C'/Networks: Part 3/Building your family tree on a micro/Low-cost System 80 memory expansion/Micro users get the upper hand/Pascal Benchmarks explained/How dentists can use micros/Programs: PET Billy (correction in Vol 4 No 6 Bludners), ZX81 Molecular Weight, Adventure in 1k, TRS-80 Word Scrambler.

Volume 4 No 5, 1983
Benchtests: NEC Advanced Personal Computer, Commodore 64/Which Spreadsheet: Microsoft's Multiplan/Casio PB100 hand-held micro reviewed/Screenplay: VIC-20 games under the spotlight/A visit to the Hanover computer faire/Check-out: Micro-soft MS-DOS2/Reliable Code: Programming tips/An introduction to the artificial intelligence program, LISP/Linking up a System 80 to a Tandy Lineprinter/Programs: Bricklayer (CBM 4032),Escape Maze (Atari 400/800).

Volume 4, No 6, 1983
Benchtest: Texas Instruments' Professional/Checkouts: Coms 35 home computer, NEC's Spinwriter daisywheel printer/Multi-Tool Word wordprocessor from Micro-soft/Occam Occult: futuristic new language/The world of creative cross-figures/MicroBee games reviewed/Are micros a good idea?/Programs: Construction Worker (System 80, TRS-80), Chicken Little (MicroBee), PET Zombies, Spectrum Blaster, Commodore 64 Sprite editor.

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* Volume 1 Nos. 1, 2, 3, 5, 10 & 11 and Volume 2 No. 1 are unavailable.

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by J J Clessa

Quickie

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Arthur and Bill have the same colour eyes.

Only one of the men has both black hair and brown eyes

Bill and Charles have the same colour hair.

Only two of the men are both tall and slim.

Charles and Dave have different builds.

Only two of the men are tall and dark-haired.

Dave and Arthur are the same height.

Only three of the men are both slim and brown-eyed.

Which is Susan's perfect man?

April Prize Puzzle

Sixty-nine entries — but since seventeen of these were not on postcards, they were immediately disqualified. This left 52 possibles — most of which contained the right answer.

The winning entry — selected at random — came from A Thomas of Lindisfarne. Congratulations Mr Thomas, your prize is on its way.

The answer is that 89 or 98 requires the greatest number of operations, 24 in all, before a palindromic number is reached.

Several of you pointed out that we frequently omit the closing date for entries, and the address to which they should be sent. We will try to rectify this in future, but just for the record:

Closing date for all entries is the last day of the month of the magazine issue.

Mark your entries with the puzzle date, for example, 'Prize Puzzle (month) 83', and send them to Lazing Around, *APC*, P.O. Box 298, Clayton, Vic 3168.

Keep puzzling.

BLUDNERS

Only one mistake noted to date: Paul England of TI has written to inform us that, contrary to our report in April's Printout, Compaq isn't suing TI, rather it's the other way around. He provides a quote from Electronic News (US) in the issue dated 28/2/83: "TI and Compaq Computer have begun talks aimed at a possible out-of-court settlement of TI's lawsuit charging Compaq with employee raiding, patent violation and use of confidential information in development of Compaq's portable computer. TI has asked for $1 million in punitive damages, plus injunctions against Compaq to prevent both more alleged staff raiding and sale of any Compaq product made using TI technology."

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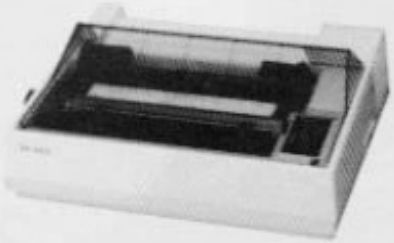

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NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in APC. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, *APC* will be publishing this guide — every month.

We'll start by considering the microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them elsewhere. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary**. Binary is a system of numbering which uses base 2 instead of the more familiar decimal — or, to be more accurate, denary-system of base 10. In binary notation there are only two digits — 0 and 1 — which the computer recognises as the absence or presence of an electric current. The easiest way to visualise this is to think of each binary digit **(bit)** as being a switch which can be either off or on. Each binary digit stands for a power of 2. The right-most digit, the least significant, is $2^0=1$, the next $2^1=2$, then $2^2=4$, $2^3=8$, $2^4=16$, $2^5=32$, $2^6=64$, $2^7=128$, $2^8=256$. So decimal 24, for example, is represented in binary as 00011000. A set of eight bits is known as a **byte** and, to make things easier for humans, a third system of numbering, **hexadecimal** or **hex** for short, is used as a sort of 'halfway house' between binary and denary. Hex uses numbers to base 16, with denary numbers between 9 and 16 represented by the letters A-F. The hex equivalent of a byte is obtained by giving each half a single character code: 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 ... E=1110 and F=111. Our example of 24 is therefore 18 in hex.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). This allocates a numerical code to each digit and letter. For example, the number 5 is given the ASCII code 35 hex, 53 decimal, whereas a capital A is represented by ASCII 41 hex, 65 decimal.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex **(machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic.** Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter,** which is usually built into the machine's ROM (see later paragraph on this page). The interpreter picks up each Basic instruction, translates it into machine code and then feeds it to the **processor** for execution. It has to do this each time the same instruction has to be executed. A much faster method is to use a **compiler,** which accepts each instruction in turn, waits until the program has been entered, then turns each instruction into machine code before running the program. This means that each instruction has to be translated once only — consequently the speed of execution is considerably improved.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE.** They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware,** this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU),** a single microprocessor chip with supporting devices such as **buffers,** which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100.**

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory. **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic;** all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks,** each of which is in turn subdivided into **sectors.** Using a program called a **disk operating system,** the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface, and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for microcomputers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU),** which looks like a TV screen with a typewriter-style **keyboard;** sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer.**

The computer can send out and receive information in two forms — **parallel** and **serial.** Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

The ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone system, allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need Telecom's permission; instead you could use an **acoustic coupler,** which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — Telecom isn't so uppity about the use of these.

DISKOGRAPHY

A BRIEF GUIDE TO FLOPPY DISKS

Jane and John Shemilt offer their advice on purchasing the correct disks for your computer.

This article is a short guide to the various types of floppy disk on the market and attempts to explain why it is important to buy the correct type of disk for your machine. It does not make any comparisons between disks from different manufacturers, so no 'best buys' are recommended.

There are two standard floppy disk sizes commonly in use: five and a quarter inch (mini) and eight inch (standard). Both these types have a similar construction, the heart of which is a mylar disk on which is deposited a metal oxide layer. The mylar disk is held in a sealed protective envelope with a soft inner lining including a cutaway for head access (see Fig 1). The disk has a large hole in the centre which fits onto the disk drive hub, which centres and rotates the disk inside the stationary envelope in the drive during use. There is at least one other hole in the mylar disk (the index hole) which lines up with the index/sector hole in the envelope once per revolution. If the disk is *soft-sectored*, there are no more holes in the mylar disk, but if it is *hard-sectored* it will have more holes in the disk which line up with the index/sector hole once each revolution. In this case, the disk is divided into sectors, ie, wedges or slices, by a series of holes (one hole per sector) in addition to the index hole. (Whether the division of the disk into sectors is hardware or software controlled will depend on the disk controller used by your computer.)

For eight inch disks, the index/sector hole in the envelope is in one of two positions depending on whether the disk is *double-sided* or *single-sided* while, for five and a quarter inch disks, the position of the index/sector hole in the envelope is always the same. The only other hole in the disk envelope of importance to the user is the write protect notch. Usually, on eight inch disks when the notch is uncovered, the disk may not be written to *write protect mode*, although on five and a quarter inch disks this notch must be covered up by an opaque material to *write protect* the disk.

The label on the disk envelope usually has a large number '1' or '2' on it, followed possibly by a large letter 'D'. The number '2' indicates that the disk is double-sided, ie, both sides of the mylar disk have a metal oxide layer which can be written to, while a '1' denotes a single-sided disk. In fact, most single-sided disks are actually manufactured as double-sided where the oxide layer on one side of the mylar has failed on inspection. It is generally *not* a good idea to use single-sided disks in a double-sided disk drive as they can cause damage to the magnetic recording heads if used frequently. However, double-sided five and a quarter inch drives can be used on single-sided five and a quarter inch drives, but only as single-sided disks and the second side of the disk may be damaged if it is used this way frequently. It is possible to buy double-sided disks with two index/sector holes in the envelope so that both sides can be used, but only one at a time, in single-sided drives by turning the disk over to *change sides*. Unfortunately these disks, when turned over, rotate in the opposite direction to their previous motion so that all the dirt and loose oxide particles, which have collected on the liner by the side of the head access slot, are dislogged and deposited on the disk surface. This debris is wiped off on the recording head and pressure pad of the disk drive and can cause damage. Also, in this case, the pressure pad on the single-sided drive is in contact with a disk surface, which is used for writing to and reading from, and can damage this surface leading to the loss of data on the disk; usually the pad presses on the unused face of a single-sided disk.

Another special eight inch double-sided disk can be obtained where both the single-sided and double-sided index/sector holes are cut out in the envelope, so that the disk can be used as a single-sided disk on a single-sided drive and as a double-sided disk on a double-sided drive. Of course, the index/sector hole which is not applicable should be covered up while using the disk. The main use of these special disks is in the transfer of software between different disk drives but, as most eight inch double-sided drives will also read and write to single-sided disks, these make a more readily available medium to transfer software.

The disk label also specifies the recording technique for which the disk is suitable.

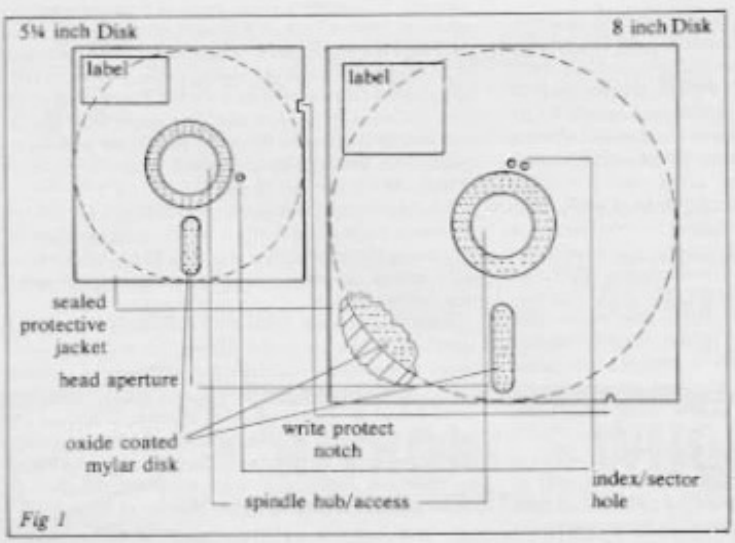

Fig 1

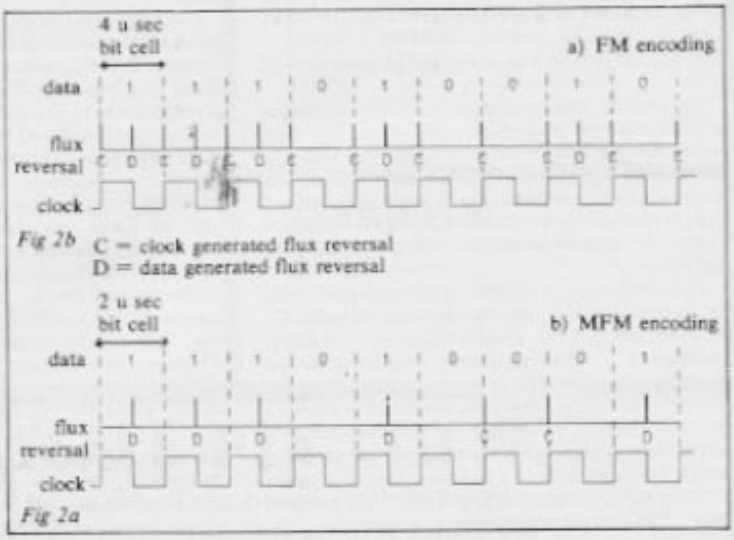

Fig 2b

Fig 2a

DISKOGRAPHY
A BRIEF GUIDE TO FLOPPY DISKS

The standard recording technique of Frequency Modulation (FM) records a flux reversal on the disk at every clock pulse (4 microseconds) to produce *bit cells*. The data is recorded serially in the form of another flux reversal in the centre of the bit cell to record a '1' bit or no flux reversal for a '0' bit. (see Fig 2a). A disk capable of being used with this recording method is called a *single density disk*. In order to double the amount of data stored on the disk, a technique called Modified Frequency Modulation (MFM) is used. In this method (see Fig 2b), the clock frequency is doubled giving a 2 microsecond bit cell. However, there are normally no flux reversals recorded on the disk at clock pulses so that only data generated flux reversals (denoting '1' bits) are recorded. This could lead to synchronisation problems if a group of '0' bits happened to be recorded in sequence and, therefore, if one '0' bit is followed by another '0' bit a flux reversal is inserted at the clock pulse (see Fig 2b). Disks suitable for MFM recording are called *double-density* disks. The actual frequency of recording in MFM is not increased over FM (single-density) technique but this double-density recording is more susceptible to the quality of the disk. A double-density disk may be formatted and used in a single-density drive but a single-density disk should not be formatted for double-density as it is prone to errors. (In practice it is often possible to get away with formatting a single-density disk as a double-density one.) The letter 'D' following the '1' or '2' on the disk label implies that the disk is of double-density quality. Even though the recording technique used by a machine may not be FM or MFM, the disk type specified for use on the particular machine will be specified as 'single' or 'double' density.

For eight inch disks that completes the story but, for five and a quarter inch disks, there is one more option to consider when purchasing. This is the number of *tracks* on the disk, ie, the number of concentric rings on the disk on which data may be recorded. On eight inch disks there are always 77 tracks but for five and a quarter inch disks, there is a choice of 35, 40 or 80 tracks. Both 35 and 40 track disks are recorded at 48 tracks per inch ('TPI') but 35 track recording uses less of the disk surface to write to than 40 track recording. Therefore, a 40 track disk can be used on a 35 track drive but not the other way round. 80 track disks are recorded at 98 TPI (half the distance between tracks) and, although 80 track disks are sold, I have never had any problems reformatting double-density 40 track disks for use on an 80 track drive. Of course, 80 track disks can be reformatted as 40 track or 35 track disks if required.

That completes this summary of the physical differences between the various floppy disks on the market. Of course, data can be written to disks, even physically identical disks, in many different formats but that is another story. END

TOP SECRET

George Sassoon explores the code of public-key cryptography.

A few years ago, there were curious happenings at a meeting of a learned mathematical society. Armed security men burst into the lecture hall; fist-fights broke out around the podium; equations were hastily rubbed off the blackboard. The cause of it all? Someone had finally invented what security agencies dread most: the unbreakable cipher.

But all these efforts were in vain. The secret was out; and the basic principle of the cipher is so simple that one kicks oneself for not having thought of it first. Credit for that must go to three workers at the Massachusetts Institute of Technology, Messrs Rivest, Shamir and Adleman. From their initials, the cipher is known as the RSA public-key cryptosystem. Why 'public-key'? The reason is that the key comes in two parts: the encryption key, which is made public, enabling anybody to encipher messages; and the decryption key, which is kept secret, enabling only the originator of the cipher to decode messages.

Until the invention of public-key systems, the only really secure cipher was the so-called 'one-time pad'. This is simply a pad printed with random numbers. If each sheet of the pad is used only once, then the system is 100 per cent secure; problems arise, though, in the distribution of the pads, which must be done by trusted couriers. If a pad is lost or copied en route to an agent in, say, Moscow, then the whole pad is compromised and must be replaced. The RSA system, with its two-part key, avoids this difficulty; the encryption key could be published in the Moscow telephone directory without compromising the system!

The separation of encryption and decryption is achieved by means of modulo arithmetic. The modulo function amounts to dividing one number by another, throwing away the quotient, and keeping the remainder. Thus 11 mod 3 is equal to 2, the remainder when 11 is divided by 3. Supposing that the original message, the plaintext, was '11', and the ciphertext was '2', the codebreaker has no way of working backwards from '2' to '11'; the original message could have been 2,5,8,11,14. . . The RSA system uses this principle, but with very large numbers. In my implementation, the modulus is not 11, but a number in excess of 2^{240}, or about 1.77×10^{72}. The text is divided into blocks of 30 ASCII characters, each block being enciphered as a unit. Thus if the message is: 'ABCDEF. . .', it would be expressed for encryption as the number:

$65 + 66 * 256 + 67 * 65536 \ldots$

the final result being a number 240 bits (or 30 bytes) long. This is known as the plaintext number P.

The next step in the RSA system is to turn the plaintext number P into the ciphertext number C. This is done as follows:

$C = P^E \bmod N$

Where E, the encryption exponent, and N, the modulus, are the public part of the key, E is usually a prime number less than 20, and N is a very large number, in my case greater than 2^{240}, which must be the product of two primes. The plaintext is thus multiplied by itself a number of times, and at each stage about half the number is thrown away. The result is the ciphertext. This is more or less equivalent to turning the message into alphabet soup, pouring it into a bucket, and then stirring it with a digital wooden spoon, spilling about half the soup with each stir. On the face of it, it would seem impossible to get back to the original message from the resulting mess of random-looking numbers. This is in fact true; it is impossible to work backwards to the original message, but it is possible to work forwards, using some

```
PRIMES CHOSEN: 5 AND 7  PRODUCT: 35
PHI(N)= 24
VALUES OF D*E SUCH THAT D*E MOD PHI(N)=1:
 25      HAS FACTOR: 5 SUITABLE FOR ENCRYPTION EXPONENT
         DECRYPTION EXPONENT IS: 5
ENCRYPTION OF 35 DIFFERENT CYPHERTEXTS:
POWER   TEXTS -------->
 1:  0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
 2:  0  1  4  9 16 25  1 14 29 11 30 16  4 29 21 15 11  9  9 11 15 21 29  4 16 30 11 29 14  1 25 16  9  4  1
 3:  0  1  8 27 29 20  6 20 22 29 20  1 13 27 14 15  1 13 22 34 20 21  8 22 34 15  6 13  7 29 15  6  8 27 34
 4:  0  1 16 11 11 30  1 21  1 16 25 11 16  1 21 15 16 11 11 16 15 21  1 16 11 25 16  1 21  1 30 11 11 16  1
 5:  0  1 32 33  9 10  6  7  8  4  5 16 17 13 14 15 11 12 23 24 20 21 22 18 19 30 31 27 28 29 25 26  2  3 34

CYPHERTEXTS:
     0  1 32 33  9 10  6  7  8  4  5 16 17 13 14 15 11 12 23 24 20 21 22 18 19 30 31 27 28 29 25 26  2  3 34

DECRYPTING:

POWER   TEXTS -------->
 1:  0  1 32 33  9 10  6  7  8  4  5 16 17 13 14 15 11 12 23 24 20 21 22 18 19 30 31 27 28 29 25 26  2  3 34
 2:  0  1  9  4 11 30  1 14 29 16 25 11  9 29 21 15 16  4  4 16 15 21 29  9 11 25 16 29 14  1 30 11  4  9  1
 3:  0  1  8 27 29 20  6 28 22 29 20  1 13 27 14 15  1 13 22 34 20 21  8 22 34 15  6 13  7 29 15  6  8 27 34
 4:  0  1 11 16 16 25  1 21  1 11 30 16 11  1 21 15 11 16 16 11 15 21  1 11 16 30 11  1 21  1 25 16 16 11  1
 5:  0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
```

Fig 1

```
CODE FILENAME : RSACOD2
 JGHJL HNFHH HFHKF HFCKO HELJH LNFHD FFFBO DMFLE DBBGE GODEP ELDIH KBHLK
 HBKDH KHWFF KOIFK JHFEA DAHDI FHOHL JHHBA DHBLH DJAGM HHFWA DHBHL JFIFJ


THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 1234567890


DETAILS OF CODE = RSACOD2  IN HEX NOTATION. SECURITY LEVEL: 4

MODULUS:
 0001 0000 0000 0000 0000 0000 0000 0000 0B0A 1B80 6E65 7453 0F10 A99D 9756 97F3

PUBLIC ENCIPHERING EXPONENT:
 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0047

SECRET DECIPHERING EXPONENT:
 0000 029B 0AD1 2073 615A 240E 6C2B 4401 CDA2 0FEB 8FA4 49D6 3FB8 61BF B0A1 A04F
```

Fig 2

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* A "perpetual" journal-based accounting system.
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Requires 48K single-disk system TRS-80 Models 1 and 3 or System 80

SBAS2 Fully integrated creditors, cashbook and profit & loss system Usual Price $250.00
Includes all of the features of SBAS1 + PLUS +

* Fully integrated accounts payable function.
* Maintains FULL RECORD of invoices and credit notes received.
* Accepts partial payments towards outstanding invoices (i.e. payments which do not match any particular invoice).
* Perpetual accounting system with easy carry-forward balancing at start/end of financial year.
* All operations conducted in memory.
* Ideal for public accountants with "shoe-box" clients.

Requires 48K Single-drive system TRS-80 Models 1 and 3 or System 80

SBAS3 Professional twin-disk system Regular Price $350
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* Will run on hard-disk system (200,000 entries in 5 Meg!)
* Only one record in memory at a time (system crashes — you lose one entry!)
* Fast disk SORT (5,000 entries in 5 minutes)
* Use a different data disk for different cashflows/ companies.

Requires 48K twin-drive system (Floppy or Winchester) TRS-80 Models 1 and 3 and System 80

★★★★★★★★★★★★

All systems display/print reports starting at any date with optional carry-forward of balances.

Report options include:	SYSTEMS
* Print cashbook with optional balances CD/FWD	1, 2, 3
* List by description/creditors name, etc)	1, 2, 3
* List by account type (advertising etc)	1, 2, 3
* List by deposit book or any chequebook	1, 2, 3
* Print trading, profit & loss and balance sheet	1, 2, 3
* Print creditors statement	2, 3 only
* Print full general journal	2, 3 only
* Provide complete trading information for taxation & other returns	1, 2, 3

SBAS2 AND SBAS3 include data-upgrade programs from previous systems

★★★★★★★★★★★★

SPECIAL INTRODUCTORY "END OF FINANCIAL YEAR" OFFER
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mathematical trickery and the secret decryption exponent D. This can be illustrated by the simple example in Fig 1.

In this example, N is chosen to be 35, which is the product of 7 and 5, two primes. There are thus 35 possible 'messages', the numbers 0 and 34. The encryption exponent is chosen as 5, so each possible message is raised to the fifth power, being reduced modulo 35 at each multiplication. Some of the resulting ciphertext messages are unchanged, those adjacent or equal to exact multiples of 7, but the rest are thoroughly scrambled.

Decryption is then carried out according to the formula:

$P = C^D \bmod N$

That is, the ciphertexts are raised to power D, the decryption exponent, also modulo N. In this simple example, D is also equal to 5. The result of this operation is to restore the original messages 0 - 34.

This example is clearly trivial, but it illustrates how the original messages can be restored in spite of the modulo operation at each multiplication. All that needs to be done is to use the same principle for very large numbers, and then the system becomes a usable cipher.

Choice of exponents

In Fig 1, both encryption and decryption exponents were taken as equal to 5. These figures were arrived at by making use of one of the rules of modulo arithmetic. This states that when working modulo N, exponents are multiplied modulo phi(N), phi(N) being the Euler totient function of N. In normal arithmetic, for successive exponentiation, the exponents are simply multiplied. Thus:

$(X^E)^D = X^{D*E}$

But in modulo arithmetic, the following rule applies:

$(X^E \bmod N)^D \bmod N = X^{D*E \bmod phi(N)}$

where phi(N) is the fearsome-sounding Euler totient function of N. The function is in fact very simple; it is the number of integers not exceeding N which are relatively prime to it. For prime numbers, the only such number not relatively prime to N is N itself, so for primes phi(N)=N-1. It can be shown that if N is the product of two primes P1 and P2, then phi(N)=(P1-1)*(P2-1).

In the example of Fig 1, the primes are 7 and 5, and phi(N) is 24. Now it is a basic truth that any number raised to the power of 1 is the number itself. So to select the encryption and decryption exponents, we need to select E and D such that:-

D*E mod phi(N) = 1

Possible values of D*E are:

25: equal to 5 * 5
49: equal to 7 * 7
73: prime
97: prime
121: equal to 11 * 11
145: equal to 5 * 29
169: equal to 13 * 13
etc.

Any of these pairs of factors would do for the encryption and decryption exponents. For demonstration, 5 and 5 were chosen, but in practice a small value for E and a large value for D would be chosen.

It will be seen that the exponents D and E are interchangeable, that is, you could equally well encrypt with the decryption exponent and decrypt with the encrypting one. This leads to another important feature of the RSA system, which is authentication of messages. Supposing our New York office sends a message to their agent in Moscow, how can he be sure that it comes from New York and not from Dzerzhinsky Square down the road? This is easily confirmed if the New York office appends a block to the message which is encrypted using D, the secret decryption exponent. The man in Moscow can decrypt it using E, the public encryption exponent. If it makes sense, then he can be sure that the message came from someone in possession of the secret exponent D, which can only be the New York office.

Implementation of the system

The first requirement is for multiple-precision arithmetic routines, capable of handling very long numbers. Z80 routines were written, which can handle

unsigned integers up to 2^{256} (over 10^{77}). Double this length is required for multiplications, so that each number occupies up to 64 bytes of memory. All the usual arithmetic functions are implemented, with the addition of 'powermod', used for evaluating the expression:

$Y = X^Q \bmod N$

When Q is very large, it is not practical to do this with successive multiplications. Instead, Q is expressed as a binary number, and X is squared mod N for each bit of Q; if the bit is 1, then the result Y is multiplied by X. Thus to evaluate X^{11},

$Y = X^1 * X^2 * X^8$.

With this system, decryption of a 30-byte cipher block takes about five minutes, using a bog-standard Z80 running at under 2 Mhz clock rate.

But before there can be any encryption and decryption, ciphers must be created. Two prime numbers must be found, whose product is in excess of 2^{240}, and the exponents E and D selected. Primes are found using the so-called probabilistic prime test, which can find a suitable pair in the region of 2^{120} in an hour or two. Exponents E and D are then selected according to the procedure outlined above. Fig 2 gives details of one cipher, RSACOD2. The ciphertext is in alphahex code, where the letters A-P represent the numbers 0-15; two letters of ciphertext corresponding to one ASCII symbol of plaintext. Thus a 30-byte block of plaintext enciphers as 12 five-letter alphahex groups. The plaintext may include carriage-returns and other control characters.

Security aspects

To break an RSA code, it is necessary to find the factors of the public-key modulus, N. When the factors are known, the Euler totient function phi(N) can be calculated, and the decryption exponent D. Finding the factors of very large numbers is extremely time-consuming if there are only two large factors. By comparison, finding large primes is very easy. Thus the present system can find primes in the region of 10^{54} in an hour or so, yet it took over 48 hours to find the factors of a number in the region of 10^{21} using the efficient Monte Carlo method. As the numbers get larger, the difficulty of finding factors increases as the 0.25th power of the number, but the difficulty of finding primes only as much as the cube of the log of the number.

So, the longer the numbers, the greater becomes the difference in computing power needed between creating a code and breaking it. Hellman has estimated that with N in the region of 200 decimal digits, the best computers in the world would take over a billion years to break it. The present Z80-based system could easily be adapted to accommodate numbers that length, at a cost of a 30-fold increase in encryption and decryption times.

There is also the brute-force approach to breaking the code, which consists of trying every possible plaintext input and seeing which one gives the known ciphertext output. Even with the present system, trying 10^{12} plaintexts per second would take about 10^{52} years to work through all possible combinations. Despite intensive world-wide efforts, no easy way of cracking RSA ciphers has been found, and it seems unlikely that one will ever be found.

There has recently been controversy as to how unbreakable this code really is. APC would be interested to hear actual experiences of breaking it.

Applications

Up until the present, the use of ciphers has been confined to military and diplomatic circles but, as Hellman points out, the proliferation of electronic communications has led to more and more confidential information being transmitted over insecure channels. It is easier to tap into a telephone line than to open a sealed letter without detection. Due to this, it is likely that more and more private individuals and organisations will resort to the use of ciphers, and if this happens then RSA ciphers and microcomputers will be sure to play a large part.

References

Hawker, Pat. Electronic Cryptography. *Wireless World*, Sept 1980.

Hellman, Martin E. Mathematics of public-key cryptography. *Scientific American*, Aug 1979.

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A PSYCHOLOGICAL APPROACH?

Paul Overaa introduces a four-part series on programming with an analysis of the more modern ideas and approaches in problem-solving.

There are so many methodologies scattered around under the terms 'structured approaches to problem solving' or 'structured programming techniques' that we are all apt to look upon new ideas and thoughts on how we should program with a certain amount of contempt. Frequently such contempt is justified because writers often rehash the work of others using a different terminology, or an alternative name simply for the sake of doing so. When I first thought of preparing this series I was motivated primarily by the desire to collect together some of the more important ideas that have appeared over the last few years. It is my opinion that there is not enough emphasis placed on how these newer techniques are evolving to form a consistent framework within which many of the older concepts are finding new life.

There is always a tendency for ideas, once useful, to be pushed both theoretically and practically to their limit. This is a good thing at times but I suspect that very often the initial simplicity of an idea becomes 'clouded'. People unfamiliar with the original thoughts have difficulty working out the basic concepts. In programming, and computing in general, this constitutes a major obstacle. So it is appropriate to take stock of the various developments in a way that can provide a general picture.

We can start by examining some very general points that are closely related to the field of computer programming. They are concerned with how we think and solve problems. More importantly they give some clues about how we react or behave when we encounter difficulties.

Solving problems

Motivation is one key to accomplishment. Another way to learn about any new subject is to 'break it up into manageable pieces'. Each piece is then far less formidable and consequently far easier to get to grips with.

Inherent in this idea is the implication that an ordered or 'structured' approach exists that enables our understanding of the lesser problems to be integrated into our understanding of the original, more complex, ideas and problems.

The microcomputer has brought us sophisticated computing power. No longer are computers the 'gods in the sky' to be admired with awe. The computer is now a readily available tool that can be used by all of us irrespective of our professions. It can save us time, increase our productivity or allow us to indulge our own creativity 'just for the fun of it'.

So you have a computer, or access to one; you have instruction manuals and books that explain how you physically program your computer; you start learning by 'hands on' experience — writing programs and experimenting with problems and uses that interest you. Gradually you come to terms with the vocabulary of the subject and you become aware of what a powerful tool you are working with. Such awareness serves to increase your desire to learn, to increase your motivation to master a seemingly complex subject.

As you start to tackle larger problems you will have become aware that difficulties arise. These difficulties are solved with much effort and diligence (yes, it is quiet in the early hours of the morning). As frequently as not you find yourself looking over large amounts of coding in an attempt to locate a 'bug' that is preventing your program from working. If you are examining a program that you wrote some time ago, the problem is even more exasperating — especially if you did not document it properly. In more unfortunate cases you get involved with trying to understand programs that have been written by other people. I'm sure that many of you will have come to the conclusion either that every programmer is a latent masochist or that there must a better approach to use.

Emphasis on 'structured programming' is an important step in the right direction but it is not in itself the complete solution. This is owing to a serious fundamental error continually made by both professional and amateur programmers alike. The difficulties in programming a computer to solve a particular problem consist of two very distinctly different parts.

Failure to appreciate the difference between the inherent logical basis of the problem, and the completely separate problem of how to code it, is one of the major causes of bad programming. It is one of the reasons why so many people run into problems as they start to tackle larger projects.

The point made in the previous paragraph has a clear corollary:

'People unfamiliar with the original thoughts have difficulty working out the basic concepts.'

Any envisaged use of computers to solve a problem requires that you find a logically correct solution before you make any attempt to involve yourself with the problems of actually coding your computer solution, that is, you should not try to solve the quite separate difficulties together.

It has consistently been found easier to tackle each part in turn. The isolation of a logical program design produces a logical solution that is portable. It is independent from the computer hardware and software on which it will be implemented.

My concern then is about the techniques of solving problems and designing the logical solutions needed to produce efficient and well structured programs in any language you care to name. If you are a newcomer to microcomputing, then take heart. Although some of the ideas may take a certain amount of time to digest, they are fundamentally simple. Be patient and think about the concepts. Apply them to problems of your own choosing and you will achieve a real and useful understanding.

Iconic modelling

The way in which we approach a problem plays an important role in determining how successful or not our solution will be. In the last twenty years much work has been done by psychologists to try and discover the basic mechanisms we use when we solve a problem. In general, what mechanisms do we use to come to terms with our intellectual and physical environment?

Jerome Bruner has attempted to describe and characterise the ways in which young children react when confronted with a problem. He was able to identify three broad stages in the problem-solving experience. The words used by Bruner — *enactive, iconic* and *symbolic* — can be thought of as keywords for a basic problem-solving framework. This framework is applicable to adult as well as children's patterns of thought.

Enactive: relates to the use of physical models and the ability and confidence to manipulate them. One of the characteristics of this enactive level is an inability to describe the situation — that is, the inability to communicate effectively without resorting to actual demonstration.

Iconic: the second recognisable stage is the use of diagrams or pictures to represent the 'enactive elements' of the problem. This has been called the iconic stage and is sometimes seen as the initial stage of abstraction, that is, separating the physical or real problem into a 'modelling situation'. It is to be hoped that such a model will embody all the enactive elements of the problem in a form that is easier to translate into totally abstract form.

Symbolic: the use of signs and symbols, previously defined to produce an abstract version of the problem. This characterises the symbolic level of confidence in problem solving.

Mathematics is typical of symbolic abstraction, and it is commonly recognised that difficulties associated with learning and understanding mathematics frequently stem from a lack of confidence in symbol manipulation.

In children these stages can be identified by the way that simple problems are tackled. Of equal importance is how the approach changes as a child gets older:- Given a dozen bricks a very young child, if asked how many he would get if he had to share his bricks with two other children, will resort to physically sharing the bricks. At a later stage he might solve such a problem by drawing three boxes and placing dots in them to represent bricks. He will be able to deduce from his iconic model that each child will receive four bricks. Later still, developing his confidence at the symbolic level will enable him to write $12 \div 3 = 4$ without hesitation.

In many situations these three levels of confidence occur simultaneously; they should not therefore be thought of as being physically distinct. The distinction to make is that the stages are conceptually different. We will often be able to look at particular lines of reasoning and identify areas that are causing problems as being symbolic as opposed to iconic or enactive.

'The way in which we approach a problem plays an important role in determining how successful or not our solution will be.'

This framework is equally recognisable in adult thinking, and the various levels of confidence can often be identified. An important point is that, when we have difficulties in tackling a problem, we frequently fall back to a lower level of problem representation in an attempt to achieve a better understanding.

Think how many times you have been presented with a mathematical problem to solve in which you plunged straight in with some symbolic argument only to find you got 'stuck' and rapidly resorted to a graph or diagram, that is, an iconic model, in order to get a better understanding of the problem itself.

These ideas produce some interesting generalities which have implications of particular benefit to us in our quest for better methods of designing and writing computer programs. It would appear, for instance, that most of us benefit by having an iconic model to fall back on while we are coming to grips with difficult or unusual problems. Some people are able to work at a symbolic level almost immediately. Such confidence is rare and those who can do this often have great difficulty in explaining to others how they arrived at a particular approach or why it was obvious to them but not to others.

So, there are two key points. Firstly, when you solve programming problems you are frequently solving other people's problems. You may very often need to explain your solutions and your lines of reasoning to others. There is a need to ensure proper communication of your ideas (often to non-technical people). Secondly, the problems you examine will often be ill or imprecisely defined. Frequently, restrictions will be added to the problem while you are in the

The following references will be of use for people who would like to examine some of the published works related to the work of Jean Dominique Warnier:

Logical Construction of Systems by Jean Dominique Warnier. Pub. Van Nostrand Reinhold Company. ISBN 0-442-22556-3.

Logical Construction of Programs by Jean Dominique Warnier. 3rd edition trans. B M Flanagan. Pub. Van Nostrand Reinhold Company.

Structured Systems Development by Keneth T Orr. Pub. Youden Press New York. ISBN 0917072-06-5. A good non-theoretical introduction. Ken Orr's works are always very readable and he knows a lot about the practical uses of Warnier's work.

Structured Requirements Definition by Keneth T Orr. Pub. Ken Orr & Associates Inc, Topeka. Kansas. Again this is useful as an introduction. It contains many of the fundamental definitions that one comes across with the newer approaches to programming.

Practical LCP by Albert C Gardner. Pub. McGraw Hill Book Co (UK) Ltd. ISBN 0-07-084561-1. This is useful but Gardner's description tends to deviate from Warnier's in what appears to be an unnecessary way. The diagrammatic notation is not as clear as the original Warnier method. This disturbs the clarity of an otherwise good interpretation.

Australian Personal Computer

* October 1981 issue contains a short introduction describing in simple terms some of the main advantages and some fundamental conventions that are used.
* April 1982 issue contains a Microsoft Basic implementation of a screen-form program. The use of the Warnier approach for program design is illustrated. This program was actually written as a 'halfway stage' before a full 8085 assembler version was prepared.
* January 1983 issue contains an 8085 assembly language program called DUMP. The complete design and implementation technique is given.

Byte Magazine. Various authors.

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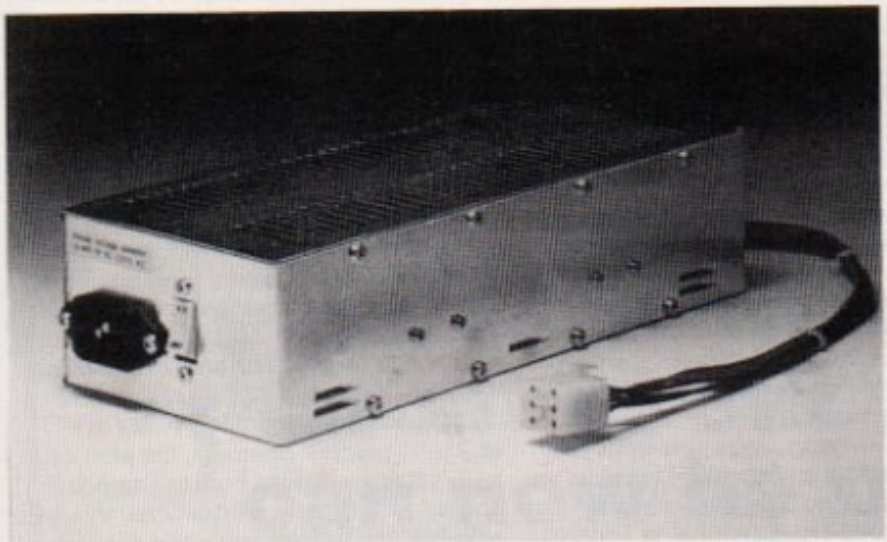

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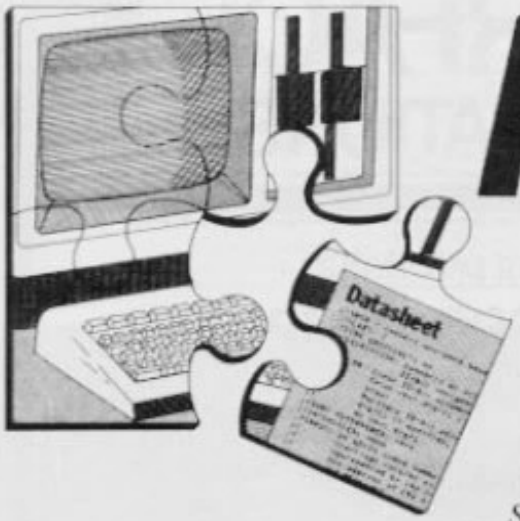
A PSYCHOLOGICAL APPROACH?

middle of finding a solution ie, the problem will change. During this time you will regularly come across quite severe difficulties. If you are working at a purely symbolic level you may conclude that some particular difficulty is insurmountable. Providing you have an 'iconic model' to fall back on you are more likely to come to terms with the new restraints.

The way, or ways, in which we describe a problem becomes important as we attempt to conceptualise and solve problems. It is also important because of the ease or difficulty with which we can convey our ideas and thoughts to others.

One of the techniques that capitalises on the above ideas is the 'Warnier diagram'. The power of using such diagrams to design programs is due in part to the separation of the logical from the practical difficulties. In addition to this the diagrams provide an iconic level with which to examine a problem. In an earlier article (*APC* January 1983) you will have seen that it is easy to cope with changes even when you are in the middle of a solution. The very nature of the technique enables us to split a problem 'as we go' into easily handled sections while maintaining a coherence between these sections.

Next month I shall discuss the implications of regarding programming as a means of operating on 'sets' of data. This, and the concept of 'Normalisation' of a data set, provides a useful approach that enables us to avoid some of the pitfalls that have been found to cause many problems in real life applications.



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Alan Tootil and David Barrow present more useful assembler language subroutines. This is your chance to build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. APC will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET, APC, P.O. Box 298, Clayton, Vic 3168.

THOSE INTRIGUING 8085 INSTRUCTIONS

Peter Caunt has written to tell of the mixed success he has had on testing the 9 unspecified instructions discovered by Jonathan Marten (February 1983).

His findings agree with Jonathan's on three of the instructions (see Fig 2).

However, Peter found code 10 (hexadecimal) to be a 'SRA HL', a 16-bit arithmetic shift retaining the sign in bit 15, and not the 16-bit rotation which Jonathan's machine thought it was. The 2-byte instructions, 28 bb and 38 bb which add immediately a single data byte value to HL and SP respectively were completely ignored by Peter's machine. Bit 5 of the flag register (supposedly a 'correct sign' flag, K) resisted all Peter's attempts to set it.

18	'RL	DE' (ie, a 17-bit rotate left)
D9	'LD	(DE),HL'
ED	'LD	HL,(DE)'

Fig 2

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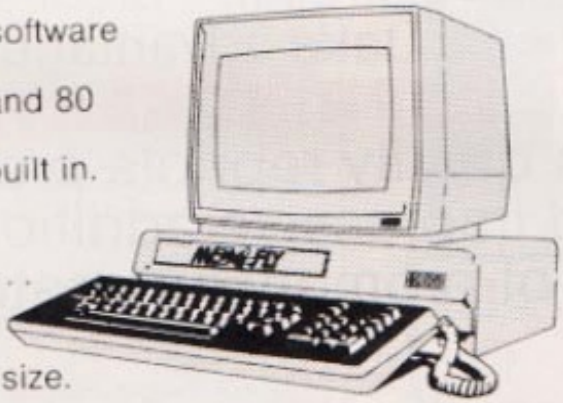

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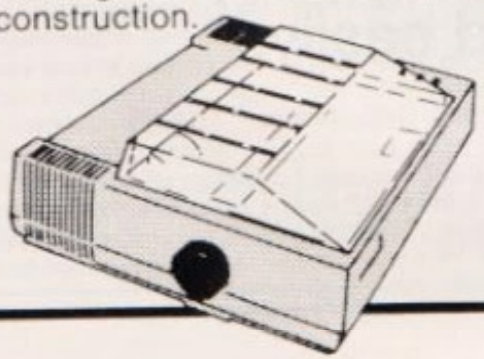

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This raises an important point about unspecified instructions. The fact that they are unspecified does mean that they cannot be guaranteed to work at all or, even if they do, produce identical results on different chips.

Peter also tested the only other unused 8085 instruction, not mentioned in February. 08 works on his machine as 'SUB HL,BC' and sets flags accordingly.

What about the 8080? All the above mentioned codes and also 20H and 30H are unused by the 8080 processor — or are they? Perhaps some reader could furnish us with the answer.

HIP-HIP-ARRAY

How do you store a two-dimensional array of matrix in linearly addressed memory — column by column? — or row by row? Whichever way it is, MATRAN from John Hardman will let you reconfigure it.

DATASHEET

```
;= MATRAN - Matrix Transposition
;/ CLASS:  1
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:      In RAM move of a two dimensional array
;/                   or matrix effecting a change from
;/                   sequential row storage at source to
;/                   sequential column storage at destination,
;/                   or vice versa.
;/ ACTION:  For each column of Source
;/              Save Source pointer
;/              For each row of Source
;/          Move element from Source to Destination
;/          Increment Destination pointer
;/          Add No. of columns to Source pointer
;/          Restore Source pointer
;/          Increment Source pointer
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  Destination area of RAM equal to Source area of RAM
;/ INPUT:  HL is pointer to start of Source matrix
;/         IX is pointer to start of Destination
;/         B is no. of rows in Source matrix (1 to 255)
;/         C is no. of columns in Source matrix (1 to 255)
;/ OUTPUT:  Transpose of Source matrix at Destination
;/          All registers returned unaltered
;/ REGs USED:  B C HL IX
;/ STACK USE:  12
;/ LENGTH:  35
;/ TIME STATES:  (rows * 60 + 67) * cols + 129
;/ PROCESSOR:  Z80

MATRAN: PUSH  HL        ;save registers          E5
        PUSH  IX        ;                        DD E5
        PUSH  BC        ;                        C5
        PUSH  DE        ;                        D5
        PUSH  BC        ;save no. of rows        C5
        LD    E,C       ;move no. of columns to DE  59
        LD    D,+0      ;                        16 00
COLLP:  PUSH  HL        ;save start of column address  E5
ROWLP:  LD    A,(HL)    ;copy element from Source  7E
        LD    (IX+0),A  ;to Destination          DD 77 00
        ADD   HL,DE     ;point to next row, same column  19
        INC   IX        ;point to next Dest. column  DD 23
        DJNZ  ROWLP     ;repeat for each row in column  10 F7
        POP   HL        ;recover start of column pointer  E1
        INC   HL        ;and point to next column  23
        LD    A,C       ;temporarily saving no. of cols.  79
        POP   BC        ;left to do in A, recover no. of  C1
        PUSH  BC        ;rows in B               C5
        LD    C,A       ;get no. of columns back into C  4F
        DEC   C         ;and repeat for all columns  0D
        JR    NZ,COLLP  ;                        20 ED
        POP   BC        ;remove no. of rows from stack  C1
        POP   DE        ;restore registers       D1
        POP   BC        ;                        C1
        POP   IX        ;                        DD E1
        POP   HL        ;                        E1
        RET             ;and return              C9
```

John says that he has tried to adapt the routine to put the transposed matrix back into the same area of memory as the source matrix but has been unsuccessful.

Now, although I cannot myself see a need for turning the rows and columns of a two-dimensional array of matrix about in the same area (doesn't mean to say that there isn't one), it seems that a nifty little algorithm would be required to do it without using any other workspace. Such an algorithm could just be useful in other, more important, contexts or might give an insight on how to deal with similar but more complex problems.

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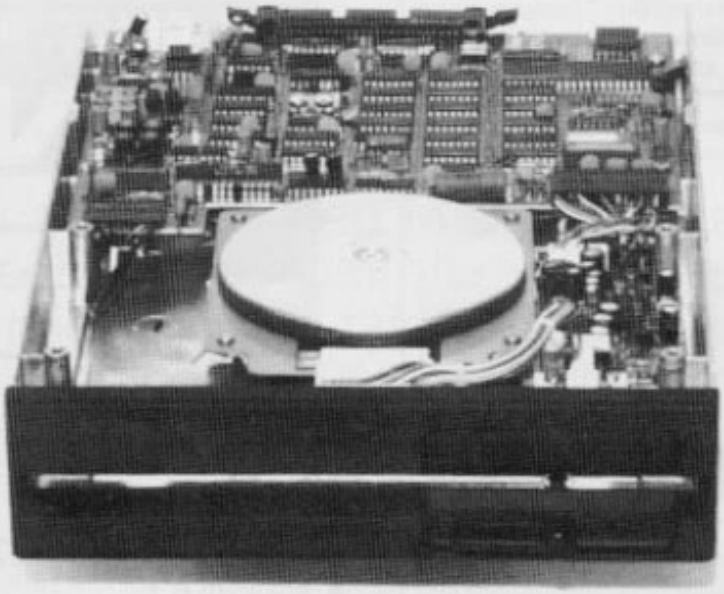

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Z80 CUBE ROOTS

Last month we printed John Kerr's lucid account of root extraction, carrying on from Steven Weller's square root programs (*APC* September, 1982). Now that you have all had a chance to apply this thinking to some code of your own, here — as promised — are John's own Z80 cube root routines, CURT1 and CURT2.

DATASHEET

```
;+CURT1 - 16-bit unsigned integer cube root
;/CLASS: 1
;/TIME CRITICAL?: No
;/DESCRIPTION: Calculates the cube root (integer part) of a 16-bit
;/              unsigned binary number, giving remainder
;/ACTION: Clear 16-bit accumulators for result, remainder & subtrahend
;/         Repeat six times: Shift left input into accumulator (3 bits)
;/         IF accumulator > current subtrahend
;/         THEN:acc := acc - subtr - 1; rotate '1' into result LSB;
;/          shift left subtr (2 bits) & add in 18 * result.
;/         ELSE rotate '0' into result LSB
;/          shift left subtr (2 bits) & subtract 6 * result.
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: BC holds 16-bit unsigned binary input number
;/OUTPUT: BC = 6-bit cube root; HL = 13-bit remainder
;/REGs USED: BC,HL
;/STACK USE: 6
;/LENGTH: 64
;/T-STATES: 1509 max
;/PROCESSOR: Z80
;
CURT1:  PUSH  AF        ; Save registers,          F5
        PUSH  BC        ; getting input            C5
        EX    (SP),IX   ; into IX                  DD E3
        PUSH  DE        ;                          D5
        LD    A,+6      ; A is loop counter        3E 06
        LD    BC,+0     ; Clear three              01 00 00
        LD    D,C       ; accumulators             51
        LD    E,C       ;                          59
        LD    H,C       ;                          61
        LD    L,C       ;                          69
        JR    START     ; Sungle bit shift 1st time 18 08
RPEAT:  ADD   IX,IX     ; Then shift three bits    DD 29
        ADC   HL,HL     ; of input number          ED 6A
        ADD   IX,IX     ; into accumulator         DD 29
        ADC   HL,HL     ;                          ED 6A
START:  ADD   IX,IX     ;                          DD 29
        ADC   HL,HL     ;                          ED 6A
        RL    C         ; Assume subtract will fail CB 11
        SCF             ; Take (subtrahend + 1)    37
        SBC   HL,DE     ; from accumulator, and    ED 52
        JR    C,ADBAK   ; if result nonnegative    38 0A
        INC   C         ; then set new bit         0C
        EX    DE,HL     ; Subtrahend into HL       EB
        ADD   HL,BC     ; effectively multiplied   09
        ADD   HL,BC     ; by four, and             09
        ADD   HL,BC     ; 18 * current result      09
        ADD   HL,BC     ; added in to obtain       09
        ADD   HL,HL     ; new subtrahend           29
        ADD   HL,BC     ;                          09
        JR    SHIFT     ; Continue                 18 09
ADBAK:  ADC   HL,DE     ; Subtraction did fail;    ED 5A
        EX    DE,HL     ; restore accumulator      EB
        OR    A         ; New subtrahend is        B7
        SBC   HL,BC     ; 4 * old value, minus     ED 42
        ADD   HL,HL     ; 6 * current result       29
        SBC   HL,BC     ;                          ED 42
SHIFT:  ADD   HL,HL     ; Done; now restore        29
        EX    DE,HL     ; remainder to HL and      EB
        DEC   A         ; continue with next three 3D
        JR    NZ,RPEAT  ; bits of input            20 D5
        POP   DE        ; Restore all              D1
        POP   IX        ; registers                DD E1
        POP   AF        ;                          F1
        RET             ; End of CURT1             C9
```

DATASHEET

```
;+CURT2 - 32-bit unsigned integer cube root
;/CLASS: 2 (flags not preserved)
;/TIME CRITICAL?: No
;/DESCRIPTION: Calculates the cube root (integer part) of a 32-bit
;/              unsigned binary number, giving remainder
;/ACTION: Clear 24-bit accumulators for remainder (A,HL) and subtrahend
;/         (C,DE); clear stack top to hold result
;/         Repeat eleven times: Shift left input into A,HL (3 bits)
;/         IF A,HL > C,DE
;/         THEN A,HL := A,HL - (C,DE + 1); rotate '1' into LSB of
;/         (SP); let C,DE := 4*C,DE + 18*(SP).
;/         ELSE (SP) := 2*(SP); C,DE := 6*(SP).
;/SUBr DEPENDENCE: Local SLEFT
;/INTERFACES: None
;/INPUT: BC,DE holds 32-bit unsigned binary number
;/OUTPUT: BC,DE = 11-bit cube root; A,HL = 23-bit remainder
```

```
;/REGs USED:  AF,BC,DE,HL
;/STACK USE:  8
;/LENGTH:     97
;/T-STATES:   3480 max
;/PROCESSOR:  Z80
;
CURT2:  PUSH    BC          ;Move input into        C5
        EX      (SP),IX     ;index registers,       DD E3
        PUSH    DE          ;saving their           D5
        EX      (SP),IY     ;original contents      FD E3
        LD      BC,0B00H    ;Loop counter B  11;    01 00 0B
        LD      A,C         ;clear                  79
        LD      D,C         ;all                    51
        LD      E,C         ;other                  59
        LD      H,C         ;registers              61
        LD      L,C         ;and                    69
        PUSH    HL          ;stack top              E5
        JR      BEGIN       ;Skip one shift 1st time 18 03
AGAIN:  CALL    SLEFT       ;Then shift three bits  CD YY YY
BEGIN:  CALL    SLEFT       ;of input number        CD YY YY
        CALL    SLEFT       ;into A,HL              CD YY YY
        SCF                 ;Take (subtrahend + 1)  37
        SBC     HL,DE       ;from accumulator A,HL  ED 52
        SBC     A,C         ;but jump to restore    99
        JR      C,NOSUB     ;if now negative        38 15
        EX      (SP),HL     ;Subtraction successful; E3
        ADD     HL,HL       ;new result bit         29
        INC     L           ;is '1'                 2C
        PUSH    HL          ;save new result and    E5
        ADD     HL,HL       ;multiply               29
        ADD     HL,HL       ;by four;               29
        EX      DE,HL       ;add this into          EB
        ADD     HL,DE       ;subtrahend             19
        JR      NC,NOINC    ;                       30 01
        INC     C           ;                       0C
NOINC:  ADD     HL,HL       ;Double                 29
        RL      C           ;subtrahend             CB 11
        POP     DE          ;Retrieve saved result  D1
        ADD     HL,DE       ;& add into subtrahend  19
        JR      NC,NEXT3    ;                       30 16
        INC     C           ;                       0C
        JR      NEXT3       ;                       18 13
NOSUB:  ADC     HL,DE       ;Subtraction didn't go; ED 5A
        ADC     A,C         ;restore accumulator    89
        EX      (SP),HL     ;Shift left result-so-far E3
        ADD     HL,HL       ;(new result bit is '0') 29
        EX      DE,HL       ;Subtract               EB
        SBC     HL,DE       ;result                 ED 52
        JR      NC,NODEC    ;from                   30 01
        DEC     C           ;subtrahend             0D
NODEC:  ADD     HL,HL       ;Shift left             29
        RL      C           ;subtrahend             CB 11
        SBC     HL,DE       ;Repeat last two        ED 52
        JR      NC,NEXT3    ;operations             30 01
        DEC     C           ;                       0D
NEXT3   ADD     HL,HL       ;In either case, the    29
        RL      C           ;correct new subtrahend CB 11
        EX      DE,HL       ;has now been calculated. EB
        EX      (SP),HL     ;Restore operands and go E3
        DJNZ,   AGAIN       ;back for next 3 bits.  10 C2
        POP     DE          ;Final result into BC,DE D1
        LD      C,B         ;(top word BC cleared)  48
        POP     IY          ;Restore index          FD E1
        POP     IX          ;registers              DD E1
        RET                 ;End of CURT2           C9
SLEFT:  ADD     IX,IX       ;Local subroutine shifts DD 29
        ADC     HL,HL       ;one bit of input number ED 6A
        RLA                 ;into accumulator A,HL  17
        ADD     IY,IY       ;                       FD 29
        RET     NC          ;                       D0
        INC     IX          ;                       DD 23
        RET                 ;End                    C9
```

DYNAMIC STORAGE

Quote of the month from John Kerr, referring to one of his less successful coding efforts: 'due to an extraneous 'RET', it uses the peculiar technique of storing an intermediate result in the program counter. . .'

We all use that technique, John.

END

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', P.O. Box 298, Clayton, Vic 3168. Please keep your contributions as concise as possible. We will pay $10—$30 for any tips we publish.
APC can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

Error trap

I have written a pair of subroutines for 3000 and 4000 series PETs, which provide an error trapping facility. They work by storing a command in the keyboard buffer, which is executed after an error, in this case causing a jump to line 12000. The interrupt routine is disabled when the trap is enabled, to prevent the user overwriting the command in the keyboard buffer. This also disables the clock, stop key, and the cassette motor. The trap must therefore be disabled before getting data from the keyboard, or using the cassette system. The routine clears the screen when an error occurs. To enable the trap use 'GOSUB 10000', and to disable it use 'GOSUB 11000'. The routines set 'ER' to —1 when the routine is enabled, and to zero when it is disabled. Your routine to deal with the error should start at line 12000, and its first action should be to disable the trap. Although variable values are preserved, the contents of the stack are lost, so you cannot continue a FOR-NEXT loop or subroutine.

Robert Oakeshott

```
10000 REM ERROR TRAP ENABLE
10010 POKE 59411,60:REM DISABLE KEYBOARD
10020 ER$="□G"12000"+CHR$(13)
10030 POKE 158,LEN(ER$):REM NO. OF CHARACTERS IN KEYBOARD
      BUFFER
10040 FOR I=1 TO LEN(ER$)
10050 POKE 622+I,ASC(MID$(ER$,I,1))
10060 NEXT
10070 ER=-1
10080 RETURN
11000 REM ERROR TRAP ENABLE
11010 POKE 59411,61:REM KEYBOARD ENABLE
11020 POKE 158,0:REM CLEAR KEYBOARD BUFFER
11030 ER=0
11040 RETURN
12000 REM ERROR CAUGHT
12010 GOSUB 11000:REM ERROR TRAP DISABLE
12020 STOP
```

Colour RAM

All Commodore 64 users must have some programs which poke directly to the screen RAM rather than using PRINT statements. And most of these users will

T.J.'s Workshop

have discovered (or even rediscovered a few times as we have) that a POKE to a screen location does not always result in anything becoming visible. You do of course need to ensure that the colour RAM byte equivalent to your chosen screen RAM byte has been POKEd with the desired colour for the character to become visible.

In particular, if you're converting PET programs, it can be all too easy to forget — and it is then sometimes a little puzzling to sort out what has gone wrong. After all, you know the program already runs on the PET . . . so it just *Must* work on the C64 when the necessary conversions for pages 0, 1, 2, 3 and screen RAM locations have been made — mustn't it?

So somewhere or other in the program, if you need the whole of screen RAM to be available for displaying your POKEd characters, you'll have the following sort of statement:

```
FOR I=55276 TO 56275 :
  POKE Lx : NEXT
```

where 'x' is your desired colour. This turns out not to be a quick process.

In fact the following test program (no unnecessary blanks typed in the statements)

```
10 TI$="000000"
20 FORI=55276TO56275:
  POKE1,5:NEXT
30 PRINTTI;"JIFFIES"
```

took 242 jiffies — or over 4 seconds — when run.

What you will find, if you haven't already, is that clearing the screen (PRINT"CLR/HOME") not only clears the screen RAM but very kindly also clears the colour RAM so you need to rezap it — for another 4 seconds or so. Apparently in early C64s a different version of the VIC-II chip reset the colour RAM to white but the current production sets colour RAM to be the screen background colour as a result of "CLR/HOME". We think it likely that all 64s in Australia (at least Australian market ones) are of the latter kind.

What all this means is that there's a faster way of setting the contents of the colour RAM. You need to USE the background colour by judicious use of a PRINT"CLR/HOME". The following program illustrates.

```
10 TI$="000000"
20 I=PEEK(53281) :
  POKE53281,5 : PRINT
  "CLR/HOME" :
  POKE53281,I
30 PRINTTI;"JIFFIES"
```

This program executes in 5 jiffies (and for some reason we don't understand, sometimes in 4 jiffies!) or less than one tenth of a second. This is about 50 times as fast as the POKE method described earlier. And the use of this technique very noticeably speeds up a program which does POKE to screen RAM. You will find that the screen (very briefly) flashes in your chosen colour, but we didn't find the flash of the screen at all objectionable.

What we have been able to do in a couple of cases is to not save the current background colour, as above, but to USE it as the next colour for the POKEd characters and just change the screen background colour by POKEing 53281 the PRINT"CLR/HOME". You don't then get a flash of colour, just a change of screen colour. And it all happens very much faster than POKEing the colour RAM in your Basic program.

Ron and Sheila Hewett

Redirected POKE

Below is a simple routine to cause System 80/TRS-80 computers to execute the

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current Basic program when the Break key is pressed. The only catch is that you must have a line 0, even if it is only a REMark. Similarly, you could initialize location 400CH (16396 decimal) to JP XXXX, where XXXX is the start address of your own routine.

```
0 POKE 16477,205: POKE
  16478,93: POKE 16479,27:
  POKE 16480,195: POKE
  16481,172: POKE 16482,30:
  POKE 16397,93: POKE
  16398,64: POKE 16396,195
```

If you want to be really mean, you could do:

```
POKE 16397,0: POKE
  16398,0: POKE 16396,195
```

which jumps to location 0000H when 'Break' is pressed, resetting the entire computer (and those three POKEs).

David Grainger

PC-1500 solution

The last issue of APC had a couple of items concerning the Sharp PC-1500 and its ability to PEEK and POKE. Both authors asked if anyone knew about the instruction set used by the Sharp.

Well, I don't have a PC-1500 but I do have the December 1982 issue of 'Pocket Computer Newsletter'. Apparently the staff of this newsletter have put a lot of work into studying the PC-1500's ROM in an attempt to uncover its instruction set. The newsletter mentions that they have published the machine language instruction set as well as a disassembler that lets users study the ROM. The newsletter has several examples of machine language operation plus a table of locations that may be CALLed to do various things not possible in Basic.

The Pocket Computer Newsletter is available by writing to P.O. Box 232, Seymour, CT 06483, USA. Single issues cost US$4.

Phil Carter

Special VIC characters

There are many programs available for the unexpanded or +3k VIC, which reserve space at the top of memory and allow part of the character set in ROM to be transferred into RAM. This lets the user invent special characters, and is terrific.

For those of us with 16k or more expansion, this method cannot be used. The screen memory starts at 4096, and Basic starts immediately after.

The little program shown, raises the start of Basic and transfers all of the character

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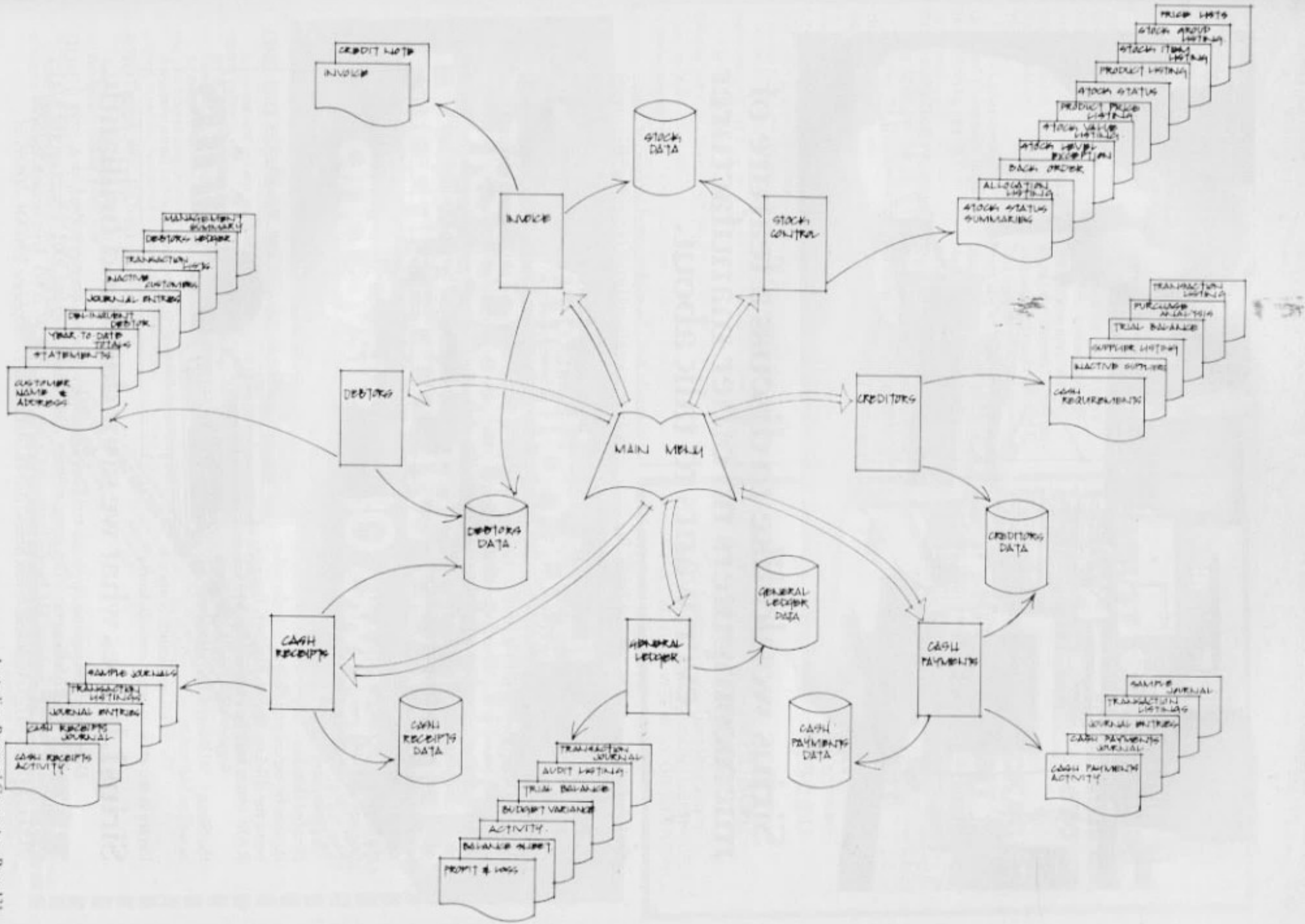
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CASH RECEIPTS DATA
GENERAL LEDGER
GENERAL LEDGER DATA
CASH PAYMENTS
CASH PAYMENTS DATA
ACTIVITY

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set except reversed lower case, into RAM. Placed before your program, it executes in the twinkling of an eye and is then erased. It leaves just over 16,000 bytes free.

To call your specially designed characters, include the following line in your program:

PK=36869:POKE PK, PEEK (PK) AND 240 OR 13

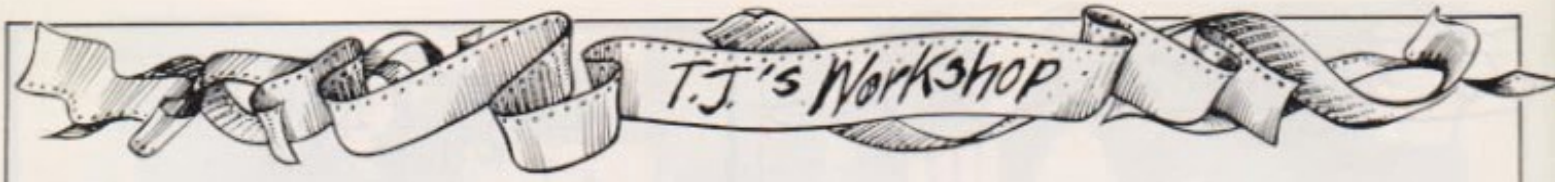
To bring the Commodore characters back, use:

POKE PK, PEEK (PK) AND 240 OR 0

If you wish to understand the machine code, I have produced a three-column listing. The first column shows the decimal OP-code and any operands involved. The second column shows the location (in HEX). The third column shows the 6502 Assembler Mnemonic in the form used by Commodore. Beneath each row of numbers is my interpretation of what it all means. I hope you find it helpful!

Don Thorpe

```
1 PRINT"□MACHINE CODE LOADING"
2 FORA=12288TO12376:READB:POKEA,B:NEXT
3 SYS12288:POKE631,131:POKE198,1:END
4 DATA56,32,156,255,200,24,32,156,255,174,44,0,232,142,44,0,
  142,46,0,173,46,0,20 1,32,200
5 DATA230,169,0,141,0,32,141,1,32,141,2,32,169,205,141,5,144,
  162,0,142,123,48,17  4,123
6 DATA48,189,0,128,157,0,20,224,255,240,7,232,142,122,48,76,47,
  48,172,55,48,152, 31,240
7 DATA14,200,140,55,48,174,52,48,232,142,52,48,76,42,48,96
```




```
DECIMAL OP-CODE  LOCATION(HEX)  ASSEMBLER MNEMONIC

56               $3000          SEC
SET CARRY FLAG-NEEDED SO THE KERNAL ROUTINE "MEMBOT" WILL READ
32 156 255       $3001          JSR $FF9C
READS BOTTOM OF RAM.  POINTER RETURNED IN X & Y REGISTERS
200              $3004          INY
INCREASE Y BY 1 (IGNORE X).  RAISES MEMORY POINTER 1 PAGE
24               $3005          CLC
CLEAR THE CARRY FLAG.  NEEDED SO "MEMBOT" WILL SET
32 156 255       $3006          JSR $FF9C
SET THE BOTTOM OF MEMORY
174 44 0         $3009          LDX $002C
LOAD X REGISTER WITH CONTENTS OF LOCATION 44
(HIGH BYTE OF START OF BASIC)

232              $300C          INX
INCREASE X REGISTER BY 1
142 44 0         $300D          STX $002C
STORE NEW CONTENTS OF X AT LOCATION 44
142 46 0         $3010          STX $002E
STORE ALSO AT LOCATION 46 (HIGH BYTE OF START OF NUMERIC VARIABLES)
173 46 0         $3013          LDA $002E
LOAD ACCUMULATOR WITH CONTENTS OF LOCATION 46
201 32           $3016          CMP #$20
COMPARE ACCUMULATOR CONTENTS WITH 32
208 230          $3018          BNE $3000
IF ACCUMULATOR CONTENTS NOT EQUAL TO 32, BRANCH BACK TO $3000
169 0            $301A          LDA #00
LOAD THE ACCUMULATOR WITH ZERO
141 0 32         $301C          STA $2000
STORE THE CONTENTS OF THE ACCUMULATOR AT $192
141 1 32         $301F          STA $2001
STORE THE CONTENTS OF THE ACCUMULATOR AT $193
141 2 32         $3022          STA $2002
STORE THE CONTENTS OF THE ACCUMULATOR AT $194
169 205          $3025          LDA #$CD
LOAD ACCUMULATOR WITH 205 (11001101 IN BINARY)
141 5 144        $3027          STA $9005
STORE 205 AT LOCATION 36869(STARTS CHAR SET AT 5120)
162 0            $302A          LDX #00
LOAD THE X REGISTER WITH ZERO
142 123 48       $302C          STX $307B
STORE ZERO AT LOCATION 12411
174 123 48       $302F          LDX $307B
LOAD X REGISTER WITH CONTENTS OF 12411
189 0 128        $3032          LDA $8000,X
LOAD ACCUMULATOR WITH CONTENTS OF 32768, INDEXED WITH X
157 0 28         $3035          STA $1F00,X
STORE CONTENTS OF ACCUMULATOR AT 5120, INDEXED WITH X
224 255          $3038          CPX #$FF
COMPARE CONTENTS OF X REGISTER WITH 255
240 7            $303A          BEQ $3043
IF EQUAL TO 255, BRANCH AHEAD TO $3043
232              $303C          INX
INCREASE CONTENTS OF X REGISTER BY 1
142 123 48       $303D          STX $307B
STORE CONTENTS OF X REGISTER AT LOCATION 12411
76 47 48         $3040          JMP $302F
JUMP BACK TO MEMORY LOCATION $302F
172 55 48        $3043          LDY $3037
LOAD THE Y REGISTER WITH THE CONTENTS OF LOCATION 12325
192 31           $3046          CPY #$1F
COMPARE THE CONTENTS OF Y WITH 31
240 14           $3048          BEQ $3058
IF EQUAL TO 31, BRANCH AHEAD TO $3058 (RETURN TO BASIC)
200              $304A          INY
INCREASE CONTENTS OF Y REGISTER BY ONE
140 55 48        $304B          STY $3037
STORE THE CONTENTS OF Y AT LOCATION 12325
174 52 48        $304E          LDX $3034
LOAD THE X REGISTER WITH THE CONTENTS OF 12322
232              $3051          INX
INCREASE THE CONTENTS OF THE X REGISTER BY 1
142 52 48        $3052          STX $3034
STORE THE CONTENTS OF X AT 12322
76 42 48         $3055          JMP $302A
JUMP TO MEMORY LOCATION $302A
96               $3058          RTS
RETURN TO BASIC
```

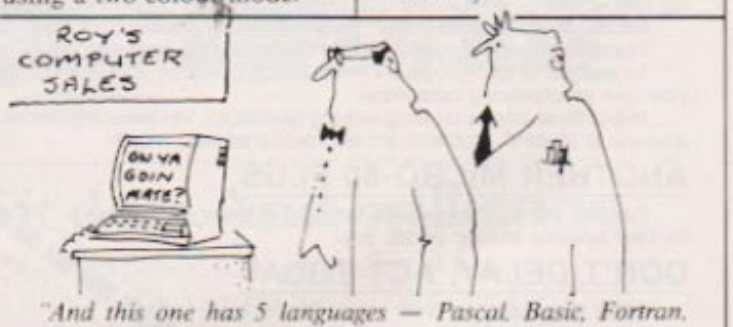

BBC secret colours

Here is a simple program to display some of the numerous shades of colour which can be obtained using the BBC micro. Colours are mixed by drawing parallel lines close together; the distance between these lines being determined by the step size in line 50.

All the effects are obtained using a two-colour mode! Mode 5 would enable up to four colours to be mixed at once.

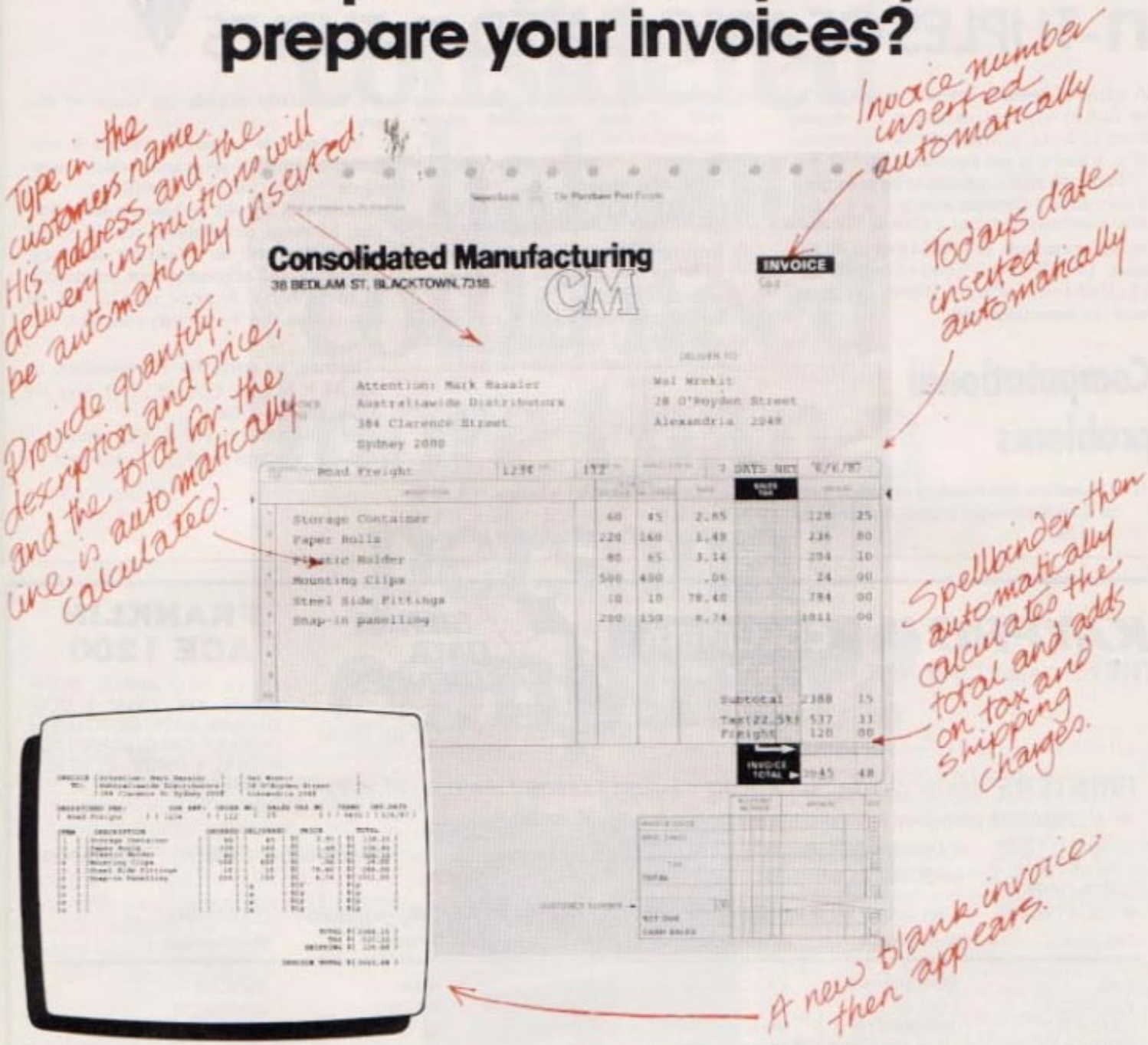
```
10  MODE 0
20  FOR C=7 to 0 STEP-1
30  FOR K=0 to 7
40  VDU
    19,0,C,0,0,0,19,1,K,0,0,0
50  FOR X%=0 TO 1280
    STEP 8
60  MOVE X%,0
70  DRAW X%,1023
80  NEXT X%
90  NEXT K
100 NEXT C
```

Vin Riley



"And this one has 5 languages — Pascal, Basic, Fortran, Cobol and Occa."

When was the last time a wordprocessor helped you prepare your invoices?



Helping you prepare invoices is just one way Spellbinder wordprocessor and office management system can be speeding paperwork through your office. Spellbinder is the most talented and easiest to use CP/M wordprocessing system. Facilities which the others sell as extras, like mailmerging and sorting are standard features on Spellbinder. And because they are fully integrated they're quicker and easier to use. And that's just the start. Spellbinder comes complete with a series of powerful built-in application programs which are easily tailored to perform office tasks like invoicing, reports and calculations.

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NUMBERS COUNT

Mike Mudge presents another batch of mathematical mind-benders.

n-TUPLES OF ASSOCIATED n-TUPLES

A triple of positive integers is defined to be (a,b,c) where a, b and c are chosen from 1, 2, 3,. . . The order of occurrence of a, b and c is not significant.

Two such triples are said to be associated if they have a common sum a + b + c and also a common product a x b x c. We shall write, for example, (14,50,54)(a)(15,40,63) since 14+50+54=15+40+63=118 and 14x50x54=15x40x63=37800; (a) being read 'as associated with'.

Computational problems

(i) Determine the smallest common sum of four associated triples. Believed to be 118.

(ii) Determine the smallest common product of four associated triples. Believed to be 25200.

(iii) Discover any quintuples of associated triples. (6,480,495)(a)(11,160,810)(a)(12,144,825)(a)(20,81,880)(a)(33,48,900).

(iv) Investigate empirically the existence of larger sets (n-tuples $n > 5$) of associated triples.

(v) Investigate empirically the existence of n-tuples of associated m-tuples for computationally feasible m and n.

Note: There are mathematical problems relating to infinite families of associated triples such as:- (16ka,bc,15d)(a)(10ka,4bc,6d)(a)(15kb,ad,16c)(a)(6kb,4ad,10c) where $a = k + 2$, $b = k + 3$, $c = 2k + 7$, $d = 3k + 7$, $k = 1, 2, 3, \ldots$ due to J Mauldon but these are essentially outside the scope of this article.

Readers are invited to submit a program, or suite of programs, which investigate the above problems. All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order). A prize of $25 will be awarded to the 'best' entry received.

Entries, to arrive by 1 September, to: Mr M R Mudge, C/- *APC*, P.O. Box 298, Clayton, Vic 3168.

Note: Submissions will only be returned if suitable stamped addressed envelopes are included.

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CHECKOUT

THE OSBORNE EXECUTIVE

The Executive — to be launched in September — tackles all the criticism levelled at its predecessor, the Osborne 1. Guy Kewney judges whether the result has been worth waiting for.

There is a new Osborne microcomputer: cheap, with a lot of CP/M software free, portable, and called the Executive. Its main technical features are designed to satisfy criticism of its predecessor.

The Osborne 1 was the first briefcase portable computer. It was also the first computer to be supplied with a 'full set' of what is today recognised as essential applications software; and it was launched at a price which was so low that it was very nearly the first CP/M micro to sell for under $2000.

As a pioneering machine, it attracted enthusiasts, who were excited by these features — plus other advanced design ideas, such as a screen that was both less (52 visible columns) than most and also more (128 columns, around a 'window').

But it was also a collection of very apparent faults, so that it was always possible to deride it as a machine which 'gave you what you paid for'. It had tiny diskettes with only 90 byte capacity each, a very small screen, and it was dreadfully ugly.

'If only the Osborne had bigger disks,' people said, or 'If only it had a slightly bigger screen,' or again 'I can't stand watching the screen jump around with that scrolling window: why can't it have an ordinary 80 column display?'

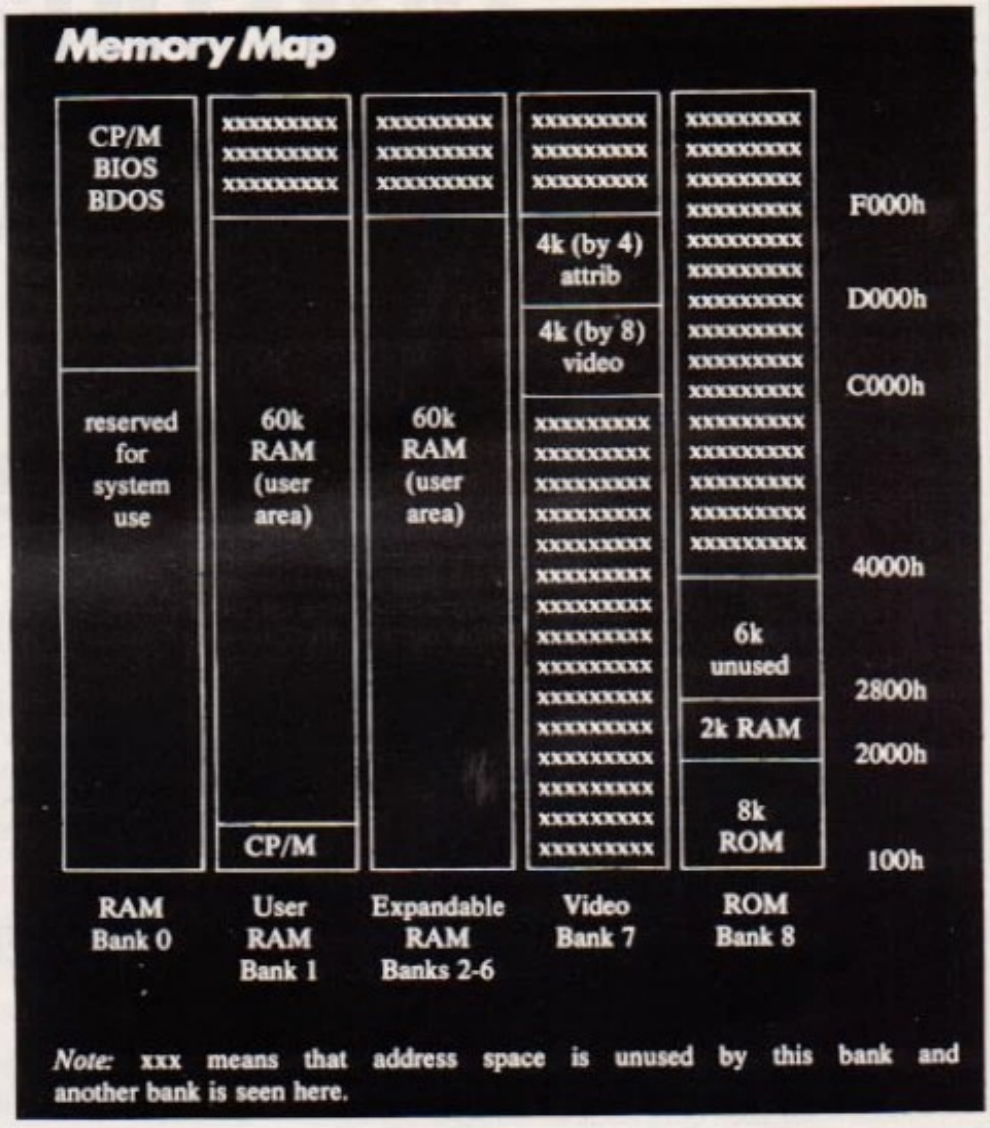
The new Osborne 2, called the Executive 1, and the soon-expected Executive 2 are both remarkable for having done very little — on the surface — other than answer these comments. But closer examination shows that there has been a considerable re-think especially in the software, mainly with the arrival of the far more sophisticated CP/M Plus operating system.

There is also a lot of new 'free' software, including Pascal, a program generator, and many advanced programmers' utilities for machine code production.

Presented with two Osbornes, one the model 1 and the other an Executive, the only distinguishing characteristic is the slight camel's hump under the carrying handle. The hump is to accommodate a cooling fan, which betrays the fact that despite the similarity there is more to the new machine.

Opened up, the new machine at first does not seem to be very different, apart from the layout. Instead of one disk on either side of the central display screen, they are now half-height drives, one above the other, on the left.

Then you notice that the screen is a bit bigger than before. On the right is an air intake grille. There is a 'proper' Centronics port — not the funny edge connec-



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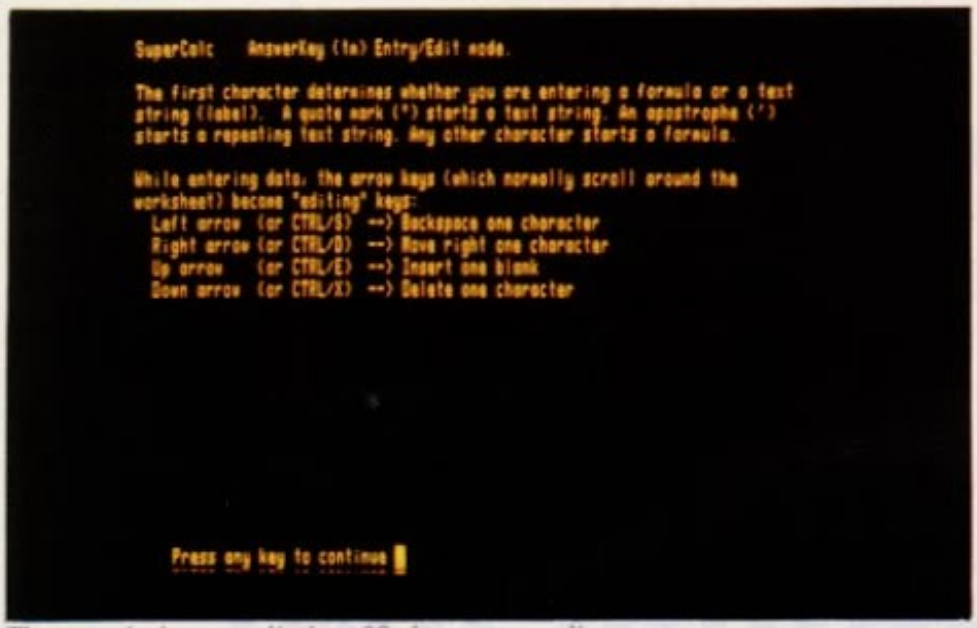

The seven inch screen displays 80 characters per line

tor that used to baffle so many customers who bought printers and couldn't connect them when they got home. There are two serial ports, not one, and a 'modem' plug.

Only when you look for the power 'on' switch, and find it in front of you (rather than tucked away behind with the fuse), and press it, do you realise that the new screen is not just a bit bigger, but has changed colour. It is 'restful' orange —and it has 80 columns.

'Insert disk in drive A and press Return' is the message on the screen.

It is fair to say that anybody who has ever used CP/M before will be able to take on the machine from this point — without any help from the manuals, because the 'HELP.COM' program supplied on the first system disk explains all the features of the machine, including all the CP/M programs supplied with it.

Specifications

The Executive uses the same Z80 processor as the Osborne 1, running at a perfectly ordinary 4 Mhz — which means that its performance on running program instructions in Basic is almost identical to its predecessor.

However, there are differences between one CP/M system and the next — depending on the way the processor board is constructed—and the Osborne 1 was relatively quick at running Microsoft Basic.

One factor which can affect benchmark timings is the number of 'wait states' that the processor gets caught up in, when signals are expected from its subordinate chips, and take longer than the Z80 would ideally like.

The operating system for the preproduction model supplied is CP/M Plus,

Superficially the Executive is not dissimilar to the Osborne 1 but refinements have been incorporated.

which differs enormously from CP/M in several ways: one of these is the way it handles disks, and another is the way it extends memory.

The Executive has 124 kbytes of memory. Theoretically, under CP/M Plus, this could be extended in 'banks' of 48 kbytes, all of which share the same memory contents for the top 16 kbytes. On the Executive this theoretical expandability has been ignored, on the grounds (I think, spurious) that there simply isn't room in the case or power in the power supply for another memory board.

As to the power supply, the company may have a point. This system, like most modern desk-top micros, needs a fan to keep it cool. The vent at the front is obvious. At the back, there is a closable hatch over the fan — with it closed, the fan will have no effect except to generate a certain amount of extra heat. On the top, there is a larger ventilation hatch, identical to that on the newer, cased version of the Osborne 1, where simple convection was more than enough to cool it down.

On the production models, Osborne will put a switch into the system, so that the fan only works when the computer gets hot. On the test machine, this heat sensing had not been included, so the noise of the fan simply had to be tolerated — and the noise, I'm afraid, did betray the fact that the power supply finds the disks a bit of a strain, because the note of the fan hum drops quite noticeably when they come on. It must also be pointed out that the power is much beefier than the Osborne 1 could put out, and this machine can operate both disks together — the old one would have blown a fuse.

Total memory in the Executive is 128 kbytes (see memory map diagram) with 60 kbytes of this available as the 'transient program area' — transient programs being things like SuperCalc and WordStar.

The machine can be connected to printers, terminals, modems and other peripherals through two RS232 ports, or a Centronics port which can be reprogrammed as a universal HP interface bus (IEEE 488 standard). Invisible to the user but available to the system designer or the clever add-on merchant, there is a direct memory access (DMA) port.

The serial ports are considerably upgraded on the originals, being programmable to run at any baud rate from 50 to 9600. The Centronics port on the old machine was just an edge connector, which meant considerable trouble in tracing a suitable cable. On this one it is still not absolutely standard as a Centronics plug because it lacks the little wire 'hooks' that lock the cable in place. However, any Centronics cable will plug firmly enough into it. And it is, apparently, a 'standard IEEE socket'.

The Direct Memory Access port is of no interest to anybody who is not planning to upgrade the Executive into a 16-bit processor with the add-on 8088 card. No more need be said of it at this stage, since it isn't available.

The diskettes, apart from being half-height, offer no surprises to Osborne 1 users, nor to anbody else. The slightly disappointing surprise is that they are still only single-sided, double density, with a maximum capacity of 200 kbytes.

Against that, they are pretty clever, being able (used with care) to get data off the Digital Equipment Robin (VT180) CP/M kit, the Xerox five-inch disk format, the Cromemco minidisk, and the IBM (CP/M-86 only) double density, as well as from earlier Osborne diskettes. That is all without loading any special program.

With the use of specially bought programs, these drives can be used not only to read, but to format, and to write, for some 20 other five-inch formats, since the operating monitor program does not force user programs to go through CP/M disk handling routines, but offers the alternative of direct access.

Software

Standard software supplied with the machine is:
UCSD P-system (Pascal interpretative run-time operating software) and CP/M Plus as operating systems; CP/M utilities, and Osborne utilities for programming the machine or for changing its operating characteristics; Personal Pearl; Supercalc 1.12; WordStar 3.4 (with Mail Merge) and Microsoft 5.3 disk Basic (interpretative) with CBasic 2.37 (compiled) as programming languages.

The utilities are worth a more detailed mention, because all too many CP/M systems skimp on these. This system comes with almost as full a set as one could wish.

In particular, the old insistence on supplying only standard CP/M programs that would work on any CP/M system has been dropped; and the assembler program ASM has been replaced by MAC. The difference is simple enough: MAC can cope with the extra instructions of the Z80, whereas ASM.COM could produce only 8080 code.

The CP/M utilities are nice; but it is the Osborne utilities that make the machine. They get a special section to themselves, below, in the 'machine under test' section.

As on the Osborne 1, all the numeric keys are programmable to send a string of characters to the console, or to any other CP/M 'logical' device. There are a total of 288 memory locations in memory, set aside to store these strings, more than twice the limit on the Osborne 1. In addition, the cursor arrow keys can be directly programmed — on the original system, there was merely a choice of 'WordStar' or 'CP/M' standard control characters.

The screen is the first piece of hardware to show a definite reduction, rather than increase, over the Osborne 1.

Adam Osborne has said that the seven-inch screen was the right size improvement — that most people felt it was 'a lot bigger' than the old five-inch screen. whereas a nine-inch screen didn't offer much over the seven-inch.

But where the old five-inch screen displayed only 52 characters per line (and this new seven-inch screen displays 80), it actually was capable of showing you 128 characters, with a little clever scrolling.

That has gone (see above), and its loss will disappoint Osborne fans.

The Executive under test

Testing the machine was a challenge which I happily dodged. I am prepared to make slight apologies for not trying out the database or the program generator, or the terminal emulation facilities, each of which warrants a full software text on its own. WordStar version 3.4 is very well known; Supercalc is a spreadsheet which needs introduction only to those who don't know what spreadsheets are; and the assembly level utilities are of interest only to the user who has had the machine for some time, or for the systems software professional (who knows them all backwards anyway).

What I did test was the new Setup and character generation utilities, SETUP.COM and CHARGEN.COM.

Chargen is a character generator. It shows you a grid of pixels, and you can load existing characters in for alteration, or develop your own from scratch. Having gone right through the dot matrix for each letter, you can end up with a character set on disk, automatically loadable, which will give serifs for each letter. Or you can write in Greek. All you need is disk space to store the characters.

Setup does almost anything. It will program one user port to use the ET/ACK protocol, at 9600 baud; the next to do XON/XOFF, at 50 baud; or both; or neither. It can set the cursor to be visible or invisible, blinking or steady, block or underline, or any combination (though obviously not invisible blinking anything) and can change screen attributes to flash, underline, inverse, half-bright or graphics.

It can even be programmed to avoid 50/60 Hz mains flicker. That is one of the more irritating things that can happen on US built machines, where the frequency

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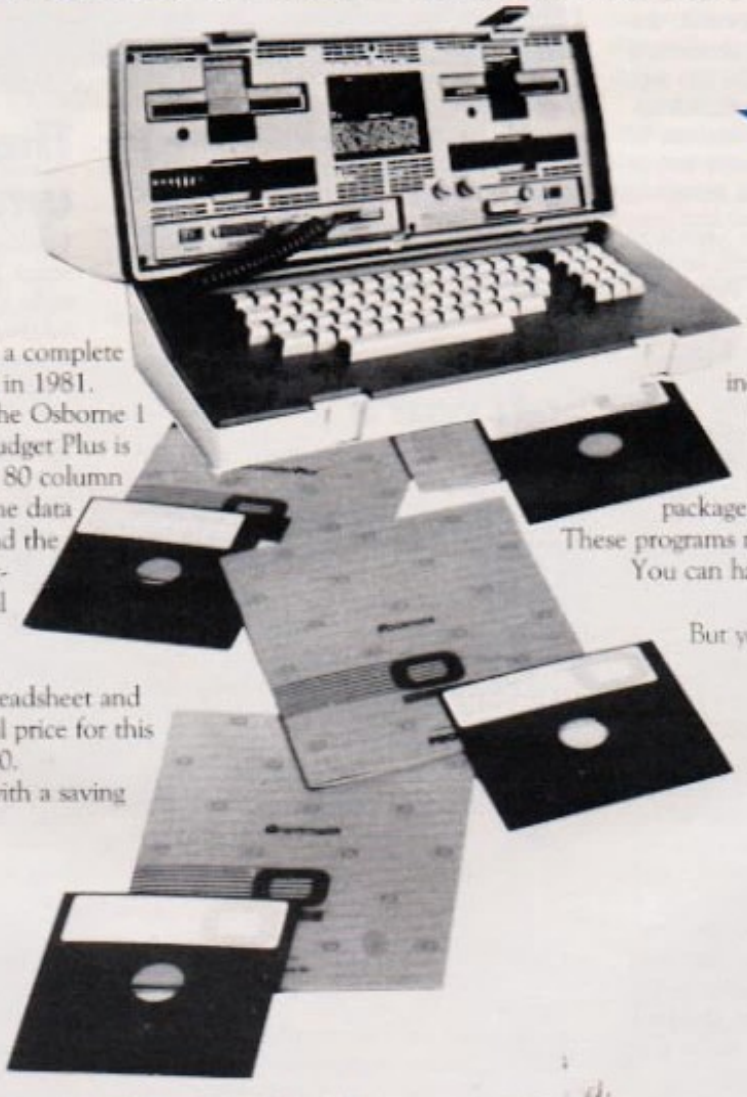

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Toowoomba Computer Centre (076) 32 7542
Town & Country Computers (07) 775 4000
Cairns Computer Centre (070) 516 010

NORTHERN TERRITORY
Computer World (089) 81 2436
The Computer Shop (089) 81 2712

NEW SOUTH WALES
Blue Mountains Business Equipment (047) 822 457
City Personal Computers Pty. Ltd. (02) 233 6902
City Personal Computers Pty. Ltd. (02) 922 3600
Complete Solutions (02) 212 1166
Computer Connection (02) 326 1404
ComputerLand Burwood (02) 745 4311
ComputerLand Chatswood (02) 411 2611
ComputerLand North Sydney (02) 929 4499
ComputerLand Central Coast (043) 24 1811
ComputerLand Parramatta (02) 683 5199
ComputerLand Top Ryde (02) 808 2666
Computers Galore (02) 908 2355
Delta Computers (02) 705 6636
Direct Computer Sales (02) 570 8344
Direct Computer Sales (02) 328 5311
Foremost Office Equipment (02) 635 5477
Grace Bros Computer Centres
City (02) 238 9111
Parramatta (02) 635 0366
Geebros Computer Centre (066) 426 790
LST Electronics (067) 66 3162
LST Electronics (067) 72 5059
LST Electronics (063) 31 4666
Otara Cash Registers (069) 825833
Seahorse Computers (040) 666 406
Seahorse Computers (042) 28 7555
Advanced Office Equipment (060) 21 7822
Computer Orchard (063) 623 889
Typewriter City Discounts (02) 267 8847
Gosford Business Machines (043) 67 7755 67 7182

AUSTRALIAN CAPITAL TERRITORY
Boulevard Business Services (062) 495 411
ComputerLand Canberra (062) 82 2342

SOUTH AUSTRALIA
ComputerLand Adelaide (08) 212 7191
Micro-80 Computing Centre (08) 211 7244
Myer Computer Centre (08) 217 0123
The Cogs Centre (086) 45 7755

TASMANIA
Quantum Computers (002) 31 0222
John Abbott Business Machines (002) 34 4044

VICTORIA
Alnet Distributors (03) 569 0189
Alpha Digital Research (03) 758 9551
ComputerLand Box Hill Pty. (03) 890 0466
ComputerLand Melbourne (03) 662 2133
Data Farm Pty. Ltd. (056) 217 155
Data Farm Pty. Ltd. (054) 43 4866
Direct Data (03) 20 6948
Geelong Computing Centre (052) 22 2644
IMA Computer Company (03) 560 2974
Myer Computer Centre (03) 661 3342

WESTERN AUSTRALIA
Computer Country (09) 444 7431
Morton Scott Business Machines (09) 328 6522
Myer Computer Centre (09) 321 0151
Computer Clover (09) 322 5651

Word-Pac™
Software for the writer.

Author Peter DeVries once said, "I love writing. It's the paperwork I can't stand."
The Osborne Personal Business Computer is an outstanding writer's system, because it automates the paperwork out of writing quickly and easily.
Through the WORDSTAR word processing system that is included with the Osborne system, anyone who writes can spend more time thinking, researching, and creating - and far less time typing, correcting, dictating, pasting, and waiting.
Any writer who has worked with an Osborne Computer finds it impossible to return to the dark ages of the typewriter or longhand.
And now WORD-PAC brings even more writing capability, efficiency, and accuracy to the Osborne Computer user.

Spellguard. The end of the misspelled word.
Spellguard will check - word by word - your document against its own dictionary of correct spellings.
When the program encounters a word it does not have in its dictionary, it asks whether the spelling is incorrect and to be marked for change, or correctly spelled.

MathStar. A program to handle all the arithmetic in your documents.
The MathStar program performs the basic arithmetic functions (addition, subtraction, multiplication, division) of rows, columns, or formulas in your document.

Grammatik. Analyse your grammar and writing style for better communication.
Grammatik expands Spellguard's capabilities to include word, phrase, and sentence analysis.
Simply ask the program to check your document.
The result? You can easily spot and correct inconsistencies that might detract from your work.

DocuMate/Plus. Simplify the creation of the table of contents and reference index.
You simply note the points you want indexed as you write.
DocuMate/Plus creates a second document with a full table of contents and complete index.
It's that easy.

Footnote. Tremendously simplifies the project of numbering and spacing footnotes in your document.
Simply write your footnotes as you write your document. (or you can create a separate note file.)
The Footnote program consecutively numbers your footnotes and footnote references (using superscripts) and makes all your page spacing decisions for you.
You can put your notes on the page where the reference occurs, or create a separate footnote appendix.

Software tools to take the paperwork out of writing. WORD-PAC.

dBase II™

dBase II is a powerful easy-to-use data management tool for constructing and manipulating numeric and character information files. A special feature of dBase II is its own English-style program building language. You may SORT, EDIT, or DISPLAY a database directly from the keyboard, or write menus and programs to support your specific applications. (Ashton-Tate, Inc.™)
dBase II is ideal for any application that involves the storage of data and retrieval in a variety of ways. For example, you could use dBase II to maintain sales statistics by listing every sale with details of product, quantity, price, salesman and customer. You would then be able to retrieve data in any useful form you want – sales totals by customer, salesman product or date – updated every time you enter a new sale.
Whatever your application – inventory control, estimating, costing, indexing, maintaining statistics, addresses – dozens of business and leisure applications.
As well as dBase II itself, with the Budget Plus you get Tutor - to help you get dBase II working to solve your problems and ZIP, a program that speeds and simplifies dBase II's operation.

OSBORNE 1 Standard Features.

Standard Hardware:
- Z80A™ CPU with 64K RAM.
- Dual floppy disk drives with 204K bytes storage each.
- 5" Green phosphor CRT with 52/80/100 column display.
- Business keyboard with numeric keypad and cursor keys.
- RS-232C and IEEE 588 Interfaces.
- Weather-resistant, portable housing.
- Operates on International voltages.

Standard Software:
- WORDSTAR® word processing.
- MAILMERGE® mail list.
- SUPERCALC™ electronic spreadsheet.
- CBASIC® programming language.
- MBASIC® programming language.
- CP/M® operating system.

OSBORNE 1 Optional Extras.

- Battery pack for one hour of processing.
- 300 baud auto-answer, auto-dial modem complete with software. (Pending Telecom approval).

Optional Software

Forth™: Forth is a high-level computer language in which the Osborne user can use the vocabulary provided, or extend it with his own words for specific applications. This language is ideal for controlling peripheral devices such as printers, cameras, timers and laboratory devices.

Microsoft® Basic Compiler: Allows Osborne users to compile their MBasic interpretive programs into true Z80 machine code. The Basic Compiler provides you with three major benefits:
1) increased speed of execution for most programs;
2) decreased program size for extremely large programs;
3) source code security.

DataStar™: DataStar is an easy-to-learn, versatile and comprehensive data entry program, retrieval and update system for your Osborne. DataStar handles recordkeeping applications from initial form design through updating, addition/deletion, and search/retrieval of records.

SuperSort™: Allows the Osborne user to perform sorting, merging, and record selection functions on data files.
SuperSort is compatible with Basic, Fortran, Cobol and assembler application programs, and can also be used with mail lists maintained with Mailman and WordStar.

Personal Datebook™: This popular program handles a calendar and appointment schedules for two people or offices (using Osborne 1 single density), keeping an accurate and complete schedule for the busy executive or professional.

Mailman™: Mailman creates and manages your mailing list.

Milestone™: Milestone is used for the planning, priority scheduling and tracking of small projects on your Osborne computer. Milestone creates Gant project charts and can be configured to find the critical path of a project.

Money Maestro™: Money Maestro is designed to provide financial recordkeeping, tax reporting and budgeting for professionals, clubs, families, and very small businesses.

muMATH-80™: muMATH-80 is a fully interactive Symbolic Math System that efficiently and accurately performs true algebraic and analytic operations.

System Checker™: A very simple verification program which allows the Osborne owner to have confidence in operation of the computer.

Disk Doctor™: This program reclaims damaged diskettes and allows you to recreate accidentally erased files.

BSTAM™: BSTAM is the telecommunications program that allows the Osborne user to send and receive any CP/M file with complete error checking.

OSBORNE

BUDGET PLUS

of the screen refresh can often clash with our mains frequency, producing wobble, flicker and other eye-irritating nasties. On the Executive, Setup can be told what the mains frequency is, and will adjust the screen frequency to avoid these problems.

But one thing Setup cannot do is edit the programmable function keys. Nor, infuriatingly, can it be programmed to send two 'ESCape' characters (Hex 1B) after each other.

The most obvious use of Setup for programming function keys lies in telecommunications, where logging on to remote computers can be a matter of typing up to 30 characters in batches of 10 (or so) — any one of which, if mistyped, can force you to start again. Press the 'control' key and one of your pre-programmed function keys, and the whole string will go out perfectly.

I find this invaluable on WordStar, where quite complex sequence of multi-key commands can be transmitted with one finger. The trouble is that when you come to alter a sequence, you have to type in the new sequence from the start — you cannot just change the offending character. It may seem a small quibble, but when you have WordStar loaded, a file ready to save and find that you've accidentally left out the letter S in a complex save and print sequence, tempers can wear thin.

Since there is no editor, when typing in programmable sequences there has to be some way of telling Setup that you have finished. Osborne chose two ESCape characters as the indication. So you cannot program your telecom system to send two ESCape characters sequentially — which is something you have to do, using Osborne's own approved Amcall program, in order to transmit an ESCape to the remote computer. A silly oversight.

One other thing that Setup cannot do is change the screen width.

It is perfectly possible, with the Osborne 1, to set up the machine (using the SETUP.COM program) so that no user is ever aware that he has 128 characters, or that there is any scrolling ability. There were reasons why this wasn't done — principally, the 80-column WordStar menu displays, which would have been illegible.

But none of these apply to the Executive.

The designers have thrown that nice wide screen away. With automatic 'scrolling' off, the machine set to have a logical screen width of 80 columns and standard software running, no one would ever be troubled by screen flicker, or horizontal scrolling jump. The only possible drawback would be that since the new screen actually needs 12-bit memory, it would use up quite a few memory chips to do this — but with only 4 kbytes devoted to video memory, the extra involved could hardly be seen as prohibitive.

This is particularly irritating when you switch to WordStar.

Most users of the Osborne 1 queue up for a neat little patch to WordStar, which stops that program pretending that it is sending display characters down a serial line to a dumb terminal, and makes it print them direct on the screen.

WordStar normally sends cursor address signals to the screen handling routines of the Console Command Processor in CP/M, which then moves the cursor, then comes back for the character, then asks for the cursor position, and so on. Cut that out, and the result is that Osborne 1 WordStar is one of the quickest text editors you ever saw, because it can update a screen faster than you can see.

It also gave its users the option of a 128 column display (only 52 visible at any one time. If and when you produced a document that was over 79 columns wide, you could see it exactly as it would print out, whereas normal WordStar users would have to put up with lines that took two lines on screen).

For this version of WordStar, MicroPro spotted that this was daft, and produced a system of horizontal scrolling *exactly like the Osborne horizontal scroll* so that, as you typed across the screen, the whole screen moved to the left.

But it did this with cursor addressing. You can go mad, watching a horizontal

Why buy an imitation . . . when you can have the real thing? EPSON

The new EPSON RX-80 dot matrix printer, featuring 8KB ROM, uses proven EPSON MX series technology combined with several new features to take the lead in moderately priced printing. Ideal for both business and personal computing use, the RX-80 guarantees the same reliability and versatility that has made the EPSON MX series the world's best selling printers.

Easy To Use, Easy To Own

ROM expansion to 8KB, and extended functions make the RX-80 easy to use, and its affordable price makes it the cost performance leader.

Quick And Quiet

Printing speed is 100 cps, ensuring high throughput. A quiet mode (decreasing 3dB) at 50 cps makes it welcome in any office environment.

A Full Character Set And More

Two full 96 ASCII character sets plus 11 international character sets provide versatile printing capability. 128 types of characters include emphasized character prints, double-strike prints, elite, alternate (Italics). Character programming is simple and easy. Programming of international character sets for USA, France, Germany, England, Denmark I, Denmark II, Sweden, Italy, Spain, Japan and Norway can also be performed quickly and with a minimum of effort. Margin setting is simple thanks to right, left and bottom user-defined margins. In addition, EPSON HX-20 portable computer graphics and characters can be printed.

Upgrade Options

In addition to the many outstanding features found on the MX series, the RX-80 also has several new functions which giving greater efficiency to the user's present systems. The current optional interface boards can also be used with the RX-80.

Expanded Commands

To meet more complicated and diverse user needs, 12 types of 1 byte command, and an expanded command group of 54 commands (following ESC) are provided.

6 Bit Image Modes

Hard copy possibilities have been greatly expanded thanks to the RX-80's 6 bit image print modes. These include 1920 dot per 8-inch quadruple density, 640 dot per 8-inch CRT graphics, and 720 dot per 8-inch CRT graphics II. These can be used in the same print line in any combination.

Paper Wizard

3 copies (including original) can be printed on 4" to 10" wide fanfold paper. Form length is programmable up to 127 lines. Paper feed is tractor feed.

Easy Maintenance, Low Power Consumption

An easily removable cover provides access to the interior for speedy maintenance. The RX-80 is economical too, having a power consumption of only 70VA max.

Making The Best Even Better

When you add it all up, cost performance, function and real versatility, there's no other printer to match the RX-80. Throughout the world the name to remember in printers is EPSON. Anything else is second best.

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scroll; but you can go mad in spades watching it happen, line by line, with cursor addressing.

If horizontal scrolling is bad, why use WordStar's latest version? And if it's good, why throw it away?

CP/M plus

Most changes from ordinary CP/M to CP/M Plus are ones which the user won't notice — bar one. There will be no more moments of 'Horrors, Bdos Error!' because it automatically logs onto a diskette as soon as it goes into the drive.

Most improvements to CP/M Plus lie in the speed and sophistication of diskette handling. This is not the moment for an explanation of what one means by 'hashed directory access', or 'least recently used sector buffering' or 'multi-sector 1/0 primitive', beyond saying that they can enormously speed up programs that use the disks a lot, and they are all features of CP/M Plus.

It can also speed up the way the system handles the screen, and the way programs and program overlays are loaded.

designed for the larger memory space, better screen handling and faster disk abilities of this operating system, will absolutely walk over those that are built round CP/M 2.2 In particular, when hard disks are more available, the ability to have files of 32 megabytes on disks of up to 512 megabytes capacity will enormously improve database managers.

In the circumstances, I found it easy to agree to Osborne engineers' requests not to run the benchmarks. Their objections were on the grounds that the performance improvement in MBasic programs might not be shown on the final production machines, if somebody puts more 'wait states' into the circuit board. My objections to the project were simpler: a) the MBasic interpreter is identical; b) there was obviously no change in the approximate speeds (a two per cent speed increase was indicated, which is not enough to write home about); and c) it would be a complete waste of an afternoon's hard graft with stopwatch and keyboard, because it totally ignored all the new go-faster features of the machine, in favour of testing a language which is very little used for commercial applications.

Overall impressions

This is the year of the IBM personal computer, 16-bit software, and MS-DOS.

As eight-bit systems go, the new Osborne — to be launched this month although shipping to the UK will not start until September — offers a lot of software for a reasonable price — and several performance improvements over standard CP/M systems. But it does remain disappointing in terms of what one might have expected.

Quite what the 16-bit version will be like, only time will tell. All we know at the moment is that it will offer colour, probably an extra application package (like Lotus 123 or Visi0n) and two 16-bit operating systems. We also know that a company called Personal Computer Products has just announced a deal with Osborne, to design the 8088 co-processor card for the Executive II.

By the time that machine is ready, there will be more than one portable on the market capable of running IBM personal computer software. One of them may even be an IBM machine.

On the positive side, the machine answers most criticisms of the Osborne 1, and looks good value for money — the Australian tag is expected to be $3995 (incl. tax). And Osborne is now established with enough dealers, and in enough corporate buying plans, that the upgrade will probably be a noticeable success.

All it needs, really, are double-sided diskettes, and a 132 column scrollable 'window' screen.

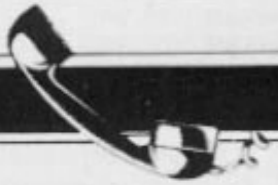
END

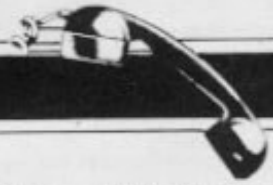
DIARY DATA

DIRECT ACCESS

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Sydney	Electronic and Computer Games and Toys '83 Contact: Industrial Presentations Australia, Telephone: (02) 412 4377	August 18—21, 1983
Melbourne	10th Australian Computer Exhibition Contact: Riddell Exhibition Promotions. Tel: (03) 699 1066	September 27—30, 1983
Boston, USA	CP/M '83 for the CP/M operating system Hynes Auditorium	September 29— October 1, 1983
Hong Kong	Consumer Electronics Show 1983 Regent Hotel/New World Hotel Contact: Ms Narelle McKinnon on Sydney 232 2422	October 15—17, 1983
Brisbane	Computer Expo '83 Contact: Robert Woodland Exhibitions. Tel: (07) 372 3380	November 4—6, 1983





NETWORK NEWS

Here is a list of all Australian personal computer networks. As more networks appear — and as more facilities are added to existing ones — we'll report them in this section, which appears monthly.

CYBERNET. Operator: Control Data Australia Pty Limited, 493 St Kilda Road, Melbourne 3004. Telephone: (03) 268 9500. Sales offices in every capital city. Facilities: Access to hundreds of applications from statistical analysis, financial modelling, linear programming, structural analysis, mineral evaluation to data base management. Hours: 0600 to 2400, Monday to Friday.

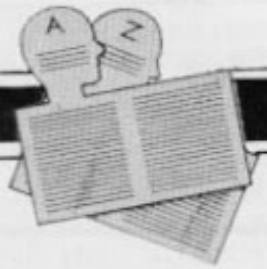
MICOM CBBS. Operator: The Microcomputer Club of Melbourne, P.O. Box 60, Canterbury 3126. Facilities: Computer bulletin board system, allows users to exchange messages on subjects of mutual interest. Free of charge. Hours: 24 hours/day, 7 days/week (single 'phone line only). Access number: 762 5088. Protocol: full duplex ASCII, 8 data bits, 1 stop bit, no parity.

The Australian Beginning. Operator: The Australian Beginning Pty Ltd. 364 LaTrobe Street, Melbourne. Tel: (03) 329 7998. Facilities: Information service, electronic mail, software storage and software downloading. Hours: 24 hours/day, 7 days/week.

INFONET. Operator: Network Services Division of Computer Sciences of Australia Pty Ltd, 460 Pacific Highway, St Leonards, NSW. Tel: (02) 439 0033. Facilities: Access to databases produced by the Australian Bureau of Statistics and the Institute of Economic and Social Research. Hours (E.S.T.): Monday to Friday (7am to 9pm), Saturday (8am to 5pm) and Sunday (8am to 11.30am).

AUSINET. Operator: ACI Computer Services, P.O. Box 42, Clayton, Victoria. Tel: (03) 544 8433. Facilities: Medium to database whose subject coverage includes agriculture, education, energy, industry, public affairs, science and technology and an online Australian database directory. Hours: 8.30am to 9.00pm E.S.T. Monday to Friday.

IP Sharp Associates Network. Operator: IP Sharp Associates Pty Ltd, 13th Floor, 175 Pitt Street, Sydney. Tel: (02) 232 6366. Facilities: The network is an international time sharing data processing network, the host computers being located in Toronto, Canada. Hours: 24 hours/day, 7 days/week.



USER GROUPS INDEX

Below is a list of alterations and additions to the list of user groups published in the last issue. The next full listing will appear in the December issue of APC.

VICTORIA

We reprint a letter received from Ross McKenzie of the Victorian Association of Computer Educators:

"I am a member of the executive of V.A.C.E. We would like you to include our group in your list of User Groups, or in some other similar way. As I write we have over 170 member schools. The predominant interest group at present is APPLE but we are aware that with time this will, and must, change.

Our Secretary is: Arthur Tatnall, P.O. Box 69, Whittlesea 3757.

We are a school-based group and rather unlike other user groups in that we have few private members —only those in education who might otherwise be excluded.

Owners of RCA VIP, ETI 660, DREAM 6800 or the new Comx 35 micro are welcome to contact Frank Rees at 27 King Street, Boort 3537 for details of a user group. A newsletter is produced and the Chip 8, 6800 and 1802 languages are catered for.

ACT

A VIC 20 User's Association has been operating for the last five months. It publishes a bi-monthly newsletter and distributes cheap software. For more information, including details of a monthly meeting, phone (062) 41 2316 or write to 25 Kerford Street, Watson 2602.

NEW SOUTH WALES

The APF Users Group has been formed and is looking for additional information, etc. Contact Norm McMahon on (02) 44 2645 or write to 288 Kissing Point Road, Turramurra 2074.

TI 99/4A SOFTWARE

Texas Instruments

Cassette Programmes (exclusive to Australia)

DEALER ENQUIRIES WELCOME

		Price	Quantity
1.	Games Tape 1 *Two exciting graphic games — Caterpillar and Invader. Both on one tape.*	$11.95	.....
2.	Games Tape 2 *Two exciting games — Snake and Space Attack, both with graphics and sound.*	$13.95	.....
3.	Haunted House *Dare you enter and explore the ruined mansion? Treasures await the brave, but stay after midnight at your peril! Play only in daylight.*	$13.95	.....
4.	Sorcerer's Castle *49 locations to explore. Can you rescue the captive princess from the clutches of the evil wizard? There are keys and weapons to aid your quest, but can you defeat the guards?*	$13.95	.....
5.	Lunar Lander/Wumpus *Lunar lander — guide your landing capsule to a safe landing on the moon's surface. On side 2 is Wumpus.*	$13.95	.....
6.	Fruit Machine/Blackjack *Two great games for gamblers. On side one is Fruit Machine which includes hold feature and colour graphics display. On side 2 is Blackjack.*	$13.95	.....
7.	3-D Maze *You may think à maze is easy to solve from above, but can you escape when you are actually inside the maze. Stunning 3D effect gives a nat's-eye view! 85 levels of difficulty.*	$13.95	.....
8.	Towers of Hanoi/Noughts and Crosses *2 great programmes on one tape. Towers of Hanoi is a puzzle. On side 2 is the traditional game of noughts and crosses.*	$13.95	.....
9.	Nim *Nim is one of the oldest games known and is thought to have originated in China. This excellent programme makes the computer a very good player, but it is possible with skill, to beat it.*	$11.95	.....
10.	Island Adventure *A superb adventure game, suitable for both beginner and more experienced player. Explore the island in your search for the treasure, but watch out for pirates.*	$13.95	.....
11.	Forbidden City *An adventure for those who enjoy a challenge! A deserted alien city awaits you.*	$13.95	.....
12.	Mastermind *The old favourite Mastermind — a game of logic.*	$11.95	.....
13.	Pharaoh's Curse *Do you believe in the curse of the pharaoh's? We think you will after playing this game. Ideal for the beginner or less experienced player, this game takes place amongst the pyramids of ancient Egypt.*	$13.95	.....
14.	Devil's Island *A great escape adventure. Fight to avoid the many hazards in your attempt to escape from the island. You won't find this easy.*	$13.95	.....
15.	3-D Noughts and Crosses/ Russian Roulette *Two great games on the one tape.*	$13.95	.....
16.	Chalice *Can you retrieve the golden chalice from the ruined temple of Kalmar? 10 skill levels to test both memory and reflexes.*	$13.95	.....
17.	Bomber *Your plane is faced with desperate fuel shortage. You must bomb away the skyscrapers below to form a runway before you crash.*	$11.95	.....
18.	Alien Attack/Penguin *2 more great games on the one tape.*	$13.95	.....
19.	Arithmetic *Covers addition, subtraction, multiplication and division. The maximum number covered is set by the user or parent, thus making this program suitable for all levels of ability. Age guide 5 to 12 years.*	$13.95	.....
20.	Spelling and Anagram *This programme gives 3 alternative spellings of a word and asks which is correct. A new word is given only when the correct spelling has been typed in. Three skill levels. The second part of the programme, Anagram, will generate anagrams to be deciphered. Age guide 8 to Adult.*	$13.95	.....

Please add $1 for orders under $20. Orders over $20 post free. I enclose ..... for the above programmes.

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PROGRAMS

APC is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs to APC please include the following:

(a) A cassette or disk of the program.

(b) A listing on plain, white paper (typewritten if no printer available).

(c) Comprehensive but brief documentation.

(d) A suitable SAE if you would like your materials to be returned after use.

Please mark (a), (b) and (c) with your name, address, program title, machine (state minimum RAM where appropriate) and — if possible — a daytime phone number. All programs must, please, be fully debugged. Programs are paid for at the rate of $20 per page of published listing, plus a $50 bonus for the Program of the Month. Send contributions to: APC Programs, P.O. Box 298, Clayton, Vic 3168.

We'll do our best to acknowledge receipt of programs as quickly as possible, but following this acknowledgement it will usually be some time before a decision can be made, so please be patient! Generally speaking, programs which are rejected for any reason are returned fairly quickly, so 'no news . . .'

ZX81 Least Squares

Least Squares is a linear regression fitting program for the 16k ZX81. Given a set of (x,y) co-ordinates, the program uses the method of least squares to calculate the equation of the best straight line through the given points. It uses a parallelogram of errors to calculate the expected errors in gradient and constant, as well as giving two widely-spaced co-ordinates to facilitate easy plotting of the line.

Subject to the amount of memory available, the program will allow any number of coordinates to be entered, although it must obviously be given a minimum of two. The coordinates may be entered in any order and the program does work for a perfectly straight line. For those of you who get some kind of perverse pleasure out of confusing poor, defenceless micros, you can defeat this one by entering coordinates of either the x or y axis the only cases where the program falls down.

```
 100 PRINT "THIS PROGRAM WILL GI
VE THE      EQUATION OF THE BEST
 STRAIGHT   LINE THROUGH ANY SET
 OF POINTS  USING THE LEAST SQUA
RES METHOD."
 110 PRINT
 120 PRINT "THE POINTS MAY BE EN
TERED IN    ANY ORDER.  THE COMP
UTER WILL   ALSO GIVE THE COORDI
NATES OF TWOWELL SEPARATED POINT
S ON THIS   BEST STRAIGHT LINE T
O FACILITATEPLOTTING THIS STRAIG
HT LINE ON AGRAPH.  THE COMPUTER
 ALSO GIVES THE STANDARDISED ERR
ORS IN BOTH THE GRADIENT OF THE
GRAPH AND INTHE CONSTANT, PROVID
ED THAT     THESE ERRORS ARE NOT
 ZERO."
 130 PRINT
 140 PRINT "PRESS ANY KEY TO CON
TINUE."
 150 IF INKEY$="" THEN GOTO 150
 160 CLS
 170 PRINT "HOW MANY PAIRS OF PO
INTS ? ";
 180 INPUT N
 190 IF N<=1 THEN GOTO 180
 200 PRINT N
 210 DIM X(N)
 220 DIM Y(N)
 230 PRINT
 240 LET L=2
 250 FOR I=1 TO N
 260 PRINT "POINT ";I;TAB 10;"X-
COORDINATE ? ";
 270 INPUT X(I)
 280 PRINT X(I)
 290 PRINT TAB 10;"Y-COORDINATE
? ";
 300 INPUT Y(I)
 310 PRINT Y(I)
 320 PRINT
 330 LET L=L+3
 340 IF L<=18 THEN GOTO 370
 350 CLS
 360 LET L=0
```

PROGRAMS

```
370 NEXT I
380 LET SX=0
390 LET SY=0
400 LET SXY=0
410 LET SX2=0
420 LET SY2=0
430 FOR I=1 TO N
440 LET SX=SX+X(I)
450 LET SY=SY+Y(I)
460 LET SXY=SXY+X(I)*Y(I)
470 LET SX2=SX2+X(I)*X(I)
480 LET SY2=SY2+Y(I)*Y(I)
490 NEXT I
500 LET S=N
510 LET MX=((SX*SY)-(S*SXY))/((
SX*SX)-(S*SX2))
520 LET CX=((SX*SXY)-(SY*SX2))/
((SX*SX)-(S*SX2))
530 LET MY=((SX*SY)-(S*SXY))/((
SY*SY)-(S*SY2))
540 LET CY=((SY*SXY)-(SX*SY2))/
((SY*SY)-(S*SY2))
550 LET CY=-CY/MY
560 LET MY=1/MY
570 LET M=(MX+MY)/2
580 LET C=(CX+CY)/2
590 LET L=1E10
600 LET L2=1E10
610 LET B=-1E10
620 LET B2=-1E10
630 LET R=-1E10
640 FOR I=1 TO N
650 IF X(I)<L THEN LET L2=Y(I)
660 IF X(I)<L THEN LET L=X(I)
670 IF X(I)>B THEN LET B2=Y(I)
                .)>B THEN LET B=X(I)
690 IF ABS (Y(I)-(M*X(I)+C))>R
THEN LET R=ABS (Y(I)-(M*X(I)+C))
700 NEXT I
710 LET L1=M*L+C
720 LET B1=M*B+C
730 LET DM=0
740 LET DC=0
750 IF N<=2 THEN GOTO 780
760 LET DM=(ABS (((B2-L2+2*R)/(
B-L))-M))/SQR (N-2)
770 LET DC=R/SQR (N-2)
780 CLS
790 PRINT "THE EQUATION OF THE
BEST        STRAIGHT LINE THROUG
H ALL THE   POINTS IS
            ",,"Y=";
800 IF M<>1 THEN PRINT M;
810 PRINT "X";
820 IF C<0 THEN PRINT "-";ABS C
830 IF C>0 THEN PRINT "+";C
840 IF C=0 THEN PRINT
850 IF DM=0 THEN GOTO 870
860 PRINT ,,"THE STANDARDISED E
RROR IN THE   GRADIENT IS +/-";D
M
870 IF DC=0 THEN GOTO 890
880 PRINT ,,"THE STANDARDISED E
RROR IN THE   CONSTANT IS +/-";D
C
890 PRINT ,,"TWO POINTS ON THIS
LINE ARE      X=";L,"Y=";L1,"X="
;B,"Y=";B1
900 STOP
```

System 80 SLC-2

by E F Grimes

The System 80's ability to load from and save to an external cassette-player is primarily intended for file-handling, but can also come in useful when a cassette refuses to load from the built-in unit. There is, however, no facility for loading SYSTEM tapes from an external cassette-player, hence this routine.

Once entered into the computer, the routine is available to the user even after typing new since it is stored above user-RAM. To load a SYSTEM tape from an external cassette-unit, type 'LOAD'. This will give you a modified system prompt, namely 'SYSTEM LOAD -2 '. The filename is now entered in the usual way.

SLC-2 is stored in the communications area of RAM normally used by the disk operating system. This means that the routine is incompatible with disk-based System 80s, but since it is specifically designed to overcome cassette loading problems, this is of no consequence.

```
100 CLEAR 100
110 POKE 16866,195 : POKE 16867,62 : POKE 16868,64
120 POKE 16776,195 : POKE 16777,62 : POKE 16778,64
130 CLS:PRINT TAB(7)"SCL2 - TO LOAD SYSTEM TAPES FROM CASSETTE C-2."
140 PRINT TAB(7) STRING$(46,61)
150 PRINT
160 PRINT"THE PROMPT IS MODIFIED TO READ :-";STRING$(10,32);"SYSTEM LOAD C-2"
170 PRINT STRING$(43,32);"*? ";CHR$(95)
180 PRINT
190 PRINT"IT SHOULD BE ANSWERED BY THE FILENAME IN THE USUAL WAY.THE TAPE"
200 PRINT "WILL THEN LOAD FROM CASSETTE C-2."
210 PRINT "ONCE LOADED, SLC2 MAY BE RE-ENTERED FROM BASIC AT ANY TIME BY"
220 PRINT"TYPING 'LOAD' & THEN 'NEW LINE'."
230 PRINT"(SLC2 RESIDES IN A SECTION OF MEMORY UNUSED BY LEVEL II, SO A"
240 PRINT"SYSTEM TAPE CAN BE LOADED ANYWHERE IN FREE MEMORY).":PRINT CHR$(10)
250 FOR N=0 TO 65
260 READ D : POKE 16446+N,D
270 NEXT N
280 SYSTEM
290 DATA62,201,50,226,65,33,110,64,205,117,43,49,136,66,205,254,32,62,42,205,42
300 DATA3,205,179,27,218,204,6,215,202,151,25,254,47,202,29,3,62,17,205,18,2,205
310 DATA150,2,195,209,2,83,89,83,84,69,77,32,76,79,65,68,32,35,45,50,0,0,0
```

★ ★ Program of the month ★ ★

TRS-80/System 80
Domain of the Djinn

by David Marsh

'Domain of the Djinn' is a well-written and thoroughly absorbing adventure game for a System 80/TRS-80 with at least 12k RAM.

The Domain is a six-storey building, each floor consisting of a maze of rooms and passages. Along with either one or two friends, your task is (surprise, surprise!) to find the treasure hidden in one of these rooms. To do this, you and your team wander through the Domain picking up the odd artefact along the way and generally being nosey.

The Domain, naturally enough, is inhabited by an assortment of zombies, trolls, ogres, dragons and other dodgy types who make it their business to lurk in dark corners — doing whatever it is mythical monsters do in dark corners. On meeting one or more of the Domain's tenants, you have a number of options; including striking up a friendly conversation, and, very sensibly, getting the hell out of it! For braver souls, you also have the option to pick a fight in order to claim the contents of the room, but I should warn you that some of the occupants have distinctly violent tendencies. Also, you shouldn't be too surprised if the room turns out to be empty after you've gone your ten rounds with a hungry goblin.

Movement through the maze is by use of the N, S, E and W keys to represent the four points of the compass. When you come across some stairs, you can go either up (U) or down (D) (logical enough). It should be noted, however, that things can get distinctly hairy down in the lower regions.

Your chances of coming out of a confrontation with an irate centaur — with the same number of limbs as when you entered the room — depend on the relative strengths of your team and that of your opponent. These strengths are measured in terms of four factors: survival, battle, magic and communication. Initially, you have to choose your team to obtain what you feel to be the optimum combination of these factors. During your journey, the more fights you win, the more monster-types you manage to convert to your noble cause (getting rich quick), and the greater the area of the maze you manage to explore, the greater your party's strength.

Survival is a measure of fighting power. Running out of survival points is not recommended since your life runs out with them. Battle points are a measure of your fighting skills — the more points you have, the less likely your opponents are to see your body as a convenient place to stick their swords. Communication points measure your ability to sweet-talk yourself out of tricky situations ('there, there, nice dragon' — that sort of thing). Magic points measure, well, magic.

Game points are awarded for various reasons: the acquisition of gold, platinum, jewels, artefacts and killing the Djinn who, incidentally, are neither poor nor defenceless — so don't waste any sympathy on them! The artefacts referred to include such things as Rhombs — handy-sized hyperspace units enabling you to jump from one place to another instantly.

However, they only work on the level you're on.

In dire emergency, you can effect a hasty exit by pressing the panic button. Since this key is noticeably lacking on the TRS-80 keyboard, SHIFTed E has to serve. This does get you out of whatever mess you've got yourself into, but at a price: you lose all your treasure to a hyperspace junkyard. You're also liable to end up just about anywhere and you can't rely on this feature too often.

Before you begin your epic voyage into the unknown, take a bit of time to choose your team carefully. Magicians rate highly on communication and magic, but they don't make particularly good 'minders'; fighters are good in battle but have the IQ of educationally sub-normal carrots. Our referee also recommends staying well clear of the lower levels until you have some strong fighters on your side!

In case all this sounds complicated, it is. It's not the sort of game you can master in ten minutes and wonder what to do next. The menus and input prompts are all quite straightforward, though, so you shouldn't have any problems running it. All in all, an addictive game — I'd certainly like to see more programs of this standard being submitted to *APC* Programs. Now you're not going to take a challenge like that lying down, are you?

DSE/A557/JW

PROGRAMS

```
1 RANDOM:GOTO5000
10 E=INKEY$:RT=0:AR="":FORU=1TO500:NEXT:CLS:PRINT@60,L;:FORU=0TO19:FORV=0TO6:S=V
AL(RIGHT$(STR$(N(L,U,V)),2)):PRINT@U*3+V*128,A(S);:NEXTV,U
25 RU=RU-1:FORU=0TO119:RESET(U,0):RESET(U,4):NEXTU:FORV=0TO4:RESET(0,V):RESET(
119,V):NEXTV:PRINT@896,CHR$(31);:GOSUB200:ET="":ET=INKEY$:IFET=""THEN30ELSEFORU
=1TO30:FORV=X1*6+2TOX1*6+3:RESET(V,Y1*6+2):SET(V,Y1*6+2):NEXTV,U
30 PP=0:E=INKEY$:IFE=""ANDET=""THEN30ELSEE=LEFT$(E+ET,1):PRINT@896,CHR$(31);:IFE
="N"THEN75ELSEIFE="S"THEN40ELSEIFE="W"THEN160ELSEIFE="E"THEN45ELSEIFE="M"THEN50
ELSEIFE="A"THENPP=1:GOTO1000ELSEIFE="U"THEN230ELSEIFE="D"THEN240ELSE30
35 IFY1=0THEN30ELSEIFPOINT(6*X1+2,6*Y1)=0THEN30ELSEIFN(L,X1,Y1-1)=0THENGOSUB70:N
(L,X1,Y1-1)=PQ
36 PRINT@X1*3+(Y1-1)*128,A(VAL(RIGHT$(STR$(N(L,X1,Y1-1)),2)));:IFPOINT(X1*6+2,6*
Y1-1)=0THEN80ELSEX2=X1:Y2=Y1:L2=L:Y1=Y1-1:GOTO100
40 IFY1=6THEN30ELSEIFPOINT(X1*6+2,Y1*6+5)=0THEN30ELSEIFN(L,X1,Y1+1)=0THENGOSUB70
:N(L,X1,Y1+1)=PQ
41 PRINT@X1*3+(Y1+1)*128,A(VAL(RIGHT$(STR$(N(L,X1,Y1+1)),2)));:IFPOINT(X1*6+2,Y1
*6+6)=0THEN80ELSEX2=X1:Y2=Y1:L2=L:Y1=Y1+1:GOTO100
45 IFX1=19THEN30ELSEIFPOINT(X1*6+5,Y1*6+2)=0THEN30ELSEIFN(L,X1+1,Y1)=0THENGOSUB7
0:N(L,X1+1,Y1)=PQ
46 PRINT@(X1+1)*3+Y1*128,A(VAL(RIGHT$(STR$(N(L,X1+1,Y1)),2)));:IFPOINT(X1*6+6,Y1
*6+2)=0THEN80ELSEX2=X1:Y2=Y1:L2=L:X1=X1+1:GOTO100
50 IFX1=0THEN30ELSEIFPOINT(X1*6,Y1*6+2)=0THEN30ELSEIFN(L,X1-1,Y1)=0THENGOSUB70:N
(L,X1-1,Y1)=PQ
51 PRINT@(X1-1)*3+Y1*128,A(VAL(RIGHT$(STR$(N(L,X1-1,Y1)),2)));:IFPOINT(X1*6-1,Y1
*6+2)=0THEN80ELSEX2=X1:Y2=Y1:L2=L:X1=X1-1:GOTO100
70 PQ=11*(RND(2)-1):IFRND(5)=1THENPQ=PQ+5+RND(6)ELSEPQ=PQ+RND(5)
71 RETURN
80 PRINT@896,CHR$(31);:PRINT@896,"DEAD END";:GOTO25
100 IFVAL(RIGHT$(STR$(N(L,X1,Y1)),2))>11THEN300ELSE25
200 MM=0:SX=VAL(RIGHT$(STR$(N(L,X1,Y1)),2)):IFSX>11THENRETURNELSEIFN(L,X1,Y1)>10
0THENMM=INT(N(L,X1,Y1)/100):GOTO210ELSERA=RND(8):IFRA=2ANDL=6THENMM=10ELSEIFRA=1
THENMM=11ELSEIFRA=2THENMM=12ELSEIFRA=3THENMM=13ELSEMM=10
201 N(L,X1,Y1)=N(L,X1,Y1)+MM*100
210 IFMM=10THENRETURNELSEIFMM=11THENE="UP"ELSEIFMM=12THENE="DOWN"ELSEIFMM=13THEN
E="UP AND DOWN"
220 PRINT@896,CHR$(31);:PRINT@896,"STAIRS "+E:RETURN
230 IFMM<>11ANDMM<>13THEN30ELSEMA=2:L2=L:X2=X1:Y2=Y1:L=L-1:IFL=0THEN3000ELSEIFN(
L,X1,Y1)=0THENGOSUB70:N(L,X1,Y1)=PQ:IFPQ>11THENRU=1
231 GOTO250
240 IFMM<>12ANDMM<>13ORL=6THEN30ELSEMA=1:L2=L:X2=X1:Y2=Y1:L=L+1:IFN(L,X1,Y1)=0TH
ENGOSUB70:N(L,X1,Y1)=PQ:IFPQ>11THENRU=1
250 NA=N(L,X1,Y1):S=VAL(RIGHT$(STR$(NA),2)):IFS>11THEN10ELSEIFN(L,X1,Y1
)=NA+100*(10+MA):GOTO10ELSEIFINT(NA/100)=10THENN(L,X1,Y1)=NA+MA:GOTO10ELSEN(L,X1
,Y1)=1300+S:GOTO10
300 BR%=0:TZ=INT(N(L,X1,Y1)/100):IFTZ=100RND(2)=2THENPRINT@896,CHR$(31);:PRINT@
896,"AN EMPTY ROOM";:N(L,X1,Y1)=N(L,X1,Y1)+1000*(1-TZ/10):GOTO25ELSERN=RND(15+L)
:IFRN>=15THENGOTO6000
305 RA=RND(10):TW=VAL(MID$(B(RA),9,1)):IFTW<LTHEN305ELSENM=(L-TW+1)*RND(3):IFNM=
0ORNM>9THEN305ELSEEZ="":FORU=1TO8:E=MID$(B(RA),U,1):IFE<>" "THENEZ=EZ+E:NEXTU
306 FORU=1TONM:FORV=1TO4:VL=VAL(MID$(B(RA),9+V,1)):Z(U,V)=RND(2(L-1)*VL)+2(L-1
)*(RND(9)-1)*VL/(VL+1):NEXTV,U:SS=0:FORU=1TONM:SS=SS+Z(U,1):NEXTU
309 FORQ=1TOR:FORQ1=1TO4:H(Q,Q1)=0:NEXTQ1,Q:GOSUB8000:GOSUB11000
330 MR=0:SR=0:FORU=1TONM:MR=MR+Z(U,3):SR=SR+Z(U,1):BR%=BR%+Z(U,2):NEXTU:GOTO400
400 PRINT:PRINT"MAGIC ADJUSTMENTS":PRINT"YOUR PARTY LOSES A TOTAL OF"MR" MAGIC F
ACTORS":MS=INT(MR/R):FORU=1TOR:H(U,3)=G(U,3)-MS:NEXTU
401 FORU=1TOR:FORHJ=1TO4:IFHJ=3THENNEXTHJELSEH(U,HJ)=G(U,HJ)+H(U,HJ):NEXTHJ,U:GO
TO440
405 FORU=1TOR:IFH(U,3)<1THENGOTO430ELSEPRINT:PRINTC(U)" ";H(U,3);")";:FORV=1TO
R:PRINT" DO YOU WANT TO GIVE "C(V)" ANY FACTORS?(Y/N)";:GOSUB10000:IFE<>"Y"THEN
430
410 J=G(H(U,3)):IFH(U,3)=0THEN430ELSEINPUT"S";J:IFJ<0ORJ>H(U,3)THEN410ELSEH(V,1)=H(V,1)+
J:H(U,3)=H(U,3)-J:G(U,3)=G(U,3)-J:G(V,1)=G(V,1)+J
412 J=0:IFH(U,3)=0THEN430ELSEINPUT"B";J:IFJ<0ORJ>H(U,3)THEN412ELSEH(V,2)=H(V,2)+
J:H(U,3)=H(U,3)-J
414 J=0:IFH(U,3)=0THEN430ELSEINPUT"C";J:IFJ<0ORJ>H(U,3)THEN414ELSEH(V,4)=H(V,4)+
J:H(U,3)=H(U,3)-J
430 IFH(U,3)>0THENNEXTV,UELSENEXTU
440 IFPP=1THEN10ELSEFORNN=1TO699:NEXTNN:CLS:PRINTTAB(18)"YOUR OPTIONS:-":PRINT:P
RINT"1) ATTACK":PRINT"2) COMMUNICATE":PRINT"3) RUN":PRINT"4) USE AN ARTIFACT":PR
INT"5) REVIEW TROOPS":PRINT"6) SHARE MAGIC":PRINT"7) LOOK":PRINT:PRINT"WHICH?";
450 UO=NM:NM=7:GOSUBP900:J=UM:NM=UO:IFJ=7THENGOSUB11000:GOTO440ELSEONJGOTO800,60
0,700,1000,7000,405
600 IFZ(1,4)=0THENPRINT"COMMUNICATION IMPOSSIBLE":GOTO440ELSEFC=0:FORU=1TOR:FC=F
C+H(U,4):NEXTU:FD=0:FORU=1TONM:FD=FD+Z(U,4):NEXTU:IFNM>RODR2*RO-R(NMTHENPRINT"TH
EY ATTACK":GOTO800ELSEIFD+RND(6)>FCTHENPRINT"THEY ATTACK":GOTO800
610 PRINT"THE "EZ";:IFNM>1THENPRINT"S";
620 PRINT" WILL JOIN YOUR PARTY":FORU=1TONM:FORV=1TO4:G(R+U,V)=Z(U,V):NEXTV:G(R+
U,0)=RA+Z(U,1)+EZ+STR$(U):NEXTU:R=R+NM:GOTO900
700 IFRU>=0THENPRINT"RUNNING IS IMPOSSIBLE":GOTO440ELSEX1=X2:Y1=Y2:L=L2:GOTO10
800 WF=0:FORU=1TOR:F(U)=0:NEXTU:IFR=1THENB3ELSEPRINT"HOW MANY WILL FIGHT";:UO=N
M:NM=R:GOSUBP900:UN=UM:NM=UO:IFUN=RTHENB3ELSEPRINT"NAMES";:FORU=1TOUN
805 INPUTE:FORV=1TOR:IFC(V)=ETHENF(V)=1:NEXTUELSENEXTV:PRINT"WHO";:GOTO805
808 CLS:FORU=1TONM:IFZ(U,1)<1THENNEXTUELSEPRINT@4*U,U;:NEXTU
810 FORU=1TOR:IFF(U)=0THENNEXTU:GOTOB30ELSEUV=0:FORV=1TO200-12*L:NEXTV:PRINT@640
,CHR$(31);:PRINT@640,C(U);" WHICH DO YOU ATTACK?";:GOSUBP900:HF=H(U,2)+RND(4*INT
(L/2))-3*L:IFHF(Z(UM,2)THENPRINT" MISS":NEXTU:GOTOB30
811 PRINT" HIT";:PL=L*(HF-Z(UM,2)):PM=2(PL-(PL-14)*SGN(INT(PL/14))):UY=RND(PM-(P
M-32760)*SGN(INT(PM/32760))):Z(UM,1)=Z(UM,1)-UY:IFZ(UM,1)>0THENNEXTU:GOTOB30ELSE
PRINT"DEAD":PRINT@4*UM," ";:IFEZ="DJINN"THENJD=1ELSEIFEZ="GIANT"THENFORWC=1TONM:
Z(WC,3)=0:NEXTWC
820 FORW=1TO200:NEXTW:FORV=1TONM:IFZ(V,1)>0THENNEXTUELSENEXTV:CLS:PRINT"YOU WIN"
:FORU=2TO4:SR=0:FORV=1TONM:SR=SR+Z(V,U):NEXTV:SR=SR/2(L+1):R:FORV=1TOR:G(V,U)=G
(V,U)+SR+2(L-1)*ABS(U-2)ANDG(V,0)=1ORU=2ANDG(V,0)=2):NEXTV,U:GOTO900
830 FORU=1TONM
832 IFZ(U,1)<=0THENNEXTU:GOTO840ELSERH=RND(R):IFF(RH)=0THEN832ELSEFORO=1TO200-(L
+NM)*5:NEXTO:PRINT@640,CHR$(31);:PRINT@640,EZ;U" ATTACKS "C(RH);:HF=Z(U,2)+RND(9
+8*INT(L/2)):IFHF<H(RH,2)THENPRINT"MISS":NEXTU:GOTO840ELSEPRINT"HIT";:UY=2*RND(HF
-H(RH,2))
834 H(RH,1)=H(RH,1)-UY:G(RH,1)=G(RH,1)-UY:IFH(RH,1)<1THENPRINTC(RH)" IS DEAD":G
OSUB4100ELSEPRINTC(RH)" HAS"H(RH,1)" S-FACTORS LEFT"
836 IFR>0THEN840ELSECLS:PRINT"YOUR TEAM IS ALL DEAD":PRINT:PRINT:PRINT"THE DJINN
 HAS BEATEN YOU":PRINT:INPUT"DO YOU WANT ANOTHER GO (Y/N)";E:IFE="N"THENENDELSER
UN
838 FORU=1TOR:P(U)=1:NEXTU:GOTO808
840 FORW=1TO500-25*L:NEXT:IFRU>0THEN808ELSEPRINT"DO YOU WANT TO RUN";:GOSUB1000
0:IFE="Y"THEN700ELSEIFU=NMTHEN808ELSENEXTU:GOTO808
900 SS=SS/2(L+1)/R:FORU=1TOR:G(U,1)=G(U,1)+SS:NEXTU:FORU=1TO500-20*L:NEXT:PRINT
:PRINT"TREASURE (-";:PRINT;TA=RND(INT(L/2)+1):TY=RND(15):IFTY<6THENPRINT"THE SACK
S ARE EMPTY":GOTO950ELSEIFTY=6THENAT="JEWELS"ELSEIFTY<13THENAT="GOLD"ELSEAT="PLA
TINUM"
910 PRINT"THE SACKS CONTAIN"TA" UNIT";:IFTA>1THENPRINT"S";
920 PRINT" OF "AT:IFAR<>""THENPRINT"YOU MAY ALSO TAKE THE "AR
```

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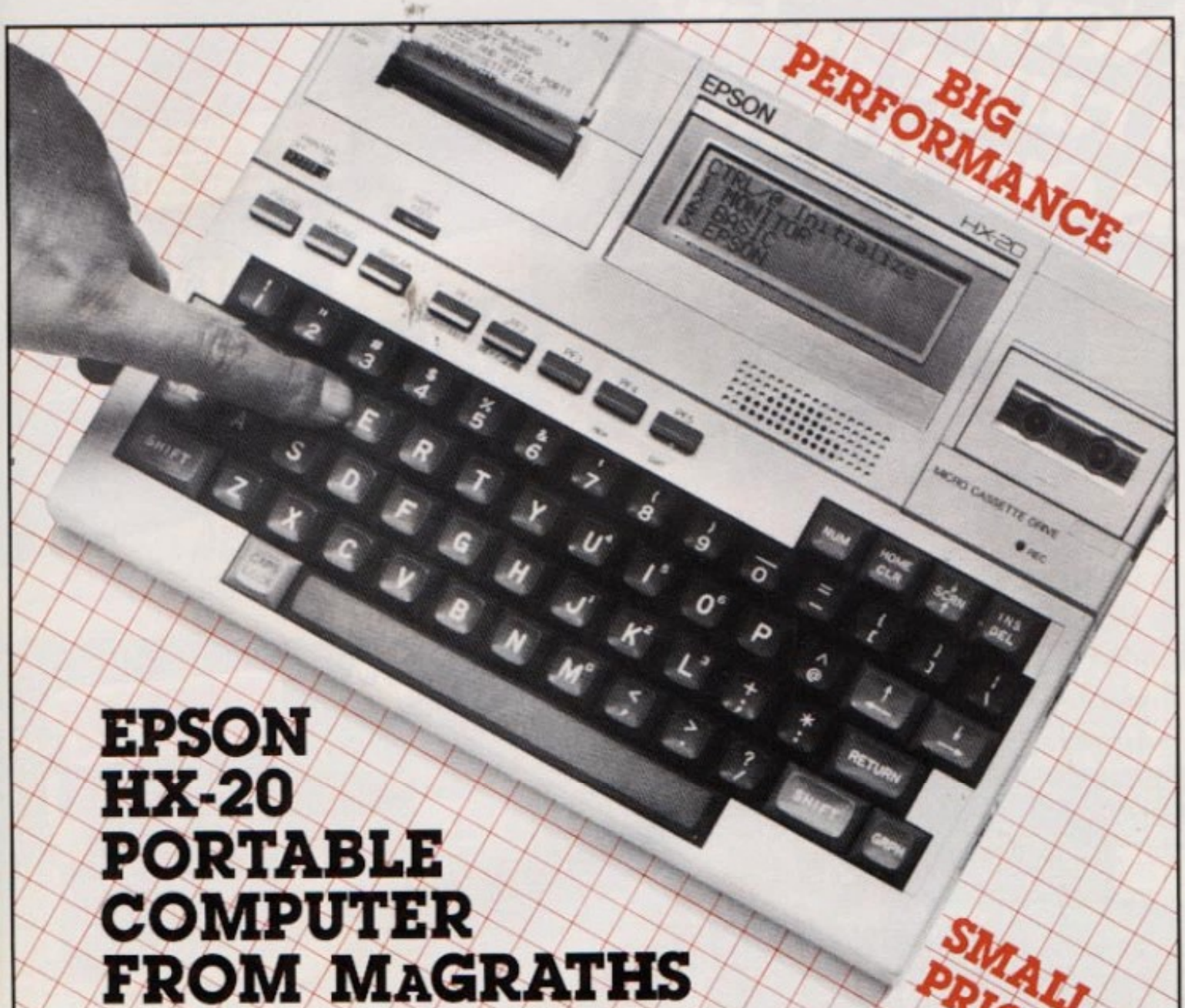
PROGRAMS

```
930 PRINT:PRINT" WILL YOU TAKE ANYTHING?";:GOSUB10000:IFE="N"THENIOELSEGOSUB4500:
FORU=1TOR:PRINT:PRINTC(U);" HOW MUCH ";AT;"?"
940 GOSUB9100:IFTT=OTHENNEXTU:GOTO944ELSEFORV=1TOTT:TA=TA-1:IFTA<OTHEN950ELSEIFA
T="JEWELS"THENCA(U)=CA(U)+CHR$(30):WB(U)=WB(U)+1
941 IFAT="GOLD"THENCA(U)=CA(U)+CHR$(28):WB(U)=WB(U)+1ELSEIFAT="PLATINUM"THENCA(U
)=CA(U)+CHR$(29):WB(U)=WB(U)+1
942 IFTA=<OTHEN944ELSENEXTV,U
944 PRINT:FORU=1TOR:MS=0:MF=0:MJ=0:IFWB(U)=<1+INT(S(U,2)/3)THEN948ELSEPRINTC(U)
;" IS OVERLOADED":FORV=1TOLEN(CA(U)):TH=ASC(MID$(CA(U),V,1)):IFTH=28THENMS=MS+1E
LSEIFTH=29THENMF=MF+1ELSEIFTH=30THENMJ=MJ+1
945 NEXTV:PRINTMS;"GOLD ";MF;"PLATINUM ";MJ;"JEWELS":PRINT"LOSE WHAT ?(B/F/J)";G
OSUB9200:EL=EH:E="":FORV=1TOLEN(CA(U)):WB=ASC(MID$(CA(U),V,1)):IFWB=28ANDEH="B"O
RWS=29ANDEH="F"ORWB=30ANDEH="J"THENWB=WB-27ELSENEXTV:PRINT"YOU HAVE NONE":GOTO944
946 FORTS=1TOLEN(CA(U)):IFTS<>VTHENE=E+MID$(CA(U),TS,1)
947 NEXTTS:CA(U)=E:IFR>1THENPRINT"DROP OR GIVE(D/G)";:GOSUB9300:IFE="G"THENINPUT"
TO WHOM";E:FORV=1TOR:IFC(V)<>ETHENNEXTVELSEIFEL="G"THENCA(V)=CA(V)+CHR$(28)ELSEI
FEL="F"ANDMF>0THENCA(V)=CA(V)+CHR$(29)ELSEIFEL="J"ANDMJ>0THENCA(V)=CA(V)+CHR$(30
)
948 NEXTU:GOSUB4500:FORU=1TOR:IFWB(U)>1+INT(S(U,2)/3)THEN944ELSENEXTU
950 IFAR=""THEN10ELSEPRINT:PRINT"WHO TAKES THE ";AR;:INPUTE:FORU=1TOR:IFC(U)=ETHE
NCA(U)=CA(U)+CHR$(10+RT):GOTO10ELSENEXTU:GOTO950
1000 GOSUB4500:PRINT:INPUT"WHOSE ARTIFACT";E:FORU=1TOR:IFC(U)<>ETHENNEXTU:GOTO10
00ELSEIFLEN(CA(U))=OTHENPRINT"HE HASN'T ONE":FORU=1TO800:NEXTU:GOTO440ELSEFORV=1
TOLEN(CA(U)):FT=ASC(MID$(CA(U),V,1)):IFFT>27THENNEXTV:GOTO440
1005 QT=RT:RT=PT-10:AM=AR:GOSUB6010:PRINT" THE ";AR:AR=AM:RT=QT:GOSUB10000:IFE<
>"Y"THENNEXTV:GOTO440
1010 LS=LEN(CA(U)):IFLS>1THENCA(U)=""ELSEIFV=1THENCA(U)=RIGHT$(CA(U),LS-1)ELSEIF
V=LSTHENCA(U)=LEFT$(CA(U),LS-1)ELSEAB=LEFT$(CA(U),V-1):AC=RIGHT$(CA(U),LEN(CA(U)
)-V-1):CA(U)=AB+AC
1015 CLS:ONPT-10GOTO1050,1090,1130,1170,1210,1250,1290,1330,1370,1410,440,1490
1020 INPUT"WHO USES IT";EM:FORU=1TOR:IFC(U)=EMTHENRETURNELSENEXTU:GOTO1020
1050 GOSUB1020:PRINT"WHAT A SMELL";G(U,4)=G(U,4)-2*(L+1):H(U,4)=H(U,4)-2*(L+1):G
OTO440
1090 GOSUB1020:G(U,2)=G(U,2)+3*(L+1)/2:H(U,2)=H(U,2)+3*(L+1)/2:PRINT"STRENGTH FL
OODS INTO HIM":GOTO440
1130 GOSUB1020:G(U,1)=G(U,1)+L+1:H(U,1)=H(U,1)+L+1:PRINT"HE FEELS BETTER":GOTO44
0
1170 PRINT"TEAM TRANSPORT":PRINT"WHERE TO,MASTER (LEVEL,SOUTH80,EAST80)";:INP
UTLE,SO,EA%:IFLE>6ORLE<1THEN1170ELSEIFSO<0ORSO>6THEN1170ELSEIFEA%<0OREA%>19THEN1
170ELSEL=LE:E1=EA%:Y1=90:IFN(L,E1,Y1)<>OTHEN10ELSEGOSUB870:N(L,E1,Y1)=PQ:GOTO10
1210 PRINT"AWAY THEY GO ";:FORU=1TOR:CA(U)="":NEXT:GOTO440
1250 PRINT"PHUT":FORU=1TO200:NEXTU:N(L,E1,Y1)=12:GOTO10
1290 IFPP=1THEN10ELSEIFEZ="GRIFFIN"ANDR+NM<=2*ROTHEN610ELSEPRINT"NOTHING HAPPENS
":GOTO440
1330 FORU=1TONM:Z(U,1)=0:NEXTU:IFPP=1THEN10ELSEIFEZ="DJINN"THENJD=1ELSEIFEZ="GIA
NT"THENFORWC=1TONM:Z(WC,3)=0:NEXTWC
1331 GOTO820
1370 PRINT"OUCH ";:FORU=1TOR:G(U,1)=G(U,1)-2*(L+1):H(U,1)=H(U,1)-2*(L+1):NEXTU:
GOTO440
1410 GOSUB1020:G(U,3)=G(U,3)+2(L+H(U,3)=H(U,3)+2(L:PRINT"FING":GOTO440
1490 GOSUB1020:PRINTC(U);" VANISHES":G(U,2)=2*G(U,2):H(U,2)=2*H(U,2):G(U,1)=G(U,
1)-3:H(U,1)=H(U,1)-3:GOTO440
1600 ENS=ENS+1:IFENS>3THEN10ELSEPRINT"EMERGENCY ";:FORU=1TOR:CA(U)="":NEXTU:GOTO
1170
3000 CLS:PRINT"YOU HAVE ESCAPED FROM THE DUNGEON":GOSUB4500:T=0:FORU=1TOR:FORV=1
TO6:T=T+G(U,V):NEXTV,U:T=T+800*JD:FORU=1TOR:IFLEN(CA(U))=OTHENNEXTU:GOTO3050ELSE
FORV=1TOLEN(CA(U)):PO=ASC(MID$(CA(U),V,1)):IFPO<13THENT=T+15ELSEIFPO=31THENT=T+2
3010 IFPO=28THENT=T+5ELSEIFPO=29THENT=T+10ELSEIFPO=30THENT=T+25
3020 NEXTV,U
3050 PRINT:PRINT"TOTAL SCORE=";T;" POINTS"
3100 INPUT"ANOTHER GO";C:IFLEFT$(C,1)="N"THENENDELSERUN
4000 DATA!!!!!!QHQ!#!QFQ!!!!4Q!#!QQQ!!!6!!#!Q#!!!!!QQ!!!QQ!!#
!Y#U+#&Y#U+G&!#U+#&Y<U+#&Y#5+#&Y<U+0&!#5++&Y#5+0&!#U+G&!<U+#&Y<J+#5
4100 IFRH<ROTHENRO=RO-1
4105 IFRH=1THENCA(2)=CA(2)+CA(1)ELSECA(RH-1)=CA(RH-1)+CA(RH)
4110 CA(RH)="":IFRH<3THENFORW=RHTOR-1:FORIE=0TO4:H(W,IE)=H(W+1,IE):G(W,IE)=G(W+
1,IE):NEXTXE:C(W)=C(W+1):CA(W)=CA(W+1):PL(W)=PL(W+1):NEXTW:IFWC>THENCA(W+1)=""
4115 FORTX=1TOR:IFP(TX)=1ANDH(TX,1)>OTHEN4120ELSENEXTTX:FORTX=1TOR:P(TX)=1:NEXTT
X
4120 CA(R)="":R=R-1:RETURN
4500 PRINT:PRINT"YOU ARE CARRYING :-":FORU=1TOR:PRINT:WB(U)=0:PRINTC(U);" - ";:I
FLEN(CA(U))=0THENPRINT"NOTHING":NEXTU:RETURNELSE:FORV=1TOLEN(CA(U)):E=MID$(CA(U
),V,1):PT=ASC(E)-10
4505 IFPT=1STHENPRINT" GOLD";:ELSEIFPT=19THENPRINT" PLATINUM";:ELSEIFPT=20THENPRIN
T" JEWELS";
4510 IFPT>17THENWB(U)=WB(U)+1:GOTO4520ELSEDT=RT:RT=PT:AM=AR:GOSUB6010:PRINT" ";A
R;:AR=AM:RT=DT
4520 NEXTV,U:RETURN
5000 CLS:PRINTCHR$(23):PRINT@146,"WELCOME TO";PRINT@202,"THE";PRINT@456,"DOMAIN
OF THE";PRINT@854,"DJINN"
5001 CLEAR700:DEFSTRA-E:DIMA(22),B(15):READB:FORT=0TO22:FORV=1TO2:FORU=1TO3:F=AS
C(MID$(B,6*T+(V-1)*3+U,1)):A(T)=A(T)+CHR$(F+95-6*INT(F/96)):NEXTU:A(T)=A(T)+CHR$
(26)+STRING$(3,CHR$(24)):NEXTV:A(T)=LEFT$(A(T),10):NEXTT
5010 CLS:PRINTTAB(13)"CHOOSE YOUR TEAM!":PRINT:DEFINTF-J,L-Z:RANDOM:D(1)="FIGHTE
R":D(2)="MAGICIAN":DIMZ(9,4),N(6,19,6)
5020 NM=3:PRINT"WHAT SIZE TEAM(1-3)?";:GOSUB9000:Q=2*UM:R=Q/2:RO=R:Q=Q+2*INT(4/Q
):DIMC(Q),P(Q),CA(Q),G(Q,6):FORF=1TOR:PRINT"MEMBER";F;:INPUT"NAME";C(F)
5040 C(F)=LEFT$(C(F),6):PRINT"WHAT TYPE (1,2)?";:NM=2:GOSUB9030:M=UM:PRINTTAB(30
);D(M)
5050 PRINTTAB(20)"S";TAB(30)"I";TAB(40)"M";TAB(50)"C";FORL=0-2TO0:PRINTO+1-L;:G(
L,1)=RND(10):G(L,1+M)=5+RND(5):PRINTTAB(20)G(L,1);:IFM=1THENG(L,3)=RND(7):G(L,4)
=RND(6)ELSEG(L,2)=RND(8):G(L,4)=RND(8)
5060 PRINTTAB(30)G(L,2);TAB(40)G(L,3);TAB(50)G(L,4):NEXTL:G(F,0)=M
5070 NM=3:PRINT"WHICH?";:GOSUB9000:FORF=1TO4:G(F,1)=G(Q-UM+1,1):NEXTI,F
5075 FORU=1TO10:READB(U):D(3*U)=LEFT$(B(U),8):NEXTU:L=1:X1=10:Y1=3:N(L,X1,Y1)=11
0):GOTO10
5080 DATAZOMBIE 13500,TROLL 26648,OGRE 15637,IMP 12425,GOBLIN 14527,W
RAITH 14550,DRAGON 39999,CENTAUR 27769,GRIFFIN 28787,BASILISK38858
6000 MJ=0:RT=RND(17):RZ=RT:IFRT<>13THENGOSUB6010:GOTO6020ELSECLS:PRINT"TELEPORT"
:FORU=1TO300:NEXTU:RU=1:L=L+RND(3)-2+INT(L/6)-INT(L/6):X1=RND(20)-1:Y1=RND(8)-1
:IFN(L,X1,Y1)=OTHENGOSUB870:N(L,X1,Y1)=PQ:GOTO10ELSE10
6010 IFRT<4THENAR="PHILTRE"ELSEIFRT<7THENAR="RHOMB"ELSEIFRT<10THENAR="WAND"ELSEI
FRT<13THENAR="RING"
6011 RETURN
6020 MR=0:IFRT<14THEN605ELSE:ONRT-13GOSUB6030,6040,6060,6080
6021 GOTO309
6030 IFL<4THEN6000ELSEEZ="BALROG":R=40:NM=RND(L-3):FORU=1TONM:Z(U,1)=-RND(2(L-1)
*20):Z(U,2)=RND(2(L-1)*18):Z(U,3)=RND(2(L-1)+20):Z(U,4)=2(L-1)*22:NEXTU:RETUR
N
6040 IFL<4ORJD=1THEN6000ELSEEZ="DJINN":NM=1:Z(1,1)=30+2(L-1):Z(1,2)=30+2(L-1)
:Z(1,3)=30+2(L-1):Z(1,4)=0:RETURN
6060 NM=1:EZ="GORGON":Z(1,1)=22+2(L-1):Z(1,2)=19+2(L-1):Z(1,3)=22+2(L-1):Z(1,
```



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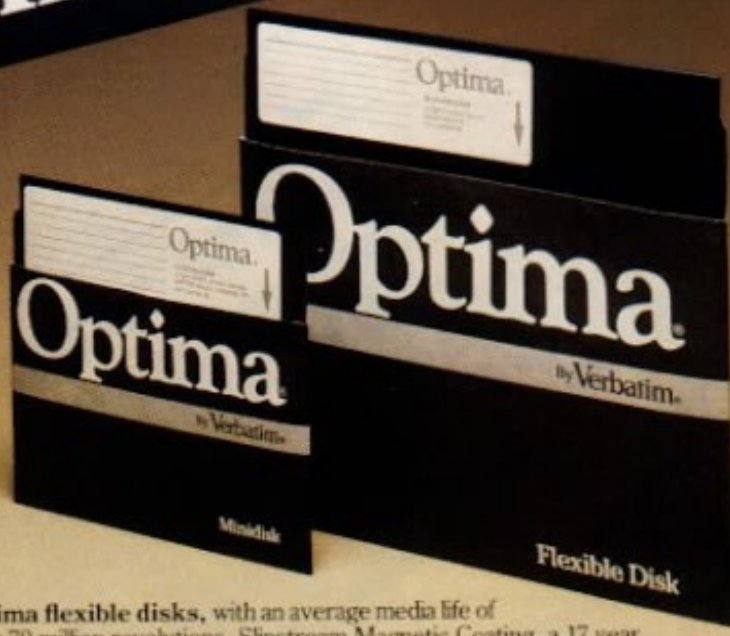

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VTM 6

PROGRAMS

```
4)=0:FORU=1TOR:IFRND(18)>=3+LTHENNEXTUELSEST(U)=1:NEXTU
6062 CLS:FORU=1TOR:IFST(U)=0THENNEXTU:RETURNELSEPRINT"THE FOLLOWING ARE PETRIFIE
D":FORU=1TOR:IFST(U)=0THENNEXTUELSEPRINTC(U):NEXTU
6064 FORU=1TOR:FORV=1TOLEN(CA(U)):IFASC(MID$(CA(U),V,1))<>13THENNEXTV,U:PRINT"YO
U ARE NOT CARRYING A CURE POTION,SO THEY ARE DEAD":FORUS=1TO1900:NEXT:FORRH=1TOR
:IFST(RH)<>1THENNEXTRH:RETURNELSEGOSUB4100:NEXTRH:RETURN
6066 INPUT"WHO WILL YOU SAVE WITH YOUR CURE POTION";AS:FORRH=1TOR:IFST(RH)=1ANDC
(RH)<>ASTHENGOSUB4100
6068 NEXTRH:FORU=1TOR:ST(U)=0:NEXTU:RETURN
6080 IFL<3ANDU>6THEN6000ELSEZ="GIANT":NM=RND(L+1)/2):FORU=1TONM:Z(U,1)=RND(2(
L-1)*30):Z(U,2)=RND(2(L-1)*30):Z(U,3)=9999:Z(U,4)=0:NEXTU:RETURN
7000 CLS:PRINT"NAME";TAB(10)"S";TAB(20)"H";TAB(30)"M";TAB(40)"C";TAB(50)"TYPE";P
RINT:FORU=1TOR:PRINTC(U);:FORV=1TO4:PRINTTAB(10*V)H(U,V);:NEXTV:PRINTTAB(50)D(U
U,0)):NEXTU:PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
7010 E=INKEY$:IFE=""THEN7010ELSE440
8000 FORRH=1TOR:IFS(RH,1)<1THENGOSUB4100
8100 NEXTRH:IFR>0THENRETURNELSECLS:GOTO836
9000 EY=INKEY$:IFEY=""THEN9000ELSEIFASC(EY)<48ORASC(EY)>48+NMTHEN9000ELSEPRINT:U
M=VAL(EY):RETURN
9100 EY=INKEY$:IFEY=""THEN9100ELSEIFASC(EY)<48ORASC(EY)>48+TATHEN9100ELSETT=VAL(
EY):RETURN
9200 EY=INKEY$:IFEY=""OREY<>"G"ANDEY<>"F"ANDEY<>"J"THEN9200ELSEEH=EY:RETURN
9300 EY=INKEY$:IFEY=""OREY<>"G"ANDEY<>"D"THEN9300ELSEE=EY:RETURN
10000 ES=INKEY$:IFES=""ORES<>"Y"ANDES<>"N"THEN10000ELSEE=ES:RETURN
11000 CLS:PRINT"THE ROOM CONTAINS"NM;" "EZ;
11010 IFNM>1THENPRINT"S";
11020 IFAR<>""THENPRINT",A "AR;
11030 PRINT" AND SOME SACKS":RETURN
```

Apple II Menucreate

by Jim Hawkins

'Apple II Menucreate' is a utility routine designed to generate menu procedures in Pascal. The program was written in Apple/UCSD Pascal but should adapt easily to other implementations.

The program requests details of the items to be included in the menu and the desired layout, before generating a text file of the appropriate Pascal procedure. This text file may be either 'Copied' straight into a program or simply called by the compiler as an 'Include' file. The resultant procedure checks for a valid response, sounding the bell in case of invalid input. It should be noted, however, that the program does not generate error messages. The example menus require some dummy procedures; the procedure 'Testbed' (see listing below) is used to generate these.

The menu procedure can be given any name and uses no global variables so that an unlimited number of menus can be called. The program will also, if required, produce the text of a dummy program in order to show the menu as it will appear on the screen. Care must be taken when entering the listing to get all the commas and inverted commas correct, otherwise a stream of 'STRING CONSTANT MUST NOT EXCEED . . .' messages will be produced.

Besides being a useful and neatly-written Pascal program, 'Menucreate' also serves to illustrate the way in which program generators work.

```
VAR
FTEXT:TEXT;  (* DISK FILE FOR TEXT OF PROCEDURE *)
LEFTMARGIN,GAP,CH:INTEGER;X:INTEGER;
INVC,OUTFILENAME,PROCNAME,MENUNAME,UNDERLINE:STRING;
MENOPT,PROCLIST:ARRAY[1..9] OF STRING;
CH:CHAR;
EIGHTY:BOOLEAN;

PROCEDURE FIRST;
BEGIN
INVC:="'"; (* MAKES PASCAL INVERTED COMMAS EASIER TO USE *)
PAGE(OUTPUT);
WRITELN(' INCLUDE FILE NAME FOR MENU ON DISK ');
WRITE(' --> ');
READLN(OUTFILENAME);
IF POS('.TEXT',OUTFILENAME)=0 THEN OUTFILENAME:=CONCAT(OUTFILENAME,'.TEXT');
REWRITE(FTEXT,OUTFILENAME); (* OPEN FILE FOR TEXT *)
WRITELN(' FILE OPENED');
WRITE(' MENU PROCEDURE NAME-->');
                              (* TO BE CALLED BY MAIN PROGRAM
                                 TO DISPLAY MENU - MIGHT JUST
                                 BE "MENU" OR "MAINMENU" *)

READLN(PROCNAME);

                              (* NOW WE START TO WRITE PROCEDURE
                                 TEXT TO DISK FILE *)

WRITELN(FTEXT,'PROCEDURE ',PROCNAME,';');
WRITELN(FTEXT,'VAR RESPONSE:CHAR;');
WRITELN(FTEXT,'COUNT:INTEGER;');
WRITELN(FTEXT,'BEGIN');
WRITELN(FTEXT,'PAGE(OUTPUT);');
WRITE(' MENU HEADING-->');
                              (* MENU TITLE TO BE PRINTED AT THE
                                 TOP OF THE SCREEN *)
```

PROGRAMS

```
READLN(MENUNAME);
MENUNAME:=CONCAT(INVC,MENUNAME,INVC);
WRITE(' TAB POSITION FOR MENU ITEMS: ');
                                (* WHERE WE WANT THE MENU ITEMS TO
                                   BE PLACED LEFT TO RIGHT *)

READLN(LEFTMARGIN);
                                (* NOW ASK IF WE WANT 80 COLUMNS OF
                                   UNDERLINE FOR TITLE - ANSWERING
                                   'N' WILL DEFAULT TO 40 *)

WRITE(' 80 COLUMNS? (Y/N> ');
      REPEAT
      READ(KEYBOARD,CH)
      UNTIL CH IN ['Y','y','N','n'];
      EIGHTY:= ( CH IN ['Y','y']);
WRITELN;
X:=LEFTMARGIN + 5;
WRITELN(PTEXT,'GOTOXY(',X,',1);WRITELN(',MENUNAME,');');

WRITELN(PTEXT,'WRITELN;');
UNDERLINE:='-----------------------------------------';
WRITELN(PTEXT,'WRITE(',INVC,UNDERLINE,INVC,');');
IF EIGHTY THEN WRITELN(PTEXT,'WRITE(',INVC,UNDERLINE,INVC,');');
END;

PROCEDURE SECOND;
BEGIN

WRITE(' NUMBER OF MENU CHOICES? ');
                                (* ALLOWS 1..9 CHOICES.  IF MORE
                                   DESIRED PATCH INPUT TO USE
                                   READLN AND USE NUMERIC VARIABLE
                                   INSTEAD OF CHARACTER.  WITHOUT
                                   ELABORATE ERROR CHECKING THIS
                                   IS EASIER FOR USERS TO CRASH,
                                   HOWEVER *)

READLN(CHOICES);
IF CHOICES>5 THEN GAP:=1 ELSE GAP:=2;
                                (* THIS LINE DOUBLE-SPACES
                                   SMALL MENUS *)
WRITELN('ENTER THE TEXT YOU REQUIRE FOR');
WRITELN('EACH MENU CHOICE.');
WRITELN;
                                (* NOW GET THE SCREEN TEXT FOR
                                   EACH OPTION AND THE PROCEDURE
                                   IN THE USER PROGRAM THAT WILL BE
                                   CALLED IF THAT OPTION IS PRESSED *)

FOR X:=1 TO CHOICES DO BEGIN
              WRITE(' CHOICE ',X,' -->');
              READLN(MENOPT[X]);
              WRITE(' PROCEDURE TO CALL FOR THIS CHOICE-->');
              READLN(PROCLIST[X])
              END;

FOR X:=1 TO CHOICES DO BEGIN
            MENOPT[X]:=CONCAT('>  ',MENOPT[X],INVC,');');
 WRITELN(PTEXT,'GOTOXY(',LEFTMARGIN,',',GAP*X+4,');WRITELN(''<',X,MENOPT[X]);
 END;
 END;

 PROCEDURE THIRD;
                                (* COMPLETE THE FILE CREATION *)

 BEGIN
 WRITELN
 (PTEXT,'GOTOXY(',LEFTMARGIN,',22);WRITE(',INVC,'PRESS SELECTION :'');');
 WRITELN(PTEXT,'REPEAT');
 WRITELN(PTEXT,'READ(KEYBOARD,RESPONSE);');
 WRITELN
 (PTEXT,'IF NOT ( RESPONSE IN [''1',INVC,'..',INVC,CHOICES,INVC,']) ');
 WRITELN(PTEXT,'THEN WRITE(CHR(7));');
 WRITELN(PTEXT,'UNTIL RESPONSE IN [''1',INVC,'..',INVC,CHOICES,INVC,']);');
 WRITELN(PTEXT,'COUNT:=ORD(RESPONSE)-48;');
 WRITELN(PTEXT,'WRITELN;');
 WRITELN(PTEXT,'    CASE COUNT OF');
 FOR X:=1 TO CHOICES DO
     WRITELN(PTEXT,'      ',X,':',PROCLIST[X],';');
 WRITELN(PTEXT,'    END;');
 WRITELN(PTEXT,'END;');
 WRITELN(' MENU TEXT FILE CREATED');
 CLOSE(PTEXT,LOCK);

 END;

 PROCEDURE TESTBED;
                                (* CREATE A DUMMY PROGRAM ON
                                   THE BOOT DISK USING THE
                                   MENU PROCEDURE AS AN INCLUDE
                                   FILE.  MUST BE COMPILED
                                   AND THEN EXECUTED *)

 BEGIN
 REWRITE(PTEXT,'TESTBED.TEXT');
 WRITELN(PTEXT,'PROGRAM TESTBED;');
 WRITELN(PTEXT);
 FOR X:=1 TO CHOICES DO
          BEGIN
          WRITELN(PTEXT);
          WRITELN(PTEXT,'PROCEDURE ',PROCLIST[X],';');
          WRITELN(PTEXT,'BEGIN');
          WRITELN(PTEXT,'GOTOXY(',(LEFTMARGIN+1),',',GAP*X+4,');');
          WRITELN(PTEXT,'END;');
          END;
 WRITELN(PTEXT,'{$I',OUTFILENAME,'}');
 WRITELN(PTEXT,'BEGIN');
 WRITELN(PTEXT,PROCNAME);
 WRITELN(PTEXT,'END.');
 CLOSE(PTEXT,LOCK);
```

PROGRAMS

```
WRITELN;  WRITELN;
WRITELN('TO SEE THE MENU COMPILE TESTMEN');
WRITELN('TO TESTMEN AND THEN EXECUTE IT.');
END;

  BEGIN

FIRST;
SECOND;
THIRD;
PAGE(OUTPUT);
WRITE(' DO YOU WANT A TEST PROGRAM FOR THIS MENU?  ');
READ(KEYBOARD,CH);
IF CH IN ['Y','y'] THEN TESTMEN;
WRITELN;
WRITELN('FINISHED.')
END.
```

CHIP CHAT

Folklore has a lovely tale to tell of how Microsoft got the contract as supplier of the IBM PC-DOS operating system. It involves an aeroplane.

But the image of Gary Kildall as the rather shy, nice sweet guy who took his aeroplane out for the afternoon, rather than face the white-shirted IBM troops who wanted to buy CP/M-86, took a bit of a dent recently.

Kildall told his version of the tale to an audience of some fifty journalists when he recently gave a short seminar on his software products.

The message he had for the world was: "Don't ask why we didn't get the IBM contract. Instead ask what Microsoft got paid for it."

And there followed a very interesting anecdote, including references to conversations on a Boeing 747, firings at high-level inside IBM, and non-disclosure agreements that deprived Digital Research of all rights to their code.

He gave his version "off the record" because he didn't want to be seen trading punches with Bill Gates of Microsoft. So we are going to respect his wishes and refrain from printing what he said.

That will annoy the hell out of him . . .

. . . A symposium of eminent American psychologists has recently held a forum entitled 'Donkey Kong, Pacman and the meaning of life' . . . A press release about a software company, Pegasus Software, which arrived in the ivory tower early in May, was titled 'Pegasus — a synonym for success'. Could this mean that the word Pegasus will soon be integrated into modern language as such? Soon we may well be referring to 'a really pegasusful young executive' or the computer that was 'never much of a pegasus' . . .

. . . We haven't run any competitions in Chip Chat to date because the general tone of the column would tend to lead to libelous entries (certainly the winners would be such), but the news that Dr Hawkeye Pearce will be the "front man" for Atari in the US is just too much.

Readers are invited to suggest equally appropriate figureheads for advertising purposes. It doesn't matter how obviously absurd the relationship is as long as you have an equally absurd justification. In the event of a tie for the $20 prize, the winner will be the one who best explains Charlie Chaplain's sponsorship of the IBM PC . . .

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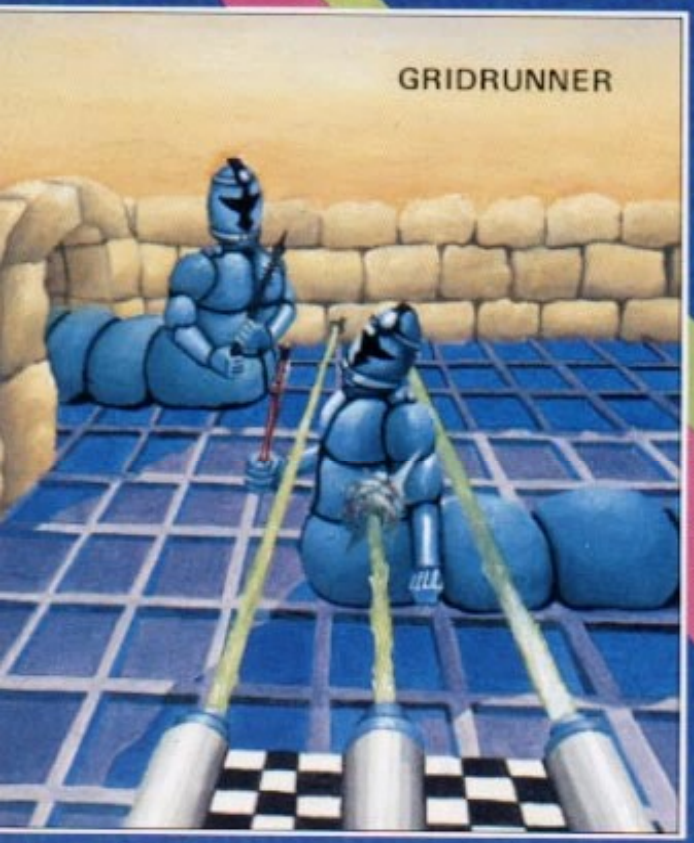

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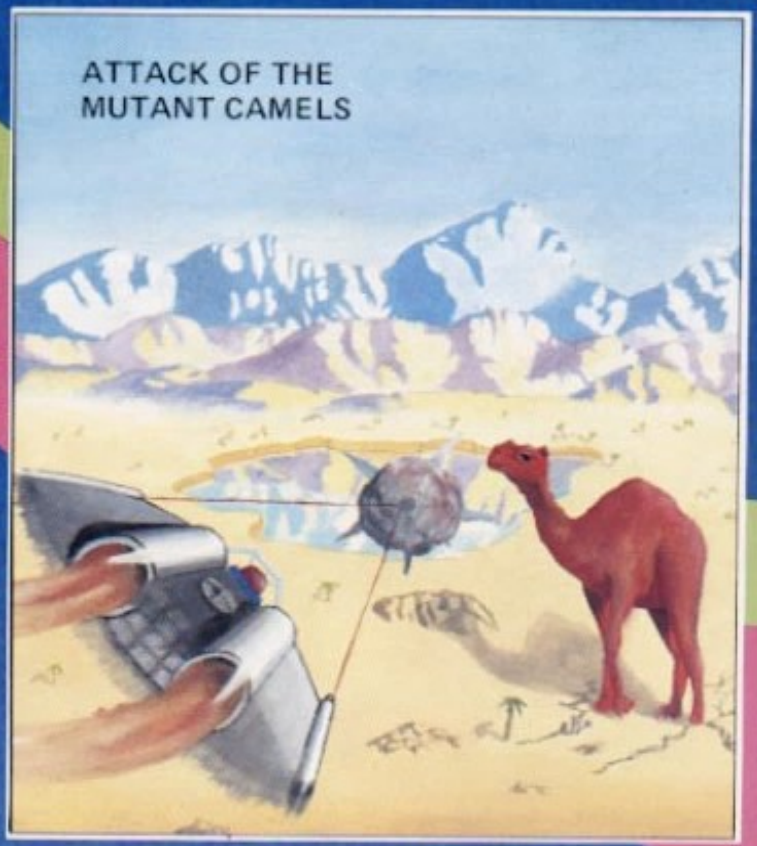

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