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PX-8: Epson plays it cards/dBase III/Framework — full preview inside.

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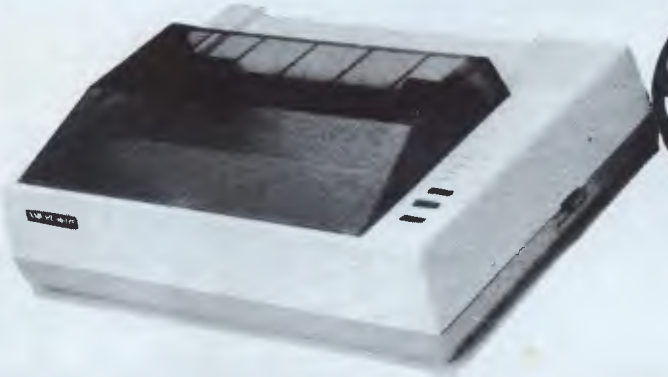

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inside

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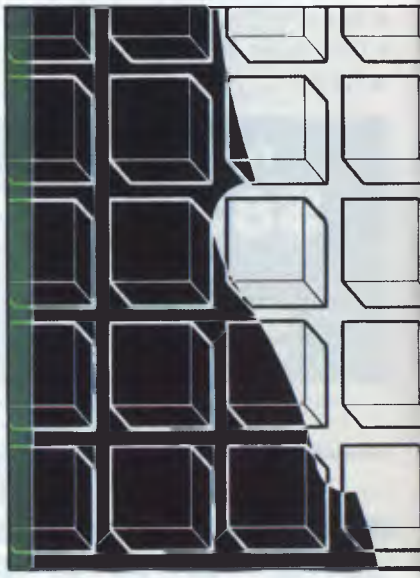
REGULARS

A home computer that costs a little more — but offers plenty. See page 48.



A computer porgram that can become

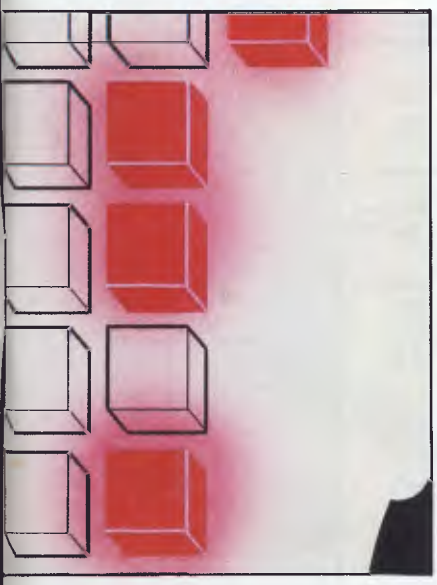
Volume 5, Number 7, July 1984

APC

FEATURES AND SERIES

BENCHTESTS & REVIEWS

Cover photography: Robert Blackburn



smart as you (almost!). See page 110.

Australia's greatest personal computer show lands in Melbourne. See preview on page 6.

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DX	Diskettes (Per Box 10) — Xidex	$ 32.00	$ 38.00
S.A.M.	Software Automatic Mouth — S.A.M.	$ 63.00	$ 63.00
WD-720	Wildcard	$ 78.00	$ 94.00
RP	Replay	$ 78.00	$ 94.00
GT-014	Graphics Table	$ 79.00	$ 95.00
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See you there

Once again the *Australian Personal Computer* Show is the venue for the launch of a huge number of computer products. It's evidence of the fact that, in this exciting, fast-moving industry of personal computers, there is a constant flow of innovative product releases making both the Sydney *and* Melbourne Shows the predominant launching pads in the Australian micro industry.

At the entrance to the Show *(don't forget to take along your complimentary invitation on the outside of this issue)* you will be given a comprehensive Show Catalogue. It'll contain the usual floor plans, introductions etc plus a stand-by-stand listing of exhibitors with a run down of what's on display. Below we've got a sneak preview of what'll be at the Show — it's by no means comprehensive: we don't want to steal all the thunder plus, in several cases, we've been sworn to secrecy. You'll just have to go along if you want to keep up-to-date with the latest in the industry.

On the business side, ICL have a brand new release: it's a multi-user (up to 16) microcomputer with a large disk capacity of 160 Mb. It's called the CLAN and has been featured in television advertisements. ICL will also be exhibiting the slightly smaller but still multi-user Personal Computer running multi-user Concurrent CP/M, with which any regular *APC* reader will be familiar.

Dick Smith Electronics marches in with its IBM PC work-alike — the Challenger, featured in the May issue of *APC*. It's considerably cheaper than the IBM yet runs most programs that work on Big Blue's baby. If you are on a budget, but want a fully blown business computer (including some applications software) have a talk to Dick Smith's people at the Show. The Challenger sells for less than $3,000. Another work-alike from DS is the Cat (the company really made its name in computers with the System 80, a TRS-80 work-alike, so if anyone knows about the ins and outs of "work-alikes" in Australia, it's Dick Smith Electronics). The Cat was seen at the Sydney *APC* Show so it is not its first public airing, but if you want a nearly Apple-compatible, the Cat is a good buy.

Another IBM PC compatible that has received a lot of press is the Compaq. It has taken quite a while to reach our shores but has now done so, courtesy of Computerland. Of course, if you want the real thing, again the Show deserves a visit. IBM will be there in force displaying machines with reduced price tags of between 13 and 19% owing to a recent across the board cut in recommended retail prices of its PCs.

In the middle range, Apple has released its IIc, a portable extension of the Apple II family. It incorporates a single 5¼ inch disk drive and will soon have an optional 80 column, 24 line display. Barson Computers also expects to have a flat screen display for its Apricot business computer. Billed as a "transportable", this feature of the Apricot has always been hampered by the necessity of having to lug a monitor along with the machine.

LCD display technology is improving in leaps and bounds. Lap held computers are popping up everywhere — NEC, Tandy and Olivetti have already launched models. Epson's full 80 column screen PX-8 is this month's cover story (and will premier at the Show) and Hewlett Packard is about to release its HP 110, an 80 column by 16 line display model which, like all the other lap helds, can run on batteries.

After you've read about Hewlett Packard's ink jet printer elsewhere in this issue, you'll probably want to see it in action at the Show. It's extremely quiet, reliable and surprisingly inexpensive. And Hewlett Packard hasn't restricted its use to HP machines only — owners of gentile micros can purchase a version designed for use with a wide range of computers.

Sanyo has a very useful product on show for the small business. It's a multi-user, multi-tasking machine (which means that more than one person can access data stored in the computer at once) running Sanyo's 'SSS' (Australian written) business software package. Take a look at it, if you're about to computerise.

At the home/enthusiast end of the marketplace, you have the chance to see a plethora of new releases for just about every brand of microcomputer. There are new peripherals: new plotters, modems, joysticks, printers and speech synthesis units to name only a few. If it's happening in Australia, it's happening at the Show.

Computermat

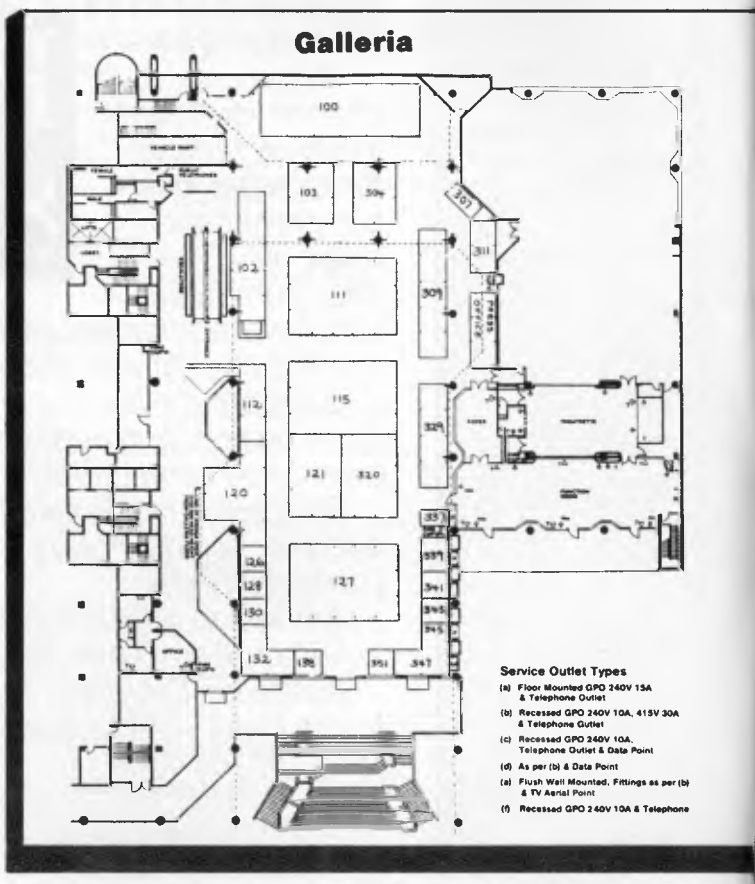
Newcomers to personal computing should be queuing at the door to experience a new concept at computer shows in Australia. Four of the country's top suppliers of computers have kindly arranged to provide twenty computers each as the basis of "hands-on" tutorial sessions. The introductory "classes" will be held during Show hours; details will be provided in the Show Catalogue at the entrance — so don't miss out!

Don't be late

While we reckon *APC* is like the "Yellow Pages" to the personal computer industry, we have to admit the 3rd *Australian Personal Computer* Show is a worthy appendix. Virtually every major name in the industry — from IBM, DEC, Wang and Sperry at the top end to the king of the home computer marketplace, Commodore, at the low end — will be exhibiting.

It is Melbourne's first personal computer show — so be early (even then you probably won't dodge the crowds!)

This is the Sh



The 3rd Australian Personal Computer Show

World Trade Centre Melbourne

18-21 July 1984

linitely a first. Interface International will have this live panther (ie, not stuffed) at It's to tie in with its launch of the Panther computer. Don't bring your dog along.

Floor Plan

Why go to the APC Show?

One of our readers retorts to the build up of the 3rd *Australian Personal Computer Show* with the above question. Well there are many reasons why you might go to the Show.

Firstly, computer shows are an ideal opportunity to meet and talk to numerous people who share the same interest. This is important, as any hobby that involves hours of sitting at a keyboard can be a rather insular one.

Shows are buyers' market-places where the competition between retailers is so intense that they often have a variety of special offers to entice you to their stand. You also get the chance to see and try a product before you buy.

A wealth of help and advice is also readily available, be it how to solve an adventure problem or which printer to buy for your computer.

A trip to the Show may even be profitable: you may find a software house for your new game, a publisher for your new book.

I'm a feverish collector of show catalogues: not only are they an invaluable source of contacts and phone numbers, they are a still photograph of an ever-changing industry.

The decision to attend the Show is entirely yours, however, just keep in mind, the 3rd *Australian Personal Show*, July 18–21, at the World Trade Centre, Melbourne.

Maria Bokic

List of exhibitors

COMPANY NAME	STAND NO
ABA Systems (Aust) Pty Ltd	420
AWA Computers	510
Ampec Electronics Pty Ltd.	617
Amust Computer Corporation (Aust) Pty Ltd	406
Anderson Digital Equipment Pty Ltd	511
Apple Computer Australia Pty Ltd	111
Arcom Pacific	412
Ashtron Scholastic	633
Australia & New Zealand Book Co Pty Ltd	345
Barson Computers Pty Ltd.	127
Business Model Systems Pty Ltd	438
CASL Financial Services	424
Case Communication Systems Ltd.	411
Commodore Computers	100
Communication Control	452
Computer Cellars	810
The Computer Company	400
Computer Resources Company	504
Computerworld Pty Ltd.	311
Data General Australia Pty Ltd	433
Data Peripherals (Vic) Pty Ltd	410
Database Management Services	613
Datatel Pty Ltd	446
Dega Research	720
Dick Smith Electronics Pty Ltd	430
Digital Equipment Corp (Aust) Pty Ltd	121
David Syme & Co Ltd	726
Distributed Data Processing Pty Ltd	407
Dragon Technology Pty Ltd.	508
Eastern Micro Electronics Pty Ltd	905
Emona Computers Pty Ltd.	426
Epson Australia Pty Ltd	509
Goodman Cannington (Aust) Pty Ltd	911
Hewlett Packard Australia Limited.	102
IBM Australia Limited.	115
ICL (Australia) Pty Ltd.	502
Interface International Pty Ltd.	415
Interfaceware Pty Ltd	416
Jedko Games Co Pty Ltd	619
John Sands Electronics	423
MC-P Applications.	520
McGraw Hill Book Co Aust Pty Ltd.	307
Maclagan Wright & Associates Pty Ltd	728
Magmedia	343
Melbourne House (Australia) Pty Ltd.	126
Memorex Pty Ltd.	351
Micro Stat Software	337
MicroBee Computer Centre	403
Microprocessor Applications	450
Microprogramming	607
Microsoft	132
Mitsui Computer Systems	600
Moore Paragon Australia Limited.	442
Multisoft.	907
Myer Computer & Business Centre	309
NCR Australia Pty Ltd.	417
NEC Information Systems Australia Pty Ltd	320
Nashua Australia Pty Ltd	711
Novus Design	901
Olivetti Australia Pty Ltd.	803
Osborne Computers (Aust)	503
Paperwork Systems Inc (Group) Pty Ltd	501
Pacific Computer Weekly	625
Pitman Publishing	462
Pragmatix Pty Ltd.	130
Pulsar Electronics Pty Ltd	516
Rexel Office Products	615
Rose Music Pty Ltd.	609
SCA Software Corporation of Australia Pty Ltd.	440
Sanyo Office Machines Pty Ltd	103
Select Microsystems Pty Ltd.	128
Sourceware Pty Ltd.	414
Sperry Computer Systems.	521
Tallgrass Technologies Australia Pty Ltd.	434
Tandy Australia Ltd	329
Technical Book & Magazine Co Pty Ltd	347
Telecomputing PCS.	520
Texas Instruments Australia Limited.	629
Think Computers	601
Tomas Systems	621
Toshiba Australia	304
Video Com Australia	464
Wabash Datatech Australia Pty Ltd	427
Wang	112
Warbuton Franki	120
William Collins	409

Micro switch

Microsoft appears to have changed its mind about how many programs we want to run at once. Secretly, quietly, and avoiding publicity, Microsoft has decided to release a new version of its operating system, MS-DOS. It does networking, and multi-tasking.

The newest version isn't available to customers yet, and isn't likely to be for some time. But the people who will supply it have been given samples to test, so that they can tell Microsoft what the problems are.

What is really interesting about the (very little) information that has filtered out from this well-shielded cage of activity is the fact that Microsoft was not talking about anything like as ambitious, last time it stood up in public to lecture. By Microsoft, I mean the chairman, Bill Gates.

Gates tells people these days that he isn't giving interviews because he wants to get back to programming. This has given rise in uninformed circles to the suggestion that he is really preparing his company for a launch onto the public stock market, a rumour which I have finally been brought to believe is premature. But in the days when he was buying the drinks at conferences and speaking his mind at parties, he used to argue that "concurrency is not what the user wants", and suggested that what was needed was the ability to switch from one program to another, fast, putting the first one on "hold" temporarily.

Word is that the test versions of multi-tasking DOS 2.0 are not quite so limited in their ambition. They include facilities for two programs to pass information between each other, while they are both running on the same system.

And what is really fascinating is that the "system" can involve two or more computers, linked by a network.

This thinking conflicts with what a lot of traditional computer people are saying. They argue that Unix, an operating system which allows several people to use the same computer and work on the same data files, will more than meet requirements for multi-tasking, and that networking will never work.

Microsoft is the largest supplier of Unix type software, with its Xenix product. For Microsoft to produce a multi-tasking MS-DOS is going to be seen as less than an act of blind faith in Unix as the saviour of the future . . .

And, coupled with the recent quote by Altos boss David Jackson ("Unix applications are as rare as rocking-horse shit") it makes my own spirits a little lighter. I don't doubt that Unix does all the things its fans say it does. It's the things it doesn't do which will hold back the industry for ten years, and the industry must move forward, or die.

Guy Kewney

NEC bundled software

The NEC APC now comes with Wordstar and Multiplan.

Mr Richard Berthet, responsible for marketing NEC's personal computer products said, "This bundle represents a value of around $1100 retail for the purchaser of an APC . . . the software has been exclusively customised for the NEC Advanced Personal Computer and so takes advantage of . . . the 44 programmable function keys and the large disk capacity. On our colour APC, Wordstar can be set up to use the eight available colours, giving word processing a whole new look".

Comdex

A daily newspaper, weighing two pounds, personally delivered to 20,000 people before breakfast, covering not just one industry, but just one show in that one industry — it takes some believing. But there is one: it's the Comdex Show Daily, published by the organisers of America's biggest computer show.

To call Comdex "big" is to concentrate on its drawback, at the expense of its real value. Its real value is that this is the show where the big manufacturers are talking directly to their biggest customers, the distributors, who are also there, talking to their biggest customers, the dealers, and everybody is surrounded by the biggest corporate buyers, the top managers of the big companies which buy micros in bulk for their executives.

Nonetheless, before reporting on the products and announcements which I found at the last show, it is worth trying to give some idea of the size of it. It occurred to me that a simple way of doing this would be to interview its newspaper, via the editor, Vic Farmer.

Farmer used to be a senior editor on America's giant computer paper, Computerworld. One day, he was assigned to cover the growing National Computer Conference for his paper, at a time when the computer industry was just turning into the sort of monster that we now take for granted.

"It was like running a big, daily newspaper," Farmer said. "There were all these conferences, all these parties, all these exhibition stands, all these people, and to cope, we had to set up a team. And filing reports back to the office was just exactly like running a live newspaper."

A few years later, Farmer had got into the routine of doing these big shows, and had a good idea of what sort of things went on, what sort of reporting costs (manpower, materials) would be involved in doing a report to be printed at the show. He started doing this, for Computerworld, and really was a bit surprised (a couple of years after that) that his face no longer fitted, and he was looking for a job.

Eventually, his search for employment led him to Sheldon Adelson, boss of The Interface Group, the enterprise behind Comdex. Comdex was becoming enormous, and Farmer managed to convince Adelson that it was big enough to take over the running of the show newsletters itself. Farmer got the job of doing The Official Show Daily.

For the four days of Comdex Spring in Atlanta each year, and the four days of Comdex Fall in Las Vegas, six months later, Adelson's team moves into high gear. Four full-time editors and three artists bring the skeleton of four daily papers down from Massachusetts, and publish the first edition to be ready for delegates the day before the conference starts.

It includes most of the information prepared for the conference organisers, by

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exhibitors. Some of that comes in months before the show, and much of it is empty puff of the "once again. Best Computers will be demonstrating its extraordinary range of diskette hole-punch equipment" vein — but much of it is really new. Farmer's team is in an enviable position here: because they don't work on regular monthly or weekly magazines, they can be safely entrusted with commercial secrets, and can research stories in depth, well in advance of the launch date. (The rest of us have to try and make sense of it on the day of the launch because the manufacturers believe that we will rush off and tell the dailies all about it. So we do all our preparatory research by asking their competitors, who usually know all about it anyway, but that's another story for another day.)

Also pre-organised will be many background articles. They range from hints and tips for keeping your feet in working condition while walking around the five to eight miles of exhibition carpet; health suggestions for avoiding strain and tension, eat-out hints for the strange town you're in, and other simple bodily requirements, right through to indepth analyses of new trends in the industry — five new portable micros, for instance, where each company contributing information about a new design thought it was unique, and was going to be the star of the show; or new deals being set up between manufacturers and distributors.

At the show, an add-on team of local freelances — photographers and writers — joins in the hunt for news.

There are reports from the conference sessions, interviews with prominent industry figures attending the show, photographs of new products and publicity stunts, and roundups of developments during the day.

At the end of each day, they sit down in front of a battery of computers — six Eagle PC machines (equivalent to IBMs) connected direct to the printworks.

"We do it with diskettes", said Farmer, "with one of the machines being connected to a modem, and everybody putting their copy onto diskettes for transmission. It's easier than a network."

At Las Vegas, the bigger of the two Comdex shows, the issues run to 200 pages, printing 50,000 copies a day.

Guy Kewney

Mac news

Macintosh's success now seems certain to me: it seems also certain that its success will have to wait for the half megabyte version, due out in December/January, when the big capacity memory chips are available on the market.

Many software producers at Comdex spoke of "limited memory" versions of their programs, for the IBM Junior, and the Macintosh — things that couldn't do quite so much, but were still usable versions of programs for the PC.

Lotus boss Mitch Kapor spoke of his company's efforts to put something on the Mac — a program something like 1-2-3 but with as many of the extra features of the new Lotus product (Symphony) as possible.

Kapor described the Mac as "somewhere between quite good and completely wonderful," and said that if only he had more memory to play with, the super-spreadsheet he is developing would be unrecognisable — and, when it is, it will be. He's given to "understatement" like that, I suppose one might say, but then most Americans are.

Another company, Living Videotext, author of Think Tank (a US rival to Brainstorm) released a version of that ideas processor, especially truncated for the Macintosh. "It isn't that 128k bytes isn't enough to do some nice things," explained David Winer, the boss: "It's just that with a machine like this, there are so many things you want to do, that it isn't enough."

That may be a little confusing, but the substance of it is simple enough. It is: for people who want to do the work that they would otherwise choose an IBM PC for — big spreadsheets, long reports, complex database structures on enormous files — for those people, the 128k byte Mac will not do. However, for those who want an ordinary eight-bit computer, the Mac is much nicer, and rather exciting.

Guy Kewney

Comdex highlights

For me the smartest product of the show is one which can tell if you are using your phone.

It's a communications board for the IBM. It's called Master Link, and it is not just a modem but also the software to run it, and also the address list and phone number list you need to run it automatically.

What makes this $1,000 board unique is the fact that it is totally invisible to the computer.

I watched the developers running Wordstar, and switch to running Master Link software by the simple technique of picking up the phone. Instantly, the Master Link board took over the system, freezing Wordstar exactly where it was, and put a menu up on the screen.

That menu included options to recall the screen display as it was, to call a phone number directly, to log on automatically to a remote system, or transfer a file to another computer from diskette, or download a diskette file.

All that, and you can go back to what you were doing simply by disconnecting the phone.

The same thing happens if the phone rings: the computer can answer it, or you can, but either way, whatever you were doing carries on.

Better yet: for a couple of hundred dollars extra, there is a little box called Nite Owl.

Nite Owl is an answering machine. You call the system up in the middle of the night, and of course it isn't switched on, and the software isn't loaded. Not to worry: Nite Owl turns the computer on, and takes commands from you from your remote portable micro. You can then dump files to the home diskette, or download files, or even load and run programs on the home system, and get the results.

Best of all: if somebody else has Master Link, then you can transmit anything you like at about twice the normal speed, because they can use data compression and expansion. That means that there are tricks to recognise common "cliches" of data, and encode them, and decode them at the other end.

I blew my mind watching a demo of Flight Simulator. That is one program which it isn't normally safe to use in business hours, because it takes such a long time to stop! You have to turn the power off first, then turn it on, wait for the system to check out its memory, wait for it to load the operating system, wait for it to load the startup program, then answer its questions about date and time, and finally load whatever program it is you want to run.

With Master Link in the box, you can actually run the comms program in the middle of Flight Simulator. If you like you can even transmit the Flight Simulator screen to your friend's computer, and he can see what you are doing (you can do this with any program).

And at any stage, either of you can switch to voice, just by giving the right command. The computer waits patiently for its turn, and doesn't lose the line.

It sounds like a lot of money, but for somebody with an IBM XT, it isn't, especially when you realise that it automatically keeps track of all the phone numbers which it dials, and links them to automatic log-on procedures — all on its own memory on the card, and independent of whatever diskette you have in the drives.

The product is distributed in the US through ModTech (see All this and more).

Guy Kewney

All this and more

Something in system integration from a startup company called ModTech: their main product is called Lois, and it reconciles your other programs.

The drawback of this product is simple: it needs an IBM with DOS 2.0. That said, it is the only attempt I know of to persuade all your conflicting business programs to talk to each other, and switch between one and the other.

Lois sits on the screen, looking like a menu. The options are various word processing, communications, spreadsheets, spelling checkers, stock market analysers, games, and so on, which you have bought over the years.

Lois can re-format files between all these programs, and can load and run each one for you, without your having to close the first one down and reload the second.

The limitation is that it can't load programs which ModTech don't know about. Currently, the list is short — only a dozen or so. But they seemed very positive about their ability to increase this list by 100 or 200 by Christmas . . .

Oh, and it will also emulate intelligent terminals. And it works with any phone. And it will do pulse and touch-tone dialling, or let you do it yourself.

With Nite Owl, you can even tell it to turn the computer on at some time later in the evening, phone some remote system, keep trying if it can't get through, log on, transmit a file, look for a particular acknowledgement, and log off, switch off the system, and sleep well, your job is well done, son.

Guy Kewney

The three new configurations of the Apricot (pictured above) made their Australian debut last month. The first has double the disk capacity of the standard machine (pictured in the centre), bringing its on line storage to 630k per drive.

The other two models are hard disk units — both using 3½ inch drives but with differing capacities of 5Mb and 10Mb. The Apricot has been billed as a transportable machine so it is welcome news from Julian Barson of Barson Computers that the "3½ inch drives are truly reliable. Unlike preceding 5¼ inch winchester drives, they are designed so that the heads retract and lock on shut-down, allowing the machine to be moved around without any risk of damage to data".

The three new configurations set the price of the Apricot from $4440 to $8000 (including a good deal of bundled software).

BBC Microcomputer
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The BBC Microcomputer is the mainstay of the British educational system and will take their youth confidently into the 21st century.

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Why? Because 'The BBC' is not just an educational computer. It is one part of the British Government's project to produce the best microcomputer for education, plus the whole range of software and training aids needed to secure for youth the advantages of computer literacy in the coming computer age. Software abounds. The TV 'Computer Programme' has only begun. There is a wide variety of books and teacher aids. And the list grows constantly.

Australia is fortunate to be able to adopt the entire project without change — and to enjoy all the future developments. For the BBC Computer Literacy Project is ongoing. It will still be with us in the 21st century.

Of course, you are probably aware that Barson Computers were selected to distribute the BBC micro in Australia and New Zealand because they have the desired technical expertise, and are capable of giving BBC Microcomputer users a very high level of support indeed.

You see, the BBC did their homework, too.

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Business and Business Studies
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Computer Learning
First Fleet Database. Factfile. Databas. Tree of Knowledge Graphs and Charts. Utilities 1. Lisp. Forth. The Classroom Micro and You. Curriculum and the Micro. Building Ideas. Keeping Learning. Home is where the chip is. Peeko Computer. The Computer Programmes 1 and 2. Acornsoft BCPL. Microtext. Bas. Procvar/Proc Flush/Proc Aid Computer procedures. Sort M/C. Sort Bas. Tas Logo. Search Bas.

Games and Educational Games
Fun With Words. Doctor Who. Fun Games. Philosopher's Quest. Monsters. Sphinx. Superlife. Adventure. Games of Strategy. Pirates. Snapper. Planetoid. Katakombs. Rocket Raid. Meteors. Super Invaders. Arcadians. Arcade Action. Games of Logic. Sliding Block Puzzle. Missing Signs. Cube Master. Chess. Time. Sailing Ships/navigation. Campaign 1346. Disraeli 1875. Castle of Riddles. Starship command. Missile Base. Snooker. Draughts. Reversi. Superlife. Battle. Cards. Hangman. Banner. Distances. Flags. Statpak. Countdown to Doom.

Graphics and Graphics Teaching
Shape Maker. Graphs and Charts. Creative Graphics. Eureka. Bar Charts. Moving Modules. Technical Drawing. Picture. Creative Graphics on the BBC Microcomputer.

General Educational Subjects
Educational I, Educational II. Results Analyst. Home Finance. Record Keeper. Desk Diary. Motorway. Farm Resources. Hill Railway. Rice Farming. Water on the Land. Prospecting. Light. Speed and Light. Urban Growth Stimulation. Urban Welfare. Census Analysis. Population Dynamics Transport/Manufacturing Location. Police. Diet. Map Skills 1 & 2. Balance Your Diet. Density and Circuit. Electrical Circuit.
Symbols to Moles. Lenses. Approximation, Estimation and Standard Form. Longitudinal Waves. Climate. Compass and Bearings. Yacht Race.

French
Respondez. Comprenez.

Logical Thinking
Venman. Vennkid. Shape. Gate. Watchperson. Spanish Main. Cat and Mouse. Logic Games. Concentration.

Language Arts
Early Learning. Word Hunt. Word Sequence. Sentence Sequence. Unscramble Spell. Pattern Recognition. Quiz. Anagram. Box/Wordshape. Dictionary Game. Vocabulary Practice. Hang the Man. Spelling Test Creation. List of Spelling Tests. Vocabulary Tester.

Mathematics
Fractions. Tables. Number Balance. Number Sequence. Maths Topics 1. Ultracalc. Algebraic. Manipulation. Trains/Arithmetic. Snap/Fractions. Ergo/Arithmetic. Morless/Number Concept. Abacus. Moving Modules. Multiplication. Speed Drills: Addition, Subtraction, Multiplication and Division. Read Speed Drills. Clear Speed Drills. Dice Addition and Subtraction. Long Multiplication. Area and Perimeter. Factor and Base Games. Equations, Pythagoras and Directed Number Games. Pythagoras Rule. Processes. Skill Counter.

Music
Music. Advanced Music.

Sciences
Evolution and Natural Selection. Particle Scattering. Genetic Mapping. Enzymc Kinetics. Homogenous Equilibrium. Gas Chromatology. Organic Synthesis. Decomposition. Sulphuric Acid. Synthesis of Ammonia. Element. Formulae. Gas Laws. Rates of Reaction. Reaction Kinetics. Compound Identification. Diet Analysis. Organic Analysis. Plant Competition, Photoelectric Effect. Mass Spectrometer. Planetary Motion. Gravitational Fields. Capacitor Discharge. Gaseous Diffusion. Radioactive Decay. Electric Impedence. Acoustics. Collisions. Momentum. Alpha/Range/Fraun/Decay. Chemical Analysis. Chemical Structures. Chemical Simulations. Atomic Structure/Equilibrium. Projectiles. Satellite Orbits. Orbits and Alpha Scattering. Exponential Growth and Decay. Alphafoil. Nuclei. Gravity. Quantum Shuffle. Random Walk. Ampere. Millikan. Malthus. Watts in Your Home. Moving Molecules. Photosynthesis. Metabolic Pathways. Wave Motion. Transverse Waves. Interference and Diffraction of Waves.

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Note: The above describes existing cassette or disk software by title or content, and is a partial list only. Additional teaching aids including books, audio and video cassettes, tutors and OHP's, are all part of the BBC Computer Literacy Project. Software by Australian and International publishers and developers: Acornsoft, Advisory Unit, Cambridge Educational Software, Edward Arnold, Golem Software, Heineman, Input, Longman, Micro Primer, Passionfruit Software, Tas & WA Education Departments.

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RS232/C port	Y	Y	Optional
Composite B/W video	Y	Y	Y
Composite PAL/NTSC	Y	Y	Optional
TV VHF output	Y	Y	Optional
RGB colour output	Y	Y	Optional
6 Apple compatible slots	Y	Y	Y
Upper/lower case	Y	Y	Y
Numeric pad	Y	Y	N
Auto repeat keys	Y	Y	Y

	Lingo 128	Medfly	Apple IIe
Cursor control pad	Y	Y	Y
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NEWSPRINT

dBase III

A copy of dBase III arrived in our offices too late for a Benchtest to be conducted, so you'll have to settle for a brief mention of its main features in *Newsprint* this month.

dBase III is for the 16-bit (and larger) computers. It can cope with over two billion records per file, 128 fields per record and ten database files simultaneously.

The program is written in the C programming language from "the ground up" and is not, according to Ashton Tate, its authors, just an enhanced version of dBase II. Although it does have the same features as dBase II.

A new feature of dBase III is the introduction of a "command assistance mode" called dBase Assistant which "guides the new user through dBase III providing him with a set of prompts to the most common areas of database use. When the cursor is moved to a dBase command word, a brief description appears explaining the category. Pressing the return key brings the category of database usage to the screen, with a menu appearing for the possible options in the command word's category", according to the publicity.

dBase III is accompanied by a tutorial in the manual which is augmented by a set of on-disk examples.

Arcom Pacific distribute the product. Telephone (07) 52 9522.

Another product from Arcom Pacific which will get its first public airing at the 3rd *APC* Show is Concurrent PC-DOS. As we've mentioned before in *APC* it's from Digital Research International, the company that cleaned up the 8-bit micro market with CP/M but which has had a less than overwhelming success in the 16-bit market, largely due to IBM opting for an alternative product from Microsoft. In response DRI worked on producing a more advanced operating system for the IBM and came up with Concurrent CP/M which enabled users to run up to four programs simultaneously. But because so many software houses had already produced programs which ran on Microsoft's operating system, Concurrent CP/M also failed to entice users to leave their less sophisticated operating system for which there are plenty of applications programs and convert to DRI's nicer but less supported system.

So, Digital Research has produced a program which it reckons has all the advantages of concurrency (ability to run more than one program at once) and can run programs designed for use on both DRI's and Microsoft's operating systems. It's called Concurrent PC-DOS.

DRI reckons it runs "most of the popular PC-DOS applications" including Lotus 1-2-3, dBase II and WordStar. It has windows to facilitate use of its concurrency feature; printer spooler (users can "queue" documents to be printed while other tasks are printing); ability to drive two printers simultaneously; and a "two-user" feature which lets two people use the same system at the same time (primarily this is designed as a remote dial-up link, so that, for example, a secretary might be preparing a document using a word processing program while a supervisor picks up or leaves a message from a remote portable computer).

Concurrent PC-DOS will work with 256k of RAM and two floppy disk drives on an IBM (or compatible) but 512k and a hard disk are recommended.

Capital show

The Microcomputer Special Interest Group (MICSIG) of the Australian Computer Society is organising "A Computer and Office Equipment Exhibition" in Canberra on the 16th and 17th of August at the Erindale Centre, Wanniassa. It's a three level show — the divisions being professional, home and office equipment.

Write to MICSIG, PO Box E237, Canberra 2600 for more details.

Video based micro learning package

Bits & Bytes is the name of a New Zealand micro mag (bet you thought they hadn't even heard of PCs. By the way, did you know a Commodore 64 sells for A$730 in Kiwiland? Cheap, eh!) and more recently a video-based micro learning package. It was created by TVOntario a self proclaimed world leader in educational telecommunications and specialist in the design of adult learning systems. B&B has been shown on public television

NEWSPRINT

stations throughout the US and received favourably, so it is probably worth a look.

Call Think Video on (02) 698 7666 for more information.

Apple bulletin board

An Australian-designed electronic mail system is expected to provide 100 Apple dealers throughout Australia with a high speed communications facility within two months.

In addition to facilitating dealer communications for Apple, the system will provide dealers with in-store equipment to demonstrate Apple business communications capabilities, both with major mainframes and with international and local databases.

Utilising Apple IIe equipment in each store, the system will employ modems and cards designed and manufactured by the Sydney-based company, Netcomm, and will run two software packages, one of which will allow dealers to log into the Apple bulletin board at North Ryde, which will supply up-to-the-minute pricing and sales messages, new product specifications, software guides, and will also accept dealer queries.

Additionally, the system is planned to provide the capability for an inter-dealer electronic mail system and will allow similar international communications for Apple dealerships with such overseas systems as Prestel, Dow-Jones and the Source.

Testing is now underway on the Apple electronic bulletin board, and the system is expected to be operational in August.

PC link

A micro to mainframe link for IBM PCs (and workalikes) has been announced by Distributed Data Processing. Tempus-Link will be on display at the 3rd *APC* Show in Melbourne, demonstrating its ability to not only provide simple file transfer but also define the PC's disks so they're accessible by the mainframe.

A single user system is available for $2,500; further installations are at a reduced price. Details on (03) 62 4698.

IBM drops price

In addition to announcing new configurations for its PC range in Australia, IBM has reduced prices by up to 19%.

The new configurations of the PC and PC XT come with 256k as standard, being priced at $3381 (system unit, keyboard, 320k disk drive and disk drive adaptor) and $7042 respectively (the same as the former but with a 10 Mb hard disk).

The new versions are scheduled to be available in September, and will be manufactured at Wangaratta.

4th generation Aussie exported

BBJ Computer Services reckons its "Today" package is "the world's first complete fourth generation product under UNIX" and will release it onto the US market later this year, previewing it at the NCC in July. It is an application development package which features a high level "user oriented" command language; decision tables; structured approach; flexible, easy to use report generation; help, test and training modes; self documenting mode; application change audit trails; three-tier control environment; ability to use files/data base system of the host computer; low cost; foreign language compatibility; ultra-fast development and running of applications; and that it is menu driven and UNIX based.

Another one

NCR has introduced a new personal computer which it says is a "16-bit industry standard compatible model". This means it runs a MS-DOS work-alike called NCR-DOS which supports programs like Lotus 1-2-3. dBase II, WordStar, Flight Simulator (mentioned in the press release not as a sales generating feature — execs don't fly jets at lunchtime — but to show how IBM PC compatible it is) and Frogger (don't know why this gets a mention).

The specs are too boringly familiar to mention here — they're virtually the same as every other IBM PC workalike. Details on (02) 922 0161.

Multi-Link

Cybex Computing has recently released a networking system for the Commodore 64 which is claimed to be substantially better than previous systems.

Multi-Link provides full communications among (up to) 48 Commodore 64s, making it ideal for schools. The satellite computers are set up in groups of six 64s daisy chained together and then connected to the master control unit. IEEE peripherals may be con-

Rakon Computers has released a Syquest removable hard disk option for the Sage microcomputer. The new drive provides 5.7Mb of formatted storage in a cartridge measuring about 11 x 12 cm. A typical Sage IV configuration utilising the removable hard disk would include a 12, 18 or 40Mb fixed winchester drive accompanied by a single half height floppy and the Syquest drive.

In addition to increasing the storage capacity of the Sage, the removable hard disk (at a cartridge cost of $135) provides another method of backup for the main drive. The drive sells for $2140.

Details on (02) 43 1351.

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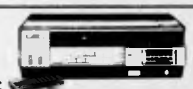

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nected to the master unit as well as standard serial devices.

Programs can be downloaded at high speed from the master unit onto any of the satellite computers. At a recent demonstration at Commodore Computers, it was shown that even protected software could be used on this system without any problems (tut, tut, tut).

From the master computer it is possible to view and control what the students are doing. Messages may be sent from satellite to satellite using a few simple commands (ie, kids can hurl electronic insults at each other). Each satellite can also access any peripheral connected to the master computer.

Security is provided at various levels including password protection and ID prefixes for special files.

Cybex expect an entire system complete will all necessary hardware, installation, software and eight satellites to sell for around $2500. Details on (08) 333 0711.

Freestyle — Beyond word processing

Freestyle's 'Outline' feature helps you 'prewrite' or organise your thoughts and ideas. It allows you to create outlines so you can see the structure of a dozen pages on a single screen and manipulate your corresponding text by moving the outline headings.

'Draw' allows you to draw boxes, charts, arrows and symbols easily, thus eliminating the need for a separate graphics package.

As well as the two main features, Outline and Draw, Freestyle also comes with horizontal scrolling, Wang-like glossary, online help screens, on-screen bold and underline, real-time justification, full cursor movement and on-screen international characters and maths and engineering symbols.

Freestyle is available for the IBM PC and compatibles under PC-DOS or MS-DOS 2.0 and 2.1. Freestyle requires 128k RAM (192k RAM recommended). Suggested retail price is $650.

Further details on (03) 459 7877.

16-bit power

Computer Transition Systems has just announced the CO-16. It provides a 16-bit operating environment to users of CP/M 2.2 microcomputers. The main CO-16 circuit board contains either an 8086 or a 68000 processor and 256k of RAM. An extra 512k of RAM is also available as an option. The CO-16 comes with either the CP/M 68k (for the 68000 version) or MS-DOS 2.11 (for the 8086 version). In addition, RAM disk software is supplied so that the CO-16 memory can be used as a RAM disk when only 8 bit operation is needed.

Priced at $1100, further details on (03) 818 7290.

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Further details on (052) 78 4284

WPS-80 Word processing for the Digital Rainbow

LOGO announces the release of WPS-80, a CP/M-80 word processor for the Digital Rainbow, Decmate II and VT180 computers.

WPS-80 uses special keys and features unique to the DEC personal computers to reduce keystrokes and enhance performance. A set of colour coded key labels are included, with each key labelled in English with words like 'Word', 'Underline' and 'Bold'.

WPS-80 also includes a full screen editor, ten cut and paste areas, HELP command and an 'oops' key to retrieve deleted text, extra wide text (WPS-80 displays up to 132 characters across the screen without using a split screen), proportional spacing on the LQP-02 letter quality printer, ragged and justified margins intermixed within a document and footnoting.

WPS-80 is distributed in Australia by LOGO. Further details (02) 929 8508.

Computer cruise

The Proud Mary is the venue for a five day cruise to learn about computers.

The programme is designed to enable participants to enjoy a relaxing top class cruise on the Murray River of South Australia and increase their knowledge of computers.

Topics to be covered include: computer databases; word processors; and spreadsheets — their content and uses. All sessions will be based on practical work using Sanyo microcomputers. There are individual terminals for each student.

Limited to 26 participants, the cruise departs Sunday evening August 5, returning August 10. The all-inclusive cost is $480.

For further information (08) 51 9472.

An addendum to this month's Benchtest of Epson's latest

Before you rush off to buy the PX-8, I am informed by a colleague who uses one all the time that he has discovered an irritating little "feature" — the diary cleans itself out every time you have a problem with any other program.

I can't imagine that anybody who buys the PX-8, which has enormous memory and Wordstar, would do so only to get the diary, but here is what happens, just in case:

Wordstar on the PX-8 is very nice, and includes a command (unknown in other Wordstars) to "transmit a file" — very nice, too. However it only seems to work if you transmit it to another Epson (a QX-10, probably) and if you don't, it won't stop without somebody pressing RESET.

At that point, all your diary dates are completely erased.

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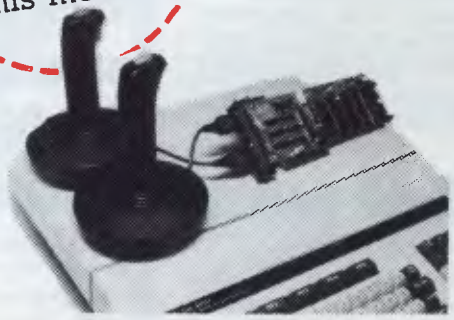

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PREVIEW

See it first at the 3rd APC Show

Framework

Ashton-Tate's new product has all the right buzzwords — 'integration', 'desktop', and 'windowing'. Steve Withers looks beyond the advertisements in this exclusive APC preview.

What is Framework?

Framework is far more sophisticated than I expected. On the surface it is a package that combines word processing, spreadsheets, graphing, database management and outlining (or "ideas processing"). While it does all these things, providing the kind of integration we have come to expect, its real power is hidden. At first, I thought the use of the word "frame" had been adopted to distinguish the product from others, but in fact there is more to it than that.

Frames add structure to windows — a frame may contain other frames

Like windows, frames seem to open up on the screen, and their size and position can be changed at will. The difference is that while you simply look through a window, a frame has more substance. Frames add structure to windows — a frame may contain other frames — as well as having an existence of its own through Framework's programming language.

At this stage I should point out that this article is based on a single day spent with Arcom Pacific working on a Beta test copy of Framework plus a study of a draft of the documentation. This means that what I saw isn't the product you will be able to buy at the end of July, although any differences should be minor. Accordingly, I intend to present a broad-brush picture of the program. Every user of off-the-shelf software knows that the fine details can make or break a program, so we plan to present a full review of Framework after its release.

To run Framework you need an IBM PC with a couple of disk drives and 256k of memory, but this should be regarded as a bare minimum. Framework really deserves a graphics board, and because it keeps all the active data in memory many users will find that some additional RAM wouldn't go amiss.

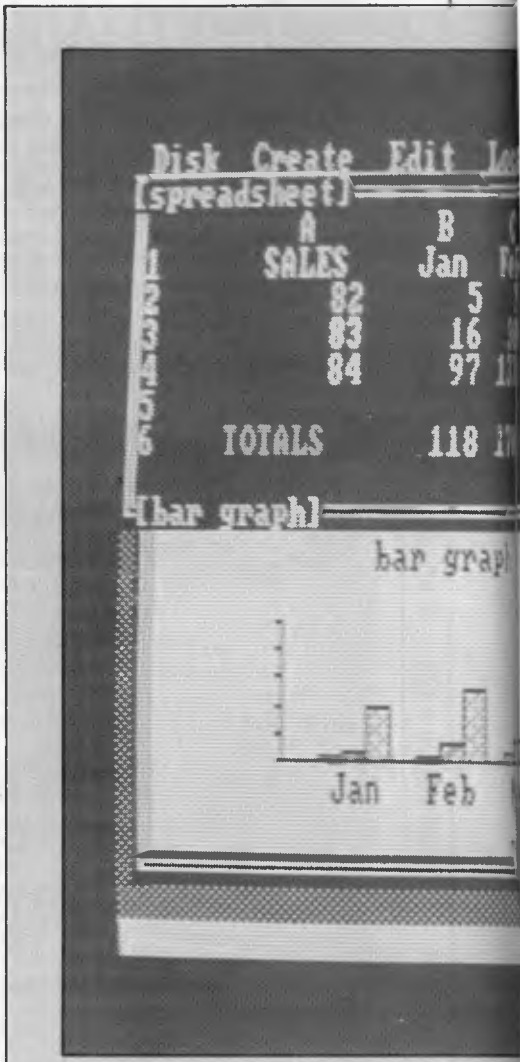
User interface

Framework has a pleasantly consistent user interface. Novice users are aided by pull-down menus that are activated by pressing the Insert key with selection carried out with the cursor keys. This type of operation is much easier with a mouse. (I'm sure a mouse driver could be added to Framework), but it's better than permanently cluttering the screen. I liked the way the menus reappear in the state you left them.

Framework's consistency can be illustrated by comparing the commands needed to change the size of a frame and to adjust the width of a spreadsheet. In both cases you press the F4 ("size") key followed by left or right arrows to stretch or shrink the object. The only difference is that you have to start by selecting the object to be adjusted. Another example is that when you press 'delete' the selected item is deleted, whether it is a whole frame, a paragraph, or a single number.

When you fire up Framwork the only thing showing on the desktop is the box representing the disk drives. You select a drive, open it, and a window opens to reveal the directory. When you choose files they pile up at the bottom of the screen — the effect is rather like a filing tray. Opening the file puts the frame onto the screen.

As there can be more than one open frame, there has got to be some way of moving from frame to frame. I mentioned earlier that frames can be nested, pressing the grey '+' key moves down a level, while the grey '–' key takes you back towards the desktop level. Switching between frames at the same level is achieved with the cursor keys (just like moving between cells in a spreadsheet).



Sample screen of Framework showing interre graphics frame. On the right, a menu and be

Although this consistency means that users won't need to constantly switch from one set of commands to another, there are a large number of commands to learn. Of course, you only need to learn the commands that are essential for your way of working, but some keyboard labels would be useful. I've seen keyboards fitted with transparent rubber covers that are flexible enough to be unobtrusive in use while effectively relabelling the keys.

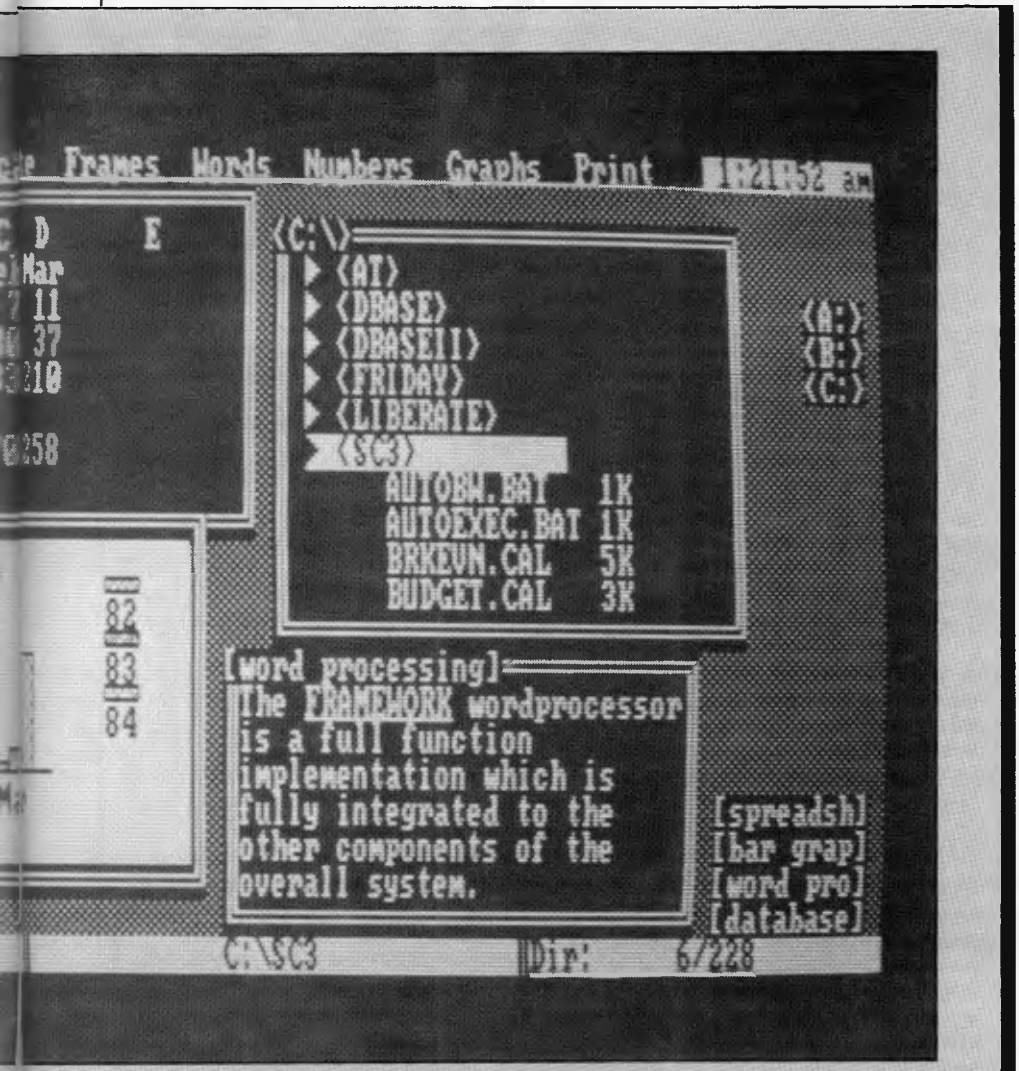
In many cases it's more convenient to enlarge a window so it fills the screen (while word processing, for example), so Framework has a "zoom" key which does just that. Pressing it a second time returns to the normal desktop display.

either inserting or overtyping. There are other, more powerful commands for moving the cursor longer distances, searching and the like. Margins may be adjusted at will and justified or ragged right formats used. When a graphics board is used, text can be shown in its normal manner, or italicised, underlined, or bolded. This also applies to text in spreadsheets, graph labels and outlines.

The page layout is not controlled from within the frame. Instead of having print commands scattered around the text they are all tucked away 'behind' the frame (much as the formula defining a spreadsheet cell hides behind the value it generates), care must be taken as these commands seem to have a minimum impact on the frame's contents. For example if a line length is specified which is less than the length of the lines within the frame the excess characters will simply be truncated.

Framework has the most comprehensive set of heads and footer commands I have seen. You may specify left, right and centre headers and footers for odd and even numbered pages, and the text of the headers and footers can be spread over more than one line.

The word processing side of Framework seems intended for 'executive' word processing; it would be fine for letters, memos and short reports, but it lacks the features that become useful on larger jobs — there's no provision for footnotes, indexing, or multiple character sets. I assume that the database manager can be used with the word processor to handle mailing lists, but the exact method isn't obvious.



...ted frames. In the upper left hand corner is a spreadsheet below which is the associated ...w that a word processing frame

Word processing

The simplest thing you can do with a frame is type some text into it. Text frames are edited in a predictable way, moving around with the cursor keys and

Spreadsheets

The most surprising thing about the spreadsheet is its default size, just 14 x 14. While you can specify a larger size, there's probably no need. Look at it this way: 14 columns give enough room for a label for each row, 12 monthly figures and a total for the year. Similarly, one row will be occupied by the column labels and another will hold column totals, leaving room for 12 items. We are back to the question of presentation — many people have realised that a condensed report provides key information quickly, hence the growing use of business graphics. Framework encourages a multi-level approach to spreadsheet analysis, call it modular spreadsheeting if you like.

The top level report might show the net profit generated by a company's divisions. This might receive information from spreadsheets at the division level that aggregate figures relating to products, and so on down the line. Framework makes the construction of interrelated spreadsheets as easy as working on one big sheet. Users of current spreadsheet programs will be familiar with the idea of building a formula by 'pointing'.

For those who aren't, it's most easily explained with an example. Suppose you wanted cell value B3 to take the value of 0.75 times A1. You position the cursor in B3 and type in "0.75*", then move the cursor to A1 and press return, and the program completes the formula for you. This is a considerable time-saver when the formula becomes more complicated, and it's less open to errors — because the cells referred to are highlighted, you are less likely to use the wrong cell. Where Framework scores is that it allows you to point to cells in other spreadsheets. It doesn't stop there, because for extra security you may tell Framework to recalculate a referenced cell before collecting its value. You can also have your spreadsheet interrogate a database frame.

Another advance is Framework's ability to reference cells in the user's language. If column B is headed "January" (ie, cell B1 contains the string "January") and row 10 is labelled "Profit", then instead of talking about cell B10, you may refer to "January.Profit". While other products (like Multiplan) allow linked spreadsheets and named areas, Framework seems to be a significant improvement.

When you are typing in data, most spreadsheets allow you to enter the value you've typed and move to the next cell with a single keystroke (typically by using the cursor keys). Framework only permits this if you are working left-to-right along a row, but I have found that I usually enter figures in columns. This is a small omission, but one that I would find annoying.

If you have an 8087 processor in your system, you'll be pleased to hear that Framework will take advantage of it during spreadsheet calculations.

Graphics

The graphics facilities are in line with Framework's orientation — business style bar and pie charts, plus line graphs and scattergrams. While these have broad application, there is no provision for things like log scaling as needed in many scientific and technical applications. It's no big deal to transform the data while it is still in the spreadsheet or database, but that doesn't result in appropriately marked axes.

Framework makes most basic tasks easy, and graphing is no exception. To draw a graph you simply select the data set to be used from a spreadsheet or database, enter the graph command (either directly or through the menu bar), and then specify the type of graph wanted. There are a few options available, but generally I found it was a case of "set and forget".

One feature makes it particularly easy to set up Framework applications for relatively unskilled users. Once a graph has been created, you can include the name of its frame in the database or spreadsheet that supplies the data, and then the graph will be updated whenever the data changes.

While Framework provides for switching between two printers and a plotter, I have no information about the particular models it can drive. Plotter support is an excellent idea — I've seen programs that produce well-formed graphs which are marred by reproduction on a dot-matrix printer. On the other hand, not everyone needs presentation quality, so a graphics printer provides an economical alternative.

The only time that Framework uses colour is when you zoom in on a graphics

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803/AAE/Little

PREVIEW

Framework

frame, probably because of the different resolution of the IBM's graphics. This gives a rather coarse look to the graph, and I think I would prefer a full screen monochrome view.

centrate on particular sections (eg, global searches are confined to the position under scrutiny) without having to explicitly reconnect it with the others. As a bonus it is also able to add page numbers to the outline, turning it into a table of contents.

For my money, outlining is the key feature of Framework. It would make so many writing jobs easier that I would consider buying it even though I have little need for graphing and database management.

Framework encourages a multi-level approach to spreadsheet analysis, call it modular spreadsheeting if you like

Database

As Framework keeps all its active data in RAM, small databases are the order of the day. If this bothers you, bear in mind that provision is made for reading dBase II, dBase III, and Friday! files into a frame. As such files are likely to be too big to fit, you can specify selection criteria to retrieve just those records you're interested in.

Framework allows the usual data management operations like searching, sorting, merging, and selection. The effect of selecting records is to make the other 'disappear' — this is because the filter expression is applied to the frame containing the database, and so it controls the appearance of the frames contents.

There are two ways of displaying a database. The default is a tabular view, showing the records in columns, while the alternative is a "forms view" which displays one record at a time. As the name suggests, by juggling with the position of the fields within the frame it is possible to design forms for data entry and display.

Ideas processing

While nested frames make it easy to structure a document, the outline facility is very convenient. When you create an outline frame, it contains a number of other frames representing the major sections of the document. Each of these contains further frames giving the subsections, and these will contain text, graphics, etc. You can start by giving each frame an appropriate title, and then go inside to flesh it out.

The beauty of this system is that you can add extra sections as necessary and rearrange material at will. While this is possible with a conventional word processor, Framework allows you to con-

DOS Access

The ability to run one program from within another is nothing new — Wordstar's had it for years. Where Framework scores is that it sets up a separate DOS session, capturing its console output in a frame for later use. There are two main benefits — all the DOS functions are available to the user, and the results of other programs can be easily brought into Framework. You can run any program you like providing you've got enough memory — everything sits in RAM simultaneously, so a 256k system could prove restrictive if you make extensive use of this feature.

By the way, Framework understands DOS 2's directory structure, so you can keep associated files in a sub-directory if you wish.

For my money, outlining is the key feature of Framework

Programming with FRED

FRED ("FRamesEDitor") is Framework's programming language. Because of the relatively complex nature of this part of the package, my comments are based on the documentation rather than first-hand experience.

It seems that every Framework feature can be invoked by FRED. FRED functions live "behind" frames and deposit their result inside or behind the frame. As functions can access the contents of other frames, this provides a means of linking frames with each other — the earlier discussion of linked spreadsheets represents a specific case of this process.

FRED is modelled on the 'language' used to build spreadsheets: every element generates a value. That's the idea, but there seem to be some exceptions like @SETSELECTION("name") which causes the frame called "name" to become the active frame.

I think FRED would be most easily learned from a worked example. It is sufficiently different from conventional programming languages to cause conceptual problems, while interlinked frames with hidden formulas would be difficult to represent on paper. A well-designed tutorial would make a lot of difference, and I hope there will be one in the final version of the manuals.

Framework's programmability means we are likely to see it used for a wide range of applications. FRED even includes a mechanism for generating menus that match Framework's own, so there is no excuse for failing to maintain the consistent user interface.

FRED has so many functions (over 140 according to the manual) that I won't try to list them, but there are financial, statistical, and mathematical functions as well as others to manipulate times and dates. The writers obviously recognise the value of the international market as they have made provision for different currency symbols and number formats — Framework is as happy with "1.500,000 Skr" as it is with "$1,500.00". On the other hand they expect everyone to express dates as month, day, year.

Conclusions

It's dangerous to draw conclusions from such a brief exposure to a new product, especially one that's still in Beta test. Framework's main competitor is bound to be Symphony, and I think that ease of adoption will play an important part. Users of Lotus 1-2-3 will, we're told, be able to move up to Symphony with a minimum of fuss, while people with extensive dBase II files would be more interested in Framework.

Given the momentum behind Ashton-Tate, I think Framework should take off, and we will probably see a number of applications that will sit on top of it.

Framework is an interesting product, so if you get a chance to try it out I suggest you take it.

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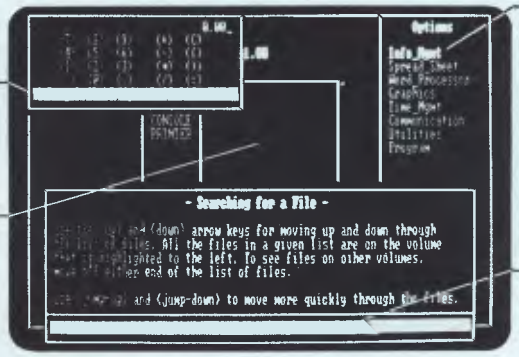

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Epson PX-8

A truly capable lap-held computer must incorporate all the specifications of a standard desktop machine. The Epson PX-8 runs on the CP/M 2.2 operating system and has unlimited access to a huge CP/M software base. Does it fit the bill? Dick Pountain reports.

What sits on your lap, has three processors, uses ROM, RAM and cassette as disk drives, and runs CP/M 2.22? The only answer as far as I know is Epson's new PX-8 Portable Computer.

Epson started the 'lap-held ' market with its HX-20, and the signs are that this sector is going to become the hottest area of competition over the next year. The market is driven largely by workaholic business practices in the US, where we are led to believe that young execs like to keep up with their spreadsheets even in the toilets of transcontinental airliners. Whatever the reason, suddenly everyone is making lap-held computers, and some of them (like the Sharp 5000 I reviewed last month) are sporting most of the features of desktop machines, including 16-bit processors. Only display technology now holds off the fully capable (which should include an 80 x 24 screen) portable computer that has been the dream of portable

'nuts' for several years; the rumours are that the last hurdle will be passed later this year by a new, fully IBM PC-compatible Tandy.

Meanwhile, Epson has brought out a replacement for the HX-20, whose small 20 x 4 display places it in a previous generation compared with the Tandy and NEC lap-helds.

The PX-8 was originally called the 'Maple', an attractive name which has been sadly dropped in favour of the inevitable hi-tech number (software writers could have gone to town with programs called 'Walnut' and 'Syrup'). It has an 80 x 8 display, and also has the powerful advantages of a built-in micro-cassette drive and a grown-up operating system, CP/M 2.2. Rather than chasing after the still-confused 16-bit market, Epson has wisely decided to go for the established winners, and is offering a selection of proven CP/M software (including WordStar) bundled with the machine.

Hardware

I can still remember the impression the HX-20 made on me when I first saw it — I wanted one. The PX-8 has a similar effect but even more pronounced. There is an air of quality about the mouldings, keyboards and various neat design touches of both machines that no-one else seems to be able to match.

The PX-8 is almost exactly the same external size as an HX-20 (A4 magazine size), the immediately obvious differences being a removable cover over the keyboard and a fold-away display, so that when packed for travelling it forms a fully-covered box. Joy of joys! — it also has a sliding carrying handle which fits flush and unnoticeable around the front edge of the keyboard. When this is extended, the machine feels very much like a small portable radio. The case is moulded in cream high-impact plastic to a very high standard; numerous legends labelling the various controls and ports are moulded in sharp relief. Two little fold-out feet at the rear of the case allow it to sit on a desk slightly tilted forward for better typing — good thinking, Epson.

The keyboard cover slips off by pulling it forwards, after which a catch can be released to allow the display to fold up out of its recess behind the keyboard. In doing so, it reveals the microcassette deck and a small audio speaker. The display can be set to various angles up to 180° (flat) in 15° increments, using a ratchet mechanism that is built into the concealed hinges. The display is the now-familiar eight-line LCD but, like the Sharp, has a full 80 characters per line. The contrast is rather better than that on the Sharp, but it still requires strong frontal illumination for comfortable reading. Until some form of flat self-luminous display becomes cheap enough, I'm afraid this is as good as we'll get. The character set is chunky and readable though it lacks descenders. Contrast is controlled by a slider which is sensibly placed below the display.

The Epson PX-8 case: 'an air of quality'.

The keyboard is very good indeed, with flattish keys with 'sculptured' tops and a superb positive action. The SHIFT and RETURN keys are properly placed and double sized. Four cursor keys are picked out in orange and live above the RETURN key. TAB, CAPS LOCK and two CTRL keys are provided, the second CTRL key placed at the end of the space bar for touch typists. Like the HX-20, the PX-8 has two extra shift keys to access the graphics character set and to turn part of the QWERTY pad into a numeric keypad (CAPS and NUM locks have red LED warning lights to show they're engaged). Above the main key block is a row of smaller keys which include STOP, ESC, PAUSE, HELP, and five programmable function keys. The HELP key is not supported at the CP/M command level, only in suitably written applications (including Portable WordStar).

The only thing I didn't like about the keyboard was the type-ahead buffer but this is a personal phobia — some people consider it indispensable. I'm the sort of impatient guy who pounds away at the RETURN key when something takes too long to happen. My reward is half a minute of frantic scrolling as the slow LCD tries to display twenty machine-gun CRs.

The PX-8 contains alternative character sets for nine different countries which can be switched either by an internal DIP switch or under software control. There is also provision for 32 user-defined characters, using ASCII codes 224 to 255 accessible from the keyboard via the GRAPH key.

The PX-8 is powered by a rechargeable NiCad cell pack which lives under a trapdoor in the bottom of the case. It's

The 'sculptured' keyboard has a superb positive action

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good for up to 15 hours of use (without power-hungry external devices) and takes eight hours to charge fully from the supplied AC adaptor. This, unlike the HX-20's, is smart enough not to overcharge however long it's left on, and the machine can be used with it connected. After a 'Low Battery' alert, the battery can be charged up to operating level in about 15 seconds, allowing you to put the house in order before setting it to charge fully.

Another trapdoor under the case contains two ROM sockets and the master reset switch. The 32k ROMs are treated by Epson's special CP/M as disk drives and are the principal medium for distributing software. Before you start to panic — no, you don't have to insert bare ROM chips, legs and all. The chips are mounted on a simple plastic carrier with their legs wrapped around which plug into a low insertion force socket, gripping it by finger grips at each end. It's no more hassle than inserting the bulky edge-connector cartridges favoured by other manufacturers and is much more compact. ROMs can be changed at any time, with only a warm start required afterwards.

At the back of the case are six I/O sockets. One is the power socket for the AC adaptor followed by the high speed serial port (for printers and disk drives), the RS232C port, and three jack sockets for Bar Code Reader, Analogue Input, and External Loudspeaker. There is no support for external cassette recorders. The main Power On/Off switch and speaker volume control are at the right-hand side of the case, and the Reset is one of those holes you poke a Biro into at the left (there are three different levels of Reset). Between the sockets is a removable panel which conceals the 50-pin system expansion bus.

Dismantling the PX-8 is gratifyingly easy: remove seven screws and the case bottom lifts off to reveal a single board computer of exquisite simplicity and uncluttered execution. There are only 36 ICs on the whole board and of those, three are ROMs, eight are 64k RAMs and three are processors. The main processor is a Z84 by Toshiba (presumably a CMOS Z80) and it's this which is the host for CP/M. Epson doesn't say, but the timings suggest it runs at 2MHz. Under its control are a Slave Processor 6301 (as used in the HX-20) which looks after all the I/O devices, with its own 6k of RAM to use as video memory. The third processor is a 7508 which controls the keyboard and the 6-bit resolution A/D convertor.

The RAM is battery-supported, and the clock-calendar chip has its own separate back-up battery which can also support the main memory for a short time in case of a low main battery. Power is automatically shut off to conserve the batteries after a period of disuse which can be set in software. A variety of automatic power on modes are also provided.

The Z80-style processor addresses the full 64k of internal RAM and also a 32k ROM called the IPL (Initial Program Loader), from which CP/M is booted into RAM. Up to 24k of the internal RAM can be configured as a RAM disk so that the machine can be used as a self-contained unit without any other mass storage. For many purposes 24k of RAM disk will not be enough, so Epson has provided two models of optional 'Intelligent RAM Disk' extension, one of 60k and the other of 120k. These are thin wedge-shaped boxes which bolt onto the underside of the case and increase its thickness but not its 'footprint'. They connect by a printed flexible ribbon cable to the system expansion bus and have their own battery back-up (Epson does not guarantee that they can be used to transfer data from one PX-8 to another).

When an external RAM disk is in use an internal one can't be assigned, so the full 64k is available to CP/M as TPA.

The microcassette deck is based on a standard Olympus mechanism and features a software tape counter as on the HX-20. Unlike the HX-20 however, the tape is configured as a CP/M device (drive H:) and its operation is normally completely transparent to the user, though a manual control mode does exist. As the tapes are set up as (sequential) CP/M media with a directory, there are complications when removing a tape from the drive (the directory is not automatically updated after writing so removing the tape could corrupt it). Tapes must only be changed with the MOUNT and REMOVE commands which guarantee that the directory is up-to-date. The tape system is not very fast (in fact, it seems slower than that on the HX-20) but it works OK as a second line of security for the RAM disk contents when you are writing lots of text on a tropical beach (some hope). Copying a 1000-word WordStar file to tape takes approximately three minutes, but PIP is appreciably faster. The cassette deck plays Olympus Pearlcorder format audio tapes through the built-in speaker or through headphones, so the machine can be used for audio typing. That's smart thinking for you.

Operating system

It's a fact of life that you can get used to anything given time. I can remember numerous occasions when I and other writers slagged off CP/M in these pages as a dreadfully unfriendly operating system, unfit for personal computer users.

Time and the computer industry marches on, and I find myself more and more in favour of the spartan simplicity of CP/M compared with some of the grisly edifices that have been erected since! The software base for this operating system is now huge and most of it is genuinely portable, give or take a few evenings cursing and spitting escape sequences.

By comparison, the 16-bit scene has

Technical specifications

CPUs	Main Z80-compatible CMOS Slave 6301 Sub 7508
Memory for Z80	64k RAM 32k ROM containing CP/M Variable RAM and ROM disk size
Memory for 6301	128 bytes on-chip RAM 4k on-chip ROM 6k video RAM
Display	80 x 8 character LCD
Keyboard	ASCII type with US, UK, Fr. Ger, Swed, Dan, Nor language character sets
Interfaces	RS232C, serial (38,400 baud), bar code reader, analogue/digital
Power supply	Rechargeable NiCad pack, AC adaptor
Dimensions/weight	297mm x 216mm x 48mm/2.3kg

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turned out to be a step backwards, with IBM ROM-BIOS compatibility (or more usually incompatibility) replacing portability. PIP and STAT now seem like old friends.

One thing that's certain is that when Gary Kildall created his little monster, he had no notion of ROM drives, RAM drives and microcassettes. Epson (or its contractors) have had a lot of work to do to get CP/M to accept these alien devices, and they've done it very well. PX-8 CP/M actually behaves more like proper CP/M than a good few desktop 'versions' I could name. In addition to the standard CP/M formula of BDOS (Basic disk operating system) and BIOS (Basic I/O system), Epson has added a complete cassette operating system (consisting of the corresponding MTOS and MIOS), plus a stack of BIOS extensions to handle the plethora of clever hardware features such as automatic power on, alarm clock/scheduler, high-res graphics, bar code reader and A/D convertor. There is even a BIOS entry point to talk to the slave processor which can be brought under the control of Z80 programs.

A very powerful innovation is the User BIOS. This is an area of RAM (the size is allocated during system configuration) which can hold new routines and then effectively become part of the CP/M BIOS. The User BIOS has its own table of entry points and a function to reload them; it provides a clean way of adding new device drivers to the ROM-based operating system.

The display driver supports four different display modes. The first, Mode 0, is the normal 80 x 8 display, though it's actually a window onto a virtual screen. To be exact, it's a window onto one of two virtual screens, the sum of whose lines must be 48; at power up they are both set to 80 x 24. It's possible to switch from one screen to the other and to scroll up and down using CTRL and the cursor keys. This applies even at the CP/M command level, so you can scroll back up a long directory listing. Mode 1 splits the screen in two vertically, with a line down the middle. The 39-column wide text wraps around to the top of the right-hand half giving, effectively, 16 lines; the two halves scroll together. Mode 2 again splits the screen, but the two halves are two separate virtual screens and can be scrolled independently. The split can be moved by the user so that one part is, for example, 20 columns and the other 59 (the sum must be 79). In all these modes the character size remains the same. Mode 3 is graphics mode in which the screen becomes a 480 x 64 dot bit map (in this case there is no virtual screen — what you see is what you get).

Much has been done to the user end of CP/M. When you boot up the PX-8, a menu of files is presented instead of the normal bare A>. Programs can be run from this menu merely by moving the cursor to the right name and pressing RETURN. Given the small display (one third of a normal CP/M screen) and the presence of at least four drives (RAM disk, two ROM disks and cassette, maybe two floppies), it's clear that you can't get everything on this menu. A system configuration program is built in which can be accessed at any time (even inside an application program) by pressing CTRL HELP. One option is to choose which drives are shown on the Menu and the types of files to show (it comes set up to show .COM files only but you can have up to four different extensions).

Pressing ESC gets you out of the Menu and into the A> prompt, where the CP/M built-in and transient utilities work as usual. You can't PIP into a ROM (they behave exactly like write-protected disks) though you can PIP out. The supplied utility ROM contains PIP, STAT, SUBMIT, XSUB, TERM, FILINK and CONFIG (another configuration program used to set RAM disk size, function keys and RS232 parameters).

One thing missing is a way to find out how much RAM is free (STAT could have been extended to do this). It doesn't usually matter in CP/M, but when you have a variable user BIOS and RAM disk, it does. The only hard fact I have is that 24k is free to Basic with no RAM disk or UBIOS, which suggests that the CP/M is larger than normal.

Initially, the RAM disk is A:, the ROMs are B: and C: and the cassette is H: with optional floppies at D: and E:, but this order can be changed from the system configuration screen if you want to have a floppy area as A: (only the cassette is fixed as H:)

Other clever things you can do with the system configuration program include setting a password to prevent unauthorised use of the machine, getting the machine to switch itself on at a preset time, setting up an alarm clock message which will be displayed at a given time (interrupting any applications which are running — ESC lets them continue) and altering the RAM disk size.

'Rather than chasing after the still-confused 16-bit market, Epson has wisely decided to go for the established winners, and is offering a selection of proven CP/M software (including WordStar) bundled with the machine.'

The ALARM/WAKE function uses the battery-backed clock/calendar in the PX, which also displays the time and date (including day of the week) continuously when you're in the file menu. WAKE sets the PX-8 to switch itself on at a specified time and date, and can also take a string which is executed as if it had been typed at the CP/M command line. You can therefore get the PX-8 to switch itself on next Christmas and run a program (perhaps Yonder Star™). By cleverly allowing wild cards in the specification of the WAKE time, the machine can perform this robot operation at regular intervals too. For instance, **/12 **:15 would cause it to WAKE on the 12th of every month, every 15 minutes throughout the day. AUTO START takes a string similar to that in WAKE but executes it automatically when you switch the machine on manually. In both cases the file menu must be switched off, otherwise the program lying under the cursor will be run instead with your string as a parameter! I know because I now have a WordStar file called DIR.

The RAM disk has to be formatted just like a real disk (though it only takes a second) and if it's corrupted you get a BDOS ERROR: BAD SECTOR just like the good old days.

Resetting the PX-8 is a rather baroque affair of the number of independent little minds in there. Many hung programs will be tamed by the STOP key on the keyboard; if not, CTRL STOP should warm start CP/M. If that fails, the Reset switch on the side of the case performs a warm boot and resets most of the system parameters to their default values (it

usually doesn't destroy programs or data). The ultimate deterrent is to press SHIFT NUM/GRAPH and Reset at the same time (borrow a friend's octopus), which blows away everything including the RAM disk and requires you to re-enter tha date and time. This should only be necessary if the battery has been removed, or something equally drastic.

One final point about the operating environment is of very special importance. You can switch off the power to the PX-8 in the middle of an application program and have it restart at exactly the same point when you switch it on. To do this, you must hold down CTRL as you switch off, otherwise it will boot up into the file menu next time you switch on. This feature has a beneficial effect on WordStar, not the quickest program in the world to start up from scratch. Now you can forget it — just switch off and start again where you left off. This feature is automatically applied when the machine switches itself off to save batteries.

Software

The PX-8 comes with a set of 'bundled' applications: a word processor (Portable WordStar), spreadsheet (Portable Calc), diary/scheduler (Portable Scheduler) and Basic. In addition, two communications programs are included among the ROM utilities: TERM is a simple asynch terminal emulation; FILINK is a file transfer program which uses a rather complex protocol of Epson's own devising.

Portable WordStar

This alone will sell the PX to many people. If you've been using WordStar as your main editor for some time (and around a million people have) then it's very difficult to cope with a different editor on your portable. How does it compare with the desktop version? Apart from the smaller screen there is little difference. Being in ROM it boots up a lot faster than any floppy disk version, and saving to RAM disk is almost instant. On the other hand, the slow updating of the LCD display makes scrolling through a document rather agonising. It's not possible to have H: (the cassette drive) as the logged drive in WordStar as it's far too slow for virtual memory access.

Because the screen is so small (the Help menus fill the whole screen), the automatic Help facility of WordStar has been suppressed and the menus are raised manually by hitting the HELP key. The SpellStar-related commands are missing from the main menu, but in their place are new commands — T for Transmit and C for Receive — to transfer files to another computer via the RS232 port.

The biggest handicap is memory space. With a 24k RAM disk (the maximum allowed internally) I could only produce a document of around five single-spaced pages; any more and a 'Drive Full' error occurs when you try to return to the first line. The file is only 13k in size but WordStar has to reserve the same again for its back-up file, hence the error; given the non-volatile memory I think I could live without .BAK files. For any serious writing, the external RAM disk (or the portable disk drive) will be essential.

Portable Calc

I wasn't supplied with a Calc ROM but played with it briefly on another machine. It's written in Micropro and seems like a perfectly useful spreadsheet with all the facilities of a desktop version. Surprisingly, the small screen does not make it at all difficult to use, probably because we are already used to scrolling a window onto a larger spreadsheet.

Portable Scheduler

The scheduling program allows you to choose a screen which represents a diary page (the date is displayed at the top). The page is split into morning and afternoon, each divided into half-hour intervals. On each line you may type a short reminder of what you are to do at that time. Any of these reminders can be automated using the ALARM/WAKE function, and each one so selected is marked on the page by a musical note beside it. At the appointed hour, the Scheduler will interrupt what you're doing, bleep, and print the reminder. This interrupting can happen even though the Scheduler (which is just a data entry program) is not loaded, because it has stored the appointment times into the User BIOS and passes them in sequence to ALARM.

TERM and FILINK

TERM provides terminal emulation using the built-in RS232C port at a range of baud rates up to 19,200, which can be set in software. Unfortunately, it's necessary to leave TERM and go into the configuration program to alter the communication parameters. TERM allows transmission and reception of files as well as direct keyboard interaction, but without any protocol. It worked well when connected to my CP/M system, and transferred files successfully in both directions at up to 2400 baud.

For reliable transfer at higher rates the more specialised FILINK should be used. Unfortunately, the protocol it uses is not XON/XOFF or ACK/NACK so you'll either have to write a special program or communicate only with Epson machines. It transfers the file name in ASCII followed by 128-byte blocks with their XOR as a check byte, and uses no less than 13 different characters as handshake signals — that is, to establish conenction it sends R (ready), receives S (set), then sends G (go).

Basic

The Basic supplied with the PX-8 is an extended version of Microsoft's Basic-80, but is not extended to the level of GW-Basic, the version used on the IBM PC and rapidly becoming the new standard. In particular, Epson's Basic does not have the sound and graphics 'sub languages' of GW-Basic, having just a SOUND command with pitch and duration, and only point and line plot commands for graphics instead.

More surprisingly, given the rich hardware environment, it doesn't have the new software interrupt structures such as ON COMM . . . GOSUB and ON TIMER . . . GOSUB, though it does have full support for the RS232 port and the alarm timer. The latter can be programmed through the ALARM command which uses the same clever wild card formats as are available in CP/M. The W option gives WAKE instead of ALARM, which means that a Basic program can be set up to run itself at programmed intervals — useful for data-logging or control activities. AUTO START and the automatic power off feature can also be used from Basic. However, the Bar Code Reader and Analogue interfaces are not directly supported and will need a machine code routine to be linked in to read them.

As on the HX-20, the program area is partitioned into five, so that up to five different Basic programs can coexist in memory. Each can be given a name, and a menu of the contents is shown on entering Basic. Swapping to a new program is done by the LOGIN command.

Benchmarks

BM1	3.0
BM2	8.0
BM3	19.5
BM4	19.0
BM5	22.5
BM6	40.0
BM7	62.5
BM8	89.0

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

Decimal, hex and octal constants can be used and double-precision (16-digit) constants are allowed. Integer-, single- and double-precision variables can be optionally declared with DEFINT, DEFSNG and DEFDBL, and type conversion is automatic.

Sequential and random files are permitted for both disks and microcassettes, though random files on the latter can either be read or written but not both (they must be closed and reopened). File I/O is performed in the same way for all external devices, files being referred to by a descriptor which includes the device name they're intended for. Up to 15 files may be open simultaneously, and memory use can be optimised by specifying the number you will be using as an option when loading Basic. For example, BASIC/F:3 will only create buffers for three files.

The Benchmark timings show that the PX-8 sacrifices little in speed to its CMOS processor. They are exactly the timings you would expect for the older desktop CP/M machine with a 2MHz processor.

PX-8 Basic has a full trapping of CP/M BDOS errors, and about time too. If you try to save to a write-protected disk, or to one with a bad sector, you'll get a Basic error message and the chance to retry, rather than being dropped into CP/M and losing all your data. All things considered, this is a thoroughly professional Basic, with a bias more toward business programs than amusement.

The system disk which came with the floppy drives contained a PROM-burning program, which I assume will be made available to third party software vendors to allow them to put their software into ROM capsules. The fact that no fancy cartridge is used should enable costs to be kept down (if the chip shortage allows them to get any ROMs at all!).

Expansion & potential use

Like the Sharp 5000, the PX-8 is a fully-fledged general purpose business computer and can be used to 'take the office with you to places where mains power is not available. The 15-hour battery life is adequate for the longest journeys and for any sort of day trip in the field. If no printer or other external devices are employed then this could extend to several days of average use.

Potential users include those people currently using portable computers, from business executives through salesmen to scientists and engineers. The latter should find the combination of the sophisticated timing facilities, with the ability to run other languages like Fortran, Forth and C, particularly attractive.

For users who require large data volumes, such as a writer or sales rep logging his contacts and orders, then one of the external RAM disks would be a good purchase. Epson has released a portable, battery-powered 3½ inch disk drive to accompany the PX-8. It wasn't available for the review, although another *APC* staff member had a brief opportunity to use one and assures me it performs well.

Another alternative is to send the data

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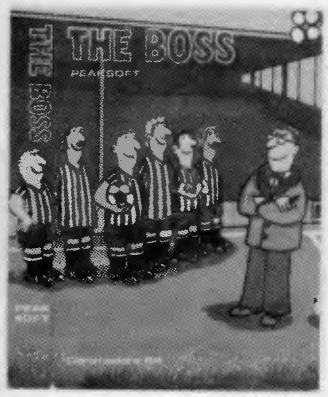

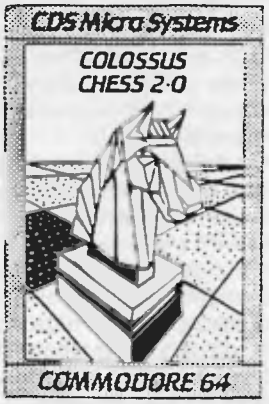

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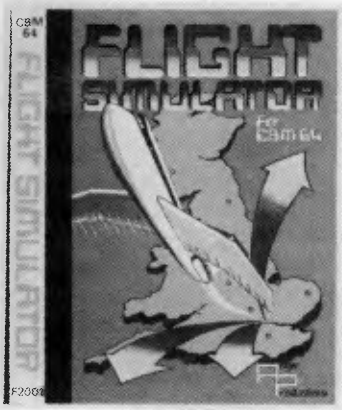

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back home by telephone link, rather than store it on the spot. I tried the battery-operated acoustic coupler (CX-21) which can be used with the PX running its TERM program. This is a 300-baud, full/half duplex, answer/originate device, compact and well constructed. One of the rubber cups is on a swivel to accommodate different shapes of telephone handset.

Epson has launched a PX-8 compatible battery portable printer. The P-40 is a 40-column thermal printer which was not available in time for this test.

The floppy disk drives (TF-20) that I used for this review are not specially designed for the PX-8 but will work with the HX-20 and the QX-10 desktop too. The twin slimline drives hold 280k per drive, and the unit is 'intelligent' in that it has a processor and boots the operating system into its own RAM (it's possible to boot the drives without a computer connected at all). This allows QX-10 disks to boot the PX-8 and *vice versa*. The drives (connected by serial link) are comparatively slow in transfer rate, and make the most extraordinary clicking noise which had me constantly worried that they were trying to read a bad sector, which they weren't.

The CX-21 acoustic coupler can be used with the PX-8's TERM program

A ratchet mechanism allows the display to be set to various angles

Documentation

The User Manual and the Basic Manual are chunky spiral-bound soft cover books (no nasty ring bindings to drop pages all over the floor) of over 300 pages each, and they are very good indeed. Both start off ominously by saying that they are not intended as tutorials (some tutorial books on CP/M and Basic are recommended) which is often an excuse for skimpy, hastily-produced stuff written by the programmers. Not so in this case. It's an excuse for clear, concise, no-nonsense, non-patronising information, on a par with that supplied by Apple and Hewlett-Packard. Just about everything you need to know is there and it's fully indexed (20 pages of index in each). The workings of all the utility programs are explained, including TERM and FILINK. The RS232 port is fully documented, including the signals and pin-outs of every alternative cable. The user manual has all those tricky little things like the console escape sequences, lack of which can often hinder you in installing new applications, and even fully documents the special BIOS routines to control the clock. For the professional software writer there is a separate Operating System Manual.

Conclusion

The PX-8 is without doubt the most capable lap-held computer to be introduced so far. Apart from the fact that it has virtually all the capabilities of a desktop CP/M machine, it also has immediate access to the huge CP/M software base which its 16-bit competitors will find difficult and costly to match. None of the existing lap-helds have attracted an adequate third party software base, largely because of the restrictive hardware limitations and a certain lack of faith in this market sector on the part of the software houses. The PX-8 should change that at a stroke.

Its price, at around twice that of the NEC and Tandy machines, puts it firmly in the professional user market, but it's still at the bottom of the price range for CP/M machines. It's extremely well made and its design makes it a pleasure to use. The variable angle display is a big improvement for word processing when compared to the flat, fixed displays of its cheaper competitors. And for many users, the inclusion of WordStar will alone be enough to tip the balance.

Prices (excluding sales tax)

PX-8	$1,300
Acoustic Coupler	$209
TF-10 Disk Drives	NA
TF-20 Disk Drives	$1391
60k RAM Disk	$404
120k RAM Disk	$570
P-40 Thermal Printer	NA

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Memotech

The British firm Memotech has launched a moderately priced colour micro that can be expanded into a small business CP/M machine. We give our verdict.

Memotech made its name in the fickle world of computers over two years ago with cheap reliable add-ons for the Sinclair micros. Not content with a role on the sidelines, in the middle of last year a Memotech micro was launched to an enthusiastic response. A year later (courtesy of Sydney firm, Interfaceware), this micro has reached our shores.

The Memotech micro comes in two forms. The MTX-500 and the MTX-512. The 500 is the cheaper at $769 (all prices quoted in this article are recommended retail only and inclusive of sales tax) and comes with 32k. The only dif ference in the MTX-512 is that it comes with 64k of RAM. This will cost you an extra $90. If you want to upgrade an MTX-500 to an MTX-512 the RAM extension will, of course, cost that bit more ($151) than having it built-in from scratch.

Memotech has produced a whole heap of software cartridges and add-ons to turn your humble MTX-500 or 512 into a fully fledged business system (or thereabouts). These were not available for the review so we'll concern ourselves only with those items that actually arrived in the cardboard carton.

Firstly there is of course the micro itself. This is large by home micro standards, nearly 20in across. This room is not wasted, though; most of it is taken up by the 79 keys which make up the Memotech's keyboard.

The keyboard is the real typewriter kind. This is essential if hopes for the machine are to be realised. Even if you are only ever to use your micro for games and your own programming, a decent keyboard is a great bonus. The MTX doesn't fail here. Typing on this keyboard is no strain on the finger or the brain. The feel of the keys is a little on the rattly side but this does not detract from them too much.

As well as the usual qwerty selection of letter keys there is also a numeric key pad and a pad of eight function keys. Full marks for that. The function keys are situated as a block at the right hand end of the keyboard and not strewn along the top row of keys like some micros. Although this is a style more in line with business machines (that's probably why Memotech chose it) it does preclude any method of temporarily labelling these keys. A perspex strip over a row of user definable keys, to take a paper strip of labels, is a trick already used by several other manufacturers and well worth copying.

On each side of the space bar there is an unlabelled key. These apparently do nothing, but if pressed at the same time they act as a reset key. Reset keys are always a good idea but because of the finality of their action it is an even better idea if they are a bit harder to accidentally hit than these.

Graphics potential

Hidden inside the impregnable fortress of your MTX case is a chip from Texas Instruments known to those in the trade as a 9918. The number, of course, need not worry you, but what should concern you is that this chip is the same as that used in several other micros. This chip controls just about every aspect of the MTX's display, the text format, the graphics, and the sprites. It is certainly a versatile little piece of plastic, more complex than the microprocessor itself, that is in charge of the whole machine.

Several other machines use exactly the same chip. This means that the graphics potential of the MTX should not be greater or lesser than these other machines. The Sord M5 ($395) uses this chip as does the Spectravideo SV318 ($399). In fact this graphics controller chip is the one specified in the recent MSX standard.

Not only, then, do other machines on the market have potentially exactly the same graphics facilities as the Memotech, but an awful lot of cheap Japanese micros to this standard will appear in the very near future.

What, then, is the potential of this marvellous chip used in the MTX? Firstly text. The MTX can put 960 characters at once up on your TV screen in a 40 x 24 format. This is as good as most home computers and about all that a normal TV can display without resorting to fuzziness. Memotech has produced an 80 column card which is essentially for real business work. It is incorporated into the disk drive unit. (There is, however, no plan for a separate 80 column add-on for home users who don't want to go to the expense of disk drives).

The text can be any of sixteen colours. These cover the usual range from bright primary colours to pastel shades. All of the colours appear a little washed out on the Memotech machine. This was not the fault of the TV used nor the display chip itself — colours on the Sord M5 for example are very strong. It seems that Memotech may have a bit of cleaning up to do on some part of the video circuitry here.

The background to the text can also be in any of the sixteen colours. It is a pity that the display chip used does not allow parts of the screen to be different background colours. The BBC micro, for example, will allow any single character to take a different background colour from its neighbour.

All of the letters, numbers, and other characters available on the MTX can be redefined to create new or accented letters and symbols. In addition to these 95 characters there are also 25 others that are set aside for your own character shapes.

The greatest attraction to buyers for the MTX in the UK has been its graphics. The potential for graphics from the controller chip in the MTX is excellent. The

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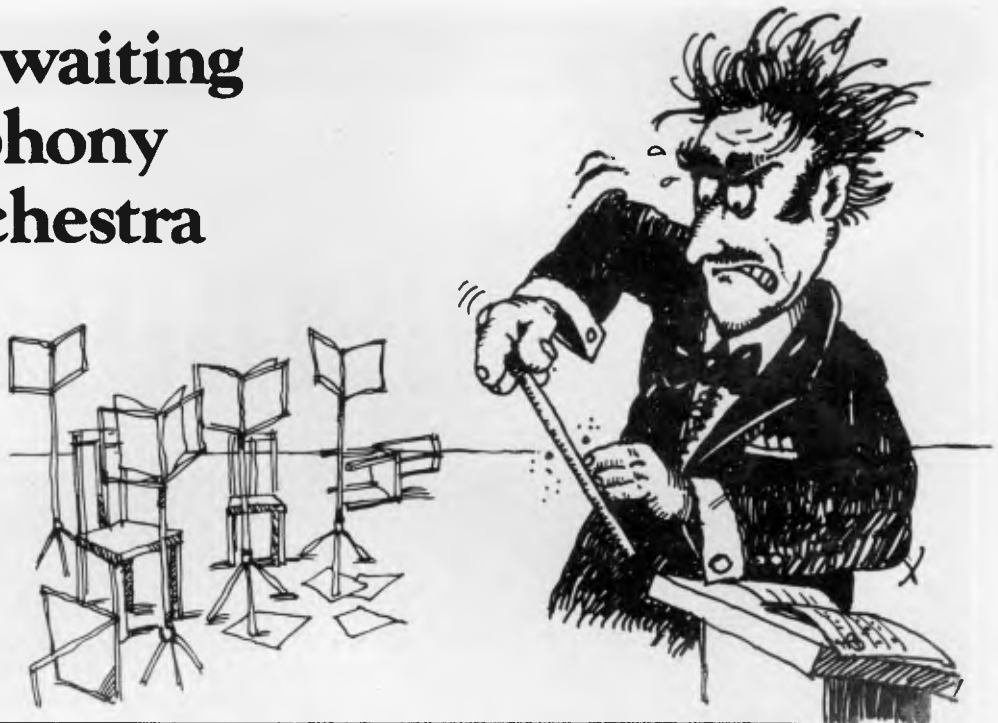

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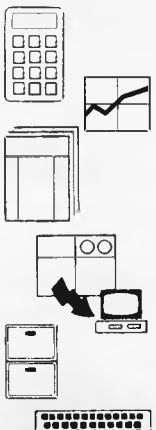

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display from this chip (so the chip's manual goes) can be best thought of as a series of transparent sheets placed inside your TV, one on top of the other. If there isn't anything at some position on one sheet then the next sheet behind will show through. On the back sheet there is a backdrop. This can be any plain colour. This sheet will also effect the border around the active part of your TV screen. In front of the backdrop there is the main graphics sheet. This can be used in a number of ways in various modes.

First there is the text mode. It is this mode that gives you the 40 column by 24 row text format. The text mode uses up very little of the screen memory (only 3k) because it is comparatively simple, but this doesn't help you much as no more is released for your program's use. The text mode display can only be in two colours. One for the characters and one for the background.

There are three graphics modes available on the MTX's graphics chip. One, the so-called multicolour mode is not too useful. This mode comprises a screen of 64 x 48 small squares. Each of these squares can be any of the sixteen colours available. However as there is no possibility of text in this mode and the graphics are, to say the least, chunky, this mode is not available from Basic.

There are two other graphics modes. These are a lot more useful. Both will allow text, graphics and sprites on the screen, and both will allow you to use all sixteen colours on the screen at once. The differences between the two modes are that mode II allows more user definable characters (768) than graphics I, giving you enough to have a different character in all of the 32 x 24 positions if you really wanted. Graphics II also allows you to define a separate foreground and background colour for each line of a sprite (they are made up of eight lines) instead of just a single pair of colours for the whole sprite as graphics I dictates. It is mode II that is used as the graphics mode by MTX Basic. Both mode I and the multicolour mode could be selected using machine code, but as mode II gives you everything that the others do and more, Memotech has wisely restricted the choice from Basic to simplify matters for the user. Drawing pictures on the screen is also simplified with the inclusion of several Logo type commands in Basic. This is not a full implementation of Logo, but a useful addition nonetheless.

Sprites

The sprites take up the remaining 32 sheets that make up your display. Each sheet can hold one sprite. By carefully arranging which sprite is on which sheet you can make your space invader, say, move in front of the flying saucers. All the difficult parts of moving the sprites around are taken care of for you. Once the sprite's shape has been defined with one command and given a number to determine which sheet it is to appear on, with another, it can be placed anywhere on or off the visible screen, or moved in a straight line, with yet another single Basic command.

By carefully arranging which sprite is on which sheet you can make your space invader, say, move in front of the flying saucers.

All this makes writing fairly complex games very simple. The problems start when you realise what commands Memotech expects you to learn for these actions. Instead of simple, easy-to-remember Basic keywords such as PUT SPRITE as there is in MSX standard Basic, Memotech have used a selection of horrible mnemonics like MVSPR and CTLSPR. True, Memotech has left the system as versatile as possible, but it would have been preferable to have made it really easy to use.

Basic

The MTX Basic has a few pluses and minuses. A versatile automatic line numbering command is included but there is no line renumbering. There are no definable functions and the Basic program editing is also a little strange.

Usually Basic editors come in one of two forms. Some form of on-screen editor is best. These allow you to move a cursor around the program lines that you have already written on the screen, changing characters as you go. The more old fashioned line editors require you to tell the micro that you want to edit a particular program line, whereupon it will present you with a copy of that line to run through making your additions and deletions. The line editor is a lot less convenient to use but simpler to implement. Memotech has chosen a sort of hybrid editing system for the MTX Basic.

As you type a program it will appear in the top two thirds of the screen. To edit a line, you have to tell the computer that you want to do so and that line appears at the bottom of the screen in a separate editing window. So far so much like a line editor. Now however you can move back and forth over that single line using cursor keys incorporated into the numeric pad to change the single line. Much in the same way as a decent screen. The net result is an editor that is fairly easy to use, certainly better than a normal line editor, but why couldn't Memotech have gone the full hog to a real screen editor?

The use of windows on the screen like this is another feature of the MTX. The screen can be divided up into sections by a program so that, say, data can be entered into one area while another part of the screen displays the results. Although the control of these windows from Basic is very versatile, the commands used are confusing. The section in the manual which deals with this is also incomprehensible, to say the least. The program, error message and editing windows are just examples of the seven windows that the screen can be divided into at any one time. The manual warns of the dangerous consequences of tinkering with these particular windows, so you are left with only four to play with.

MTX Basic includes a versatile sound facility too. The almost standard three voices plus a noise channel are provided with the sound output directed to your TV speaker. The Basic commands to control this are better thought out than those to control the graphics. Single notes can be played or tunes easily constructed. Some control of the envelope, or shape, of the sound is also possible. For this last facility, Memotech has not resorted to its tactics of horrible mnemonic commands, either. The relevant numbers are just tacked on to the end of the sound statement if needed, or not if they are not required. Couldn't be simpler.

Basic is not the only language that is included with an MTX. The 24k of ROM also contains an assembler and strange new language called Noddy. Noddy is a text handling program. It is not a word processor but a text formatting and shuffling program. It is difficult to see why it was included at all. Had the trouble been taken to make this language some real use to users of the MTX then nothing but praise could be bestowed on Memotech. As it is, however, Noddy is likely to spend most of the time totally ignored.

Noddy's only redeeming feature is the sense of humour that it reveals in its authors. The command to be used in Basic to call up a Noddy program is 'PLOD'. Erstwhile followers of Enid Blyton will recognise the name of

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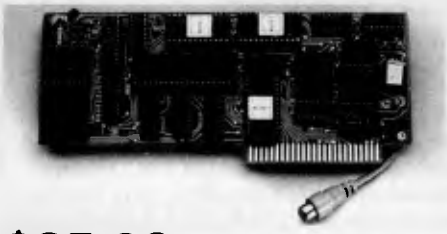

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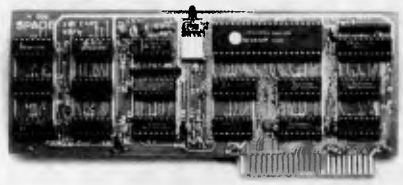

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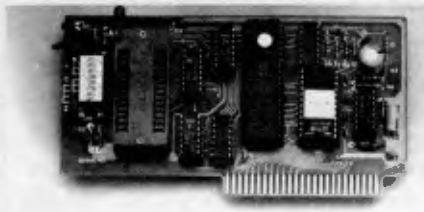

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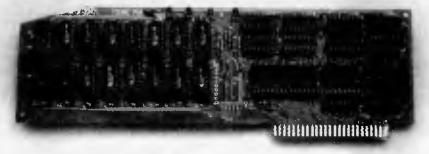

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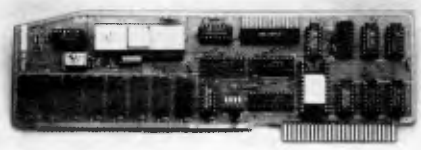

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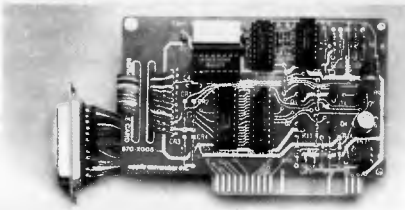

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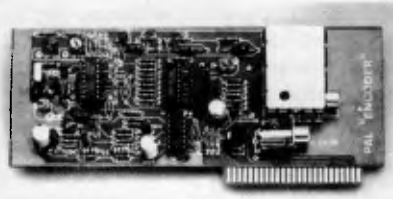

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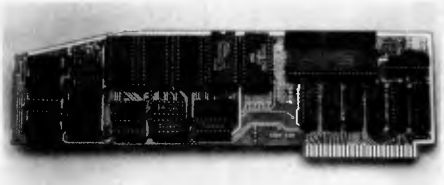

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In addition to Noddy, the MTX machines also offer a built-in assembler. Assembly language is the intelligent man's machine code. It offers all the advantages of machine code, such as speed and efficiency of memory usage, without half of the hassle. Assembly language is about half way between machine code and Basic on the understandability scale. The assembler that resides in the MTX's ROM, takes your assembly language program and translates it to genuine machine code before it is run.

The joy of using assembly language on the MTX, however, is that programs written in this language can be incorporated into Basic programs in a similar way to their inclusion on the BBC micro. However, there is a major difference between the assembler language built-in to MTX and BBC Basics. In BBC Basic the assembler language program is listed, just like Basic, as part of the Basic program. This means that it can be edited and shifted around just as though it was a Basic program. Not so on the MTX.

The assembly programs on the MTX are written in a different mode from normal Basic program writing. This separate mode is a bit like the separate mode needed to edit a Basic program. Programs can be written and edited for inclusion in a Basic program only in the assembler mode. The commands used to list and edit the assembly language program in the assembler mode also leave much to be desired. It seems that Memotech, in its striving to simulate the concepts of business machines, has taken a leaf out of WordStar's book. All the editing commands are horrible single letter mnemonics.

There are several other items included with the micro itself, in the Memotech box. For a start, there is, of course, a power supply. It is styled to go nicely with the main machine, and (unusually) includes such items as an on/off illuminated switch and decent lengths of lead. There are also five cassettes neatly tucked into the expanded polystyrene of the packaging.

Two of these are games provided by 'Continental Software'. These are 'Toado' — a variant on the Frogger theme — and Draughts, which speaks for itself. The other three cassettes include a demonstration tape to goggle at, when you first use your micro, a blank tape to take your own programs, and a cassette recorder head-cleaning tape; a very thoughtful touch. A cassette lead is also provided.

Continental has released a range of games software including adventure, chess, bridge and arcade-style programs.

Documentation

In a word: poor. The 250 page manual is not typeset (ie, just typed) and it lacks an index. Nearly all the explanation is confusing and the contents page is barely complete. On the positive side, it is comprehensive although at times difficult to follow.

Expansion

The Memotech can be expanded to a total of 512k RAM in steps of 128k units costing $405 each. On the business side, a package called the FDX system can be added to the 512. It includes two 5¼ inch floppy disk drives (Qume disks, each of 500k capacity); the 80 column colour card mentioned earlier; CP/M; a word processor called New Word which comes as a ROM cartridge; and the SuperCalc spreadsheet. The FDX package sells for $2130.

If you're a speed freak, an extra $359 will get you a "silicon disk" system which is simply 256k of RAM configured to look like a floppy disk drive to the operating system. Of course, accessing the RAM is a lot faster than accessing data on a floppy disk drive.

Promised software packages include an accounting system and educational software. Unfortunately, none of the above were available for review at the time of going to press.

Conclusion

The manual distracts from what is mainly a good machine. The Memotech MTX is not revolutionary in any way, but it is, however, a tried and trusted design and sturdy in construction.

If you're looking for a business machine for serious work then it is bound to be a better bet to buy a machine purpose designed for that task. If you're wanting a machine only for playing games and the simplest of programming then there are cheaper home micros on the market with similar capabilities.

However, if you fall between the business and the home micro market you will find either of the MTX a good buy, giving you a decent home machine and a good base for future expansion.

'ThinkJet' Ink Jet

Ink Jet printers offer the next quantum leap in printer technology available to the home/small business market. Of course, laser printers are still undoubtedly the best, but the $200,000.00 starting price puts it slightly out of the PC class. Ian Davies takes a look at the 2225A ink jet printer by Hewlett Packard, and also mentions the 2225C, which is built for the non-HP world.

The Hewlett Packard HP2225A "ThinkJet" printer uses Ink Jet Technology which means several things. Firstly, that the printer is very quiet — 50 Db to be exact, which is quieter than many hard disk drives and most cooling fans.

Ink Jet?

Traditional impact printers employ chunks of metal which fly about with great velocity, hurling themselves at the paper through an inked ribbon, (which also moves), thereby leaving an imprint on the paper to mark their passing. Ink jet printers simply spray ink onto the paper where ever it is supposed to go. There are four movements in a traditional printer — the horizontal movement of the print head, the movement of the paper, the movement of the ribbon and the insane slamming of the print head against the paper. Ink jet printers remove the need for two of these movements — the ribbon is done away with, and most importantly, the print head is dispensed with. It is the physical slamming of the print head against the paper which creates most of the noise and imposes the greatest limitations on the speed of traditional printers.

Of course, the trick with ink jet printers is to make ink go where you want it to, and preferably nowhere else. The ink is propelled at the paper using electrically charged droplets. The ink flows from a reservoir into a tiny holding chamber where the drop is then charged and may be accelerated towards the paper by a number of cathodes which correspond to the print pins in a normal dot matrix printer. The difficulty with ink jet printers is generally that the ink is in a much more fluid state than inked ribbons, therefore refilling them can be an extremely messy process. HP have solved this problem in their HP2225 by integrating the ink reservoir and the ink head into one disposable unit, good for about 500 pages. Initially this might appear very wasteful, but really it is no different from disposable ribbon cartridges, and a darn sight easier to use.

The 2225A

As well as being much quieter than the average printer (you can sit next to it and not realise that it is actually printing), the 2225 is faster, cheaper, much more reliable and smaller. What more could one ask for?

Its print speed is a respectable 150 characters per second with bi-directional logic-seeking movement. The speed of vertical paper movement is 2 inches per second, (or 5.08 cms/sec). It provides four different print pitches and can perform underlining and bolding in a single pass — operations which normally devastate the efficiency of most printers.

Paper feed is achieved via both tractor and friction feed. Although the 2225 only accepts two sizes of paper (quarto and A4), narrower paper may be employed using the friction feed. The print line itself is 80 characters wide in

normal mode, and can be set to 40 or 142 in expanded and compressed modes respectively. Vertical line spacing may be one of two settings — 6 LPI or 8 LPI.

The print head (or should I call it an "ink head" or perhaps a "jet head") produces characters in an 11 x 12 character cell, which certainly outperforms most other dot matrix printers. With this dot resolution, it is surprising that HP did not install the necessary intelligence for the 2225 to provide different fonts or perform correspondence quality printing.

Graphics are achieved by individually controlling the print elements. This can be done in two modes: a normal mode of 96 x 96 dots per inch providing a total width of 640 dots, and a high density mode of 192 x 96 dots per inch, yielding a total of 1280 dots across the page. The graphics mode is set to the printer in the normal way, with each bit in a byte corresponding to the individual print elements. Conventional impact printers may damage themselves when used in graphics mode, specifically when all the bits are used continuously without interruption, as they tend to overheat their electromagnetic mechanisms. Needless to say, the same cannot happen to an ink jet such as the 2225.

The 2225 supports 128 printable characters, and includes escape sequences to control bolding, underlining, pitch, line spacing, page length, text length, wrap around, bi-directionality, and a debugging mode which prints the control sequences instead of doing them. These commands are sufficient for most users of the printer, but do lack some of the facilities found on other "dot matrix" printers, such as font selection, letter quality mode, font definition and double height characters. A 1000 byte input buffer is included which greatly speeds most screen dumps.

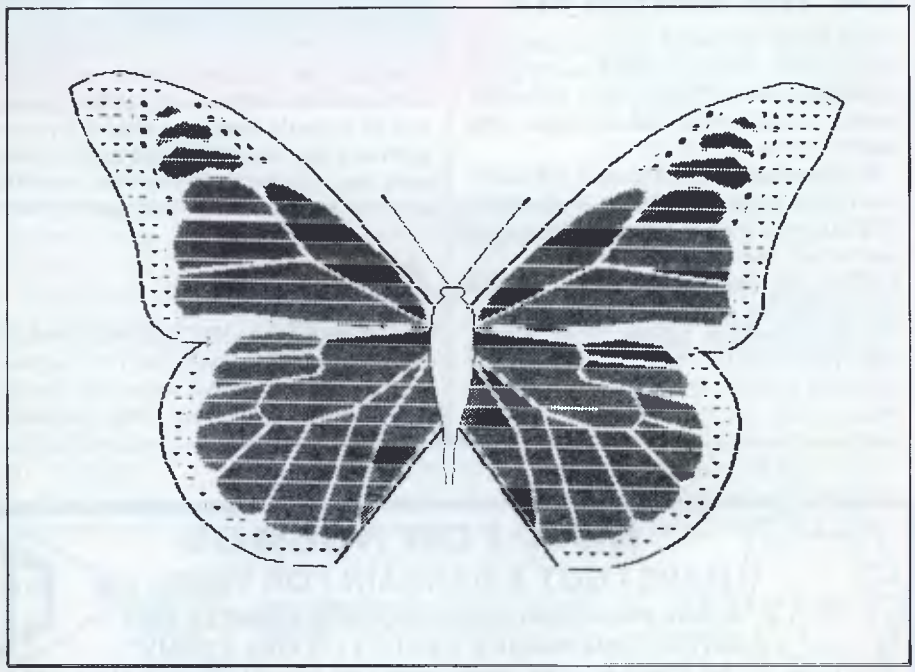
Changing the print head is childs play. A simple lever releases the cartridge allowing it to be removed using two fingers. The new cartridge can then be slipped in and the level secured. No problems at all. The cartridge stores the ink in a small bladder which collapses as the ink is used up, so it is possible to visually inspect the amount of ink remaining. The only maintenance required on a regular basis is cleaning the contacts between the cartridge and the rest of the printer, as a dirty contact can cause one of the print lines to be deactivated, thereby causing a white line through all your output. This can be performed using a tissue and yields immediate results.

The printer itself looks more like one of those 'el-cheapo' printers available for those 'el-cheapo' home games computers. Its physical dimensions are only 206mm x 292mm x 89mm and it weighs in at 3.3 kg. Quite simply, the 2225 can afford to look puny since it does not contain all the whirring bits of the average impact dot matrix printer. Don't judge a printer by its physical stature — the 2225 is just as good as any of its more chunky impact counterparts — it just uses smarter technology.

But

The 2225 ink jet printer seemed to be the best of everything to me. It appeared to have all the desirable features of a dot matrix impact printer as well as the one desirable feature of thermal printers (quiet operation) without the need for that silly thermal paper. However, HP do recommend that you use the approved "ThinkJet" paper in the printer, which apparently is more absorbent than normal paper. So I tried using several varieties of "Non-ThinkJet" paper, ranging from high quality computer stationery to a sheet off an old writing pad. The result in all cases was that the print darkness was greatly reduced. Indeed, the output looked like a normal impact printer whose ribbon had reached the end of its life. The best result was achieved by using the old writing paper.

The "ThinkJet" paper is not anything like thermal paper — it is just normal paper which happens to work very well with the 2225. This presents no great problem unless you are planning to use the 2225 on preprinted stationery or on letterheads. The best course of action might be to wander into HP with a few



Graphics demo on the 225A

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  CHARACTER SETS
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~■
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 !"#$%&'()*+,-./0123456789:;(=)?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~■
 ÀÁÉÊËÍÏ´`^¨~ÙÛ£¯  °ÇçÑñ¡¿Ÿ£¥§f¢äëöüáéóúàèòùäëöüÅîØÆåíøæÄìÖÜÉïßÖÄÑãÐdÍÌÓÒõŠšÚÝÿ
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Sample printout on HP's recommended stationery

```
  CHARACTER SETS
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~■
 ÀÁÉÊËÍÏ´`^¨~ÙÛ£¯  °ÇçÑñ¡¿Ÿ£¥§f¢äëöüáéóúàèòùäëöüÅîØÆåíøæÄìÖÜÉïßÖÄÑãÐdÍÌÓÒõŠšÚÝÿ
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PQRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~■
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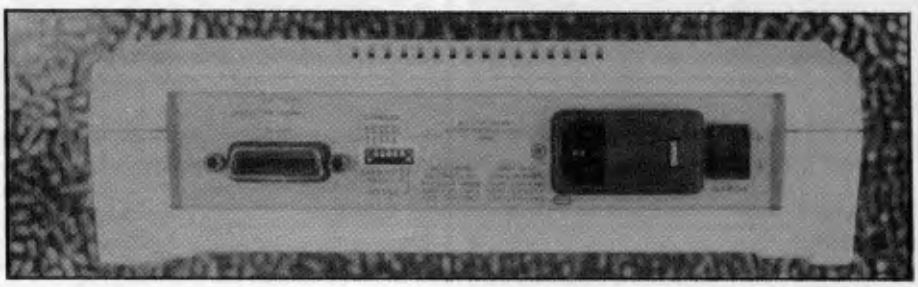
And what it looks like if you go for garden variety stock

sheets of your favourite paper and see how well it works. Certainly if you are only planning on using plain paper, or do not mind lighter printing, then this special paper requirement is not a problem — it just means that from now on you buy your computer stationery from HP.

For the non-HPers

The 2225A connects to your machine via the trusty HP-IB, which is a very good method of connecting devices, but is not overly popular with IBM or Apple this year.

For those of you who do not use some form of HP machine, HP also produce the 2225C, which connects via a standard Centronics parallel printer port. The 2225C can provide emulation of the Epson MX-80 and MX-100 as well as the IBM graphics printer. This means that your current word processor or graphics system should be capable of driving the 2225C correctly. Unfortunately, the documentation on these compatibility modes was rather sparse, and so it would always be best to try your software on the 2225C first, just to make sure your graphics system is not sending any unusual Epson control sequences.



Rear view of the 'jet' printer

Conclusion

Unfortunately, the HP2225 was secured by bolts requiring a special HP unscrewing implement, so we were not able to get inside the box. The external impressions are that the 2225 is a rugged, well put together machine and should present no reliability problems.

The print speed is good, the noise is excellent and the print quality is adequate. It would be nice if it could perform letter quality output, but who knows, HP may decide to expand their range of ink jet printers. I certainly hope so.

Most importantly, the price is one of its features — just $684 plus sales tax makes it a cost effective alternative to impact printing.

FRAMEWORK

Framework® is the first of a new generation of products that goes beyond today's integrated spreadsheets. It is an order of magnitude better than the original integrated products and windows.

The heart of Framework is a unique "frames" technology. Frames are actually self-contained, inter-related displays that can be nested, resized and relocated anywhere on the screen. Frames bring new flexibility to the way information is created and managed with a PC. With this truly three-dimensional design, the user can create infinite logical hierarchies of information, leading to as deep a level of complexity as needed for the task at hand. There is no limit to the number of frames that are active in the system. Framework's user interface is one of the most elegant designs yet conceived.

Word Processing

Framework's word processor is dynamite! It gives users the choice of frame or fullscreen viewing of documents, multiple margins within a single file, automatic justification and repagination, header/footers, page numbers and more. The streamlined menu system helps new users get started in a hurry and "shorthand" commands help veterans work even faster.

Outlining

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Graphics

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DOS Access

The new DOS access capability allows any user to actually run other PCDOS software inside Framework. This allows users to gather data from other programs without quitting Framework. It will be of great help to people who frequently shuttle between programs and to businesses who perform frequent interchange of programs or data with larger systems.

Custom Applications

Framework comes complete with its own programming language. Users can begin writing their own custom packages or use software developers right away. In addition, dealers will continue to receive the excellent support that has helped make Ashton-Tate the front-runner in the software industry with dBASE II and FRIDAY!

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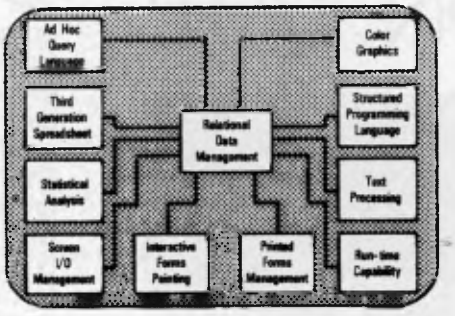

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FORMERLY TRADING AS MICRO DATA BASE SYSTEMS

Apple's Instant Artist

Helena Siedlecka discovers a talent for design using Penguin's new graphics package for the Apple.

For Apple users who've found that tasks always seem to need more graphics facilities than one has on tap, the Complete Graphics System from Penguin Software is now available in Australia.

A set of versatile graphics utilities designed for programmers and non-programmers alike, it contains almost everything needed to draw pictures, graphs, plans, maps and perspectives.

Presentation

The disk and manual come in a slim foam-packed cardboard box with a wrap-around cover the size of a thick paperback. The front cover shows a smart airbrush illustration and the back cover's tempting screen shot of the palette describes what you can do.

The otherwise dull parts of the documentation have been made lighthearted and amusing. For example, cartoons on the disk sleeve remind you NOT to store your disk at the bottom of the budgie's cage, in the toaster, in the back pocket of your jeans, and so on.

Features

This new version of the Complete Graphics System II combines various programs, all compatible with their brothers and sisters in the Penguin series. Using this system you can design a house in 3D and look at it from any angle, paint it in 100 colours with 96 brushes, add text, turn it upside down, and more.

However, the title, Complete Graphics System, might be an overstatement, since it lacks a printout facility, and animation. This is because these are complex functions, best handled by other, more specialised programs.

Any graphics created with the system can be printed using the Paper Graphics program, or made into presentations using the presentation system, Transitions. Animations can be added with The Graphics Magician.

It's compatible for use with a paddle, joystick, trackball and touch tablets such as the Koala Pad. It also supports the new Apple Mouse, as well as the Apple Graphics Tablet. But if you don't have any of these you can still use the keyboard.

In use

Since the disk is copyable, it is best to work with a copy and keep the original in a safe place. Placing a copy of the master in the disk drive and turning on gets you to the Main Menu.

Depending on the type of input device you have you type a number from 1 to 4. From here you can choose the drawing facility you need. But it's a good idea to first check the disk-access defaults; the program- and data-disks can be redefined. The usual way is to type 1 or 2 but this would be a mistake here, causing problems later, such as a DOS Syntax Error. The correct procedure is to type D1 and D2 if you have two disk drives, or D1 if you have one drive. A more intelligent parsing routine would be an idea. Of course, you can add this, since it's an unprotected program.

To test the capabilities of this package, I elected to design a computer graphics work station, with shelves for books, monitors, a printer and so on, starting with a 3D wire model.

As my preferred input device is a Bit Pad, I typed in 2 and selected the 3D Panel Creator from the Main Menu by typing P. This option enables you to construct your design in 2D as flat panels which are saved in a 3D format. To see them on the screen assembled as a 3D image, they are loaded into the 3D Viewing Program. Editing can be done using the 3D Point Editor program.

With the 3D Panel Creator, you can recreate an object of specific size by setting the scale on the screen. The scale can be altered by changing the distance between the two dots on the screen.

You can only use the keyboard to draw in this option. That seems limiting if you have grown accustomed to touch tablets or similar devices. However, you could also add alternative input devices, such as a light pen, which may be the only advanced pointer-device which isn't supported.

Drawing every flat surface of the work station, filling in all the details and reassembling it in 3D to scale would be quite complicated and time-consuming, in spite of the simplicity and efficiency of the program. So instead I decided to experiment with the colour palette.

To get out of the 3D Panel Creater I pressed M which brought me back to the Main Menu. Keying in the number for the Bit Pad allows access to the drawing screen and colour palette. Input device controls consist of single key press commands even a gorilla would find simple.

Pressing the spacebar flips between the colour palette and the drawing screen. If you want any drawing functions displayed alongside the palette, you point at it using your input device, which controls little arrows on the screen.

Penguin has made the most of the six primary Apple colours by texturing small areas with a variety of coarse to fine patterns, creating lighter and darker tones. In my dabblings I found these textures particularly effective for landscaping, and I imagine they would be ideal for use in graphs, maps, architectural symbols or any graphic work that does not have too much detail, or requires hatching.

I used a variety of small and large brushes from the 96 brush screen and as in normal painting it is best to start from the back and work forward, using broad strokes to lay down the base colours, later picking out the details with a small brush. Results can be achieved quickly and easily.

Conclusion

The Complete Graphics System's comparatively-sophisticated set of facilities would take months to fully explore. It would be useful to a commercial artist for anything not too detailed, and is well ahead of comparable packages in this price range ($99.95). Add the related Penguin programs, and you'll be well away, and at reasonable cost.

Penguin Software is distributed in Australia by Imagineering.

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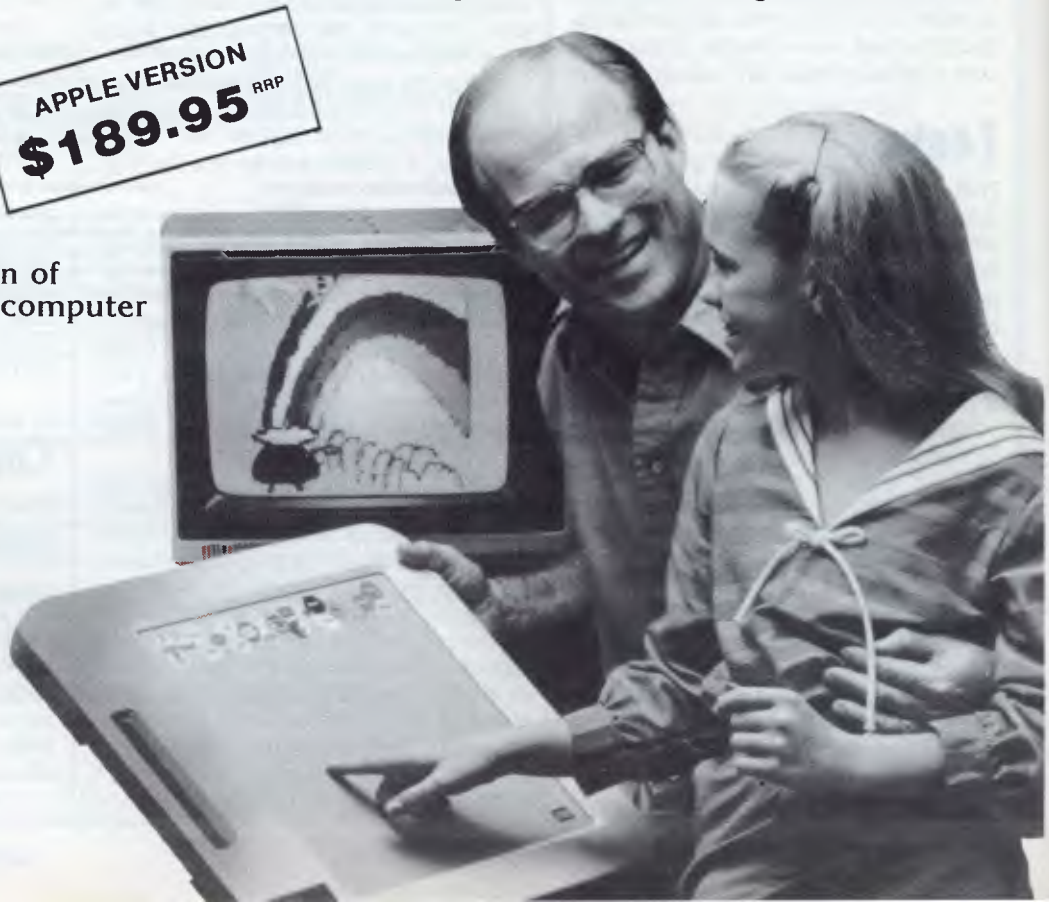

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TEACH YOURSELF ASSEMBLER

Paul Overaa continues his series on assembly language programming with a general discussion of arithmetic operations.

This is part five of APC's Teach Yourself Assembler series. It's unique in using Basic as its point of reference, and avoiding the 'drop you in it' approach often used on this subject. Three processors, the Z80, 6502 and 8080 are covered in detail, but enough information is provided to enable users of other processors to follow the course. Copies of earlier articles in the series, which started in March 1984, may be obtained from our Back Issues dept.

The 8-bit processors, such as the Z80, 8080 and 6502, have instructions to perform only elementary addition and subtraction. To provide anything more sophisticated requires us to program the more complex procedures in terms of these simple operations. This month we look at some general ideas, then next month we'll relate this to assembly language routines.

We 'take for granted' the facilities offered by high level languages for adding, subtracting, multiplying and dividing, and an appreciation of how languages, such as Basic, actually perform the 'arithmetic' is useful for gaining insight into the problems involved when providing such facilities. Our first job is to look, in a general sense, at the way we represent numbers inside a computer.

Integers

With the eight bits of a single byte we can represent numbers from 00000000 Binary to 11111111 Binary — that is, from 0 to 255 decimal. To represent larger numbers we must use 'more bits'. By using two bytes for the representation we can deal with integer numbers up to the value 65536 (1111 1111 1111 1111 Binary). The magnitude of a number that can be represented in this way is therefore limited by the number of bytes we choose to assign to its representation. This form of representation is called 'unsigned binary'. To allow for the occurrence of negative numbers it is necessary to make provisions within the representation of the number to indicate whether it is positive or negative. This can be done by using one bit as a 'sign' bit. By convention, we use the most significant bit, the left-hand bit. It is set to zero to represent a positive number and to 1 to indicate a negative number. An 8-bit 'signed binary' number will therefore have only seven bits for the numerical value. For example, Decimal 5, which is 101 Binary, can be represented as follows:

+5 Signed binary form = 0 0000101
−5 Signed binary form = 1 0000101

(Leading bit used to represent the sign of the number — separated for clarity only.)

By using a suitable number of bytes, and using one bit as a sign bit, we can represent both positive and negative numbers of any magnitude. Are our problems of representation over? If we just wanted to represent the numbers, then yes. The problem is that we want to manipulate them (add, subtract, and so on). We'll first add two positive numbers, 4 and 5, as an example:

+4 is 00000100
+5 is 00000101
Result 00001001 represents 9 (which is correct).

Now we try adding the two numbers −4 and +5:

−4 is 10000100
+5 is 00000101
Result 10001001 represents −9 (which is incorrect).

The correct result is +1, so clearly a problem exists with the representation, or the way we are using it. The solution lies in using 'two's complement' representation. In this form, positive numbers are represented in the usual signed binary form. The difference lies in the representation of the negative numbers. We take the 'unsigned binary' form and complement it: turn all the 1s into 0s and 0s into 1s (often called the 'ones' complement' form). Having done this, we add 1 to the result to obtain the final 'two's complement' representation. It can be shown that by using this representation, the results of arithmetic operations, including the sign, come out correctly.

Here are some examples to outline the general idea. Let's try the addition of −4 to +5 again. +5, being a positive number, is represented in usual signed binary form but we must convert −4 to its two's complement in the manner described above. We represent the number in binary form, complement it, and add 1 to the complement. When the correct representation has been obtained, retry the example and check the result. The details are shown in Fig 1.

One of the 'rules' of two's complement arithmetic is that the setting of the carry flag can safely be ignored.

If the magnitude of a result is too large to be expressed within the bits allotted for the representation of the numerical part of the number, it's possible for the sign bit to be changed accidentally. This is called 'overflow' and the effect is an incorrect result.

The most obvious cause of such an error is an 'internal carry' from bit6 to bit7, as the following example will show:

0 0111111 two's comp form of +63
0 1000001 two's comp form of +65
1 0000000
↑

(The 'sign' bit has been changed due to a carry from bit 6 to bit 7).

Overflow can also occur when we add two negative numbers. In general, it occurs when the result cannot be expressed in the seven bits available. It is obviously useful to be able to detect such a condition and most processors, including the Z80 and 6502, have an 'overflow' flag

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for this purpose (the 8080 does not possess an overflow flag).

Multiple-byte integers

The magnitude of the largest integer we

```
Conversion to the two's complement form
   00000100 is binary 4
   11111011 One's complement form of -4
   11111100 Two's complement form of -4
Addition of the two's complement forms
        11111100 -4 (two's complement form)
        00000101 +5 (two's complement form)
(1)     00000001 result +1 (which is correct)

I
Carry flag is set
in this example
```

Fig 1 Addition using two's complement arithmetic

```
4  REM
5  REM
6  REM
10 INPUT Please enter integer value; X%        Input an integer value
20 MSB$=HEX$(PEEK(VARPTR(X%)+1))'              Most significant byte
30 IF LEN(MSB$)=1 THEN MSB$=0+MBS$
40 LSB$=HEX$(PEEK(VARPTR(X%)))'                Least significant byte
50 IF LEN(LSB$)=1 THEN LSB$=0+LSB$
60 PRINT MSB$+LSB$'                            Shows how X% is stored
70 END
80 REM
```

Fig 2 Print hex representation of integer X%

	< MSB >		< LSB >	
66 =	0000	0000	0100	0010 Binary
Complement	1111	1111	1011	1101
Add 1				1
Two's complement form	1111	1111	1011	1110
Equivalent Hex form	F	F	B	E

Fig 3 Explanatory details for –66

1 bit	n bits	1 bit	m bits
Sign	Exponent	Sign	Mantissa

Fig 4 Schematic form

can represent is governed by the number of bytes used. We can show this by looking at how Microsoft's Basic stores the 'integer variables'. When you write the Basic statement LET X% = 10, the per cent sign indicates that an integer variable, x%, is being assigned the value 10. Can we write a program to look at the internal representation of such a number? Yes, easily.

The function VARPTR(X%) is used to obtain the address of the variable X%. This byte, and the contents of the following byte, are examined using the PEEK() function (after prior translation to hexadecimal form by use of the HEX$() function). For hex numbers less than 16, the HEX$() function returns only one character (for example, F rather than 0F), so we add the '0' to such numbers from within the program. The program in Fig 2 asks for an integer value and prints the hex form of the internal representation.

(Note: The function VARPTR(), an abbreviation of 'variable pointer', is normally used to pass addresses of variables from a Basic program to an assembly language routine).

If this program is run with the number 15,000F will be obtained, which corresponds to the binary number 0000 0000 0000 1111. With −66, you will get FFBE — Fig 3 shows the reason why.

Floating point representation

The representation of wide ranges of decimal numbers has its own special problems. The usual way of coping with wide variations in magnitude is to use scientific notation. For example, 26063.15 can be represented as 2.606315×10^4, or −0.000003415 can be written -3.415×10^{-6}. This gives a clue to providing a similar computer representation. We need to reserve bits for the mantissa, and further bits for the exponent. We also need to indicate the signs of each part of the number. In scientific notation, we 'normalise' the number by moving the decimal point to a position where the mantissa takes a value between 1 and 9.999. It transpires that for floating point representation, it's better to move the 'binary point' to the far left of the number:

111.1101 is represented as $.1111101 \times 2^3$

.0000111 is represented as $.111 \times 2^{-4}$

The general floating point format is based on a schematic form, m and n varying according to the number of bits chosen. Fig 4 illustrates the essential idea.

Binary coded decimal

For some applications, it is necessary to have complete numerical accuracy. An often quoted example is the use of computers in accountancy. For these applications, an alternative representation called 'binary coded decimal', or 'BCD', is sometimes used.

The principle is to code each digit separately, using as many bits as necessary. Each digit requires four bits with some combinations being unused:

BCD	*Number*
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010 – 1111	Unused codes

Two digits are packed into each byte, thus the amount of space a number will require is dependent on how many characters are present.

The advantage of representing numbers in this way is that complete accuracy is obtained. The disadvantages are firstly, that more memory is required to store the numbers and secondly, that arithmetic operations are slower.

Next month: Having briefly described some of the more common ways of representing numbers within a computer, we turn our attention to simple routines that use some of the forms we have discussed. In the meantime, try this experiment: take a number and multiply is by 2, 4 and 8. Express the number and all the products in their binary form. What do you notice about the bit patterns?

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SOFTWARE
Operating Systems

Eric Bagshaw continues the third part of our operating system overview which focuses on the practical merits of various systems.

In this last part of the *APC* operating system trilogy, we will concentrate on the practical use of the more common systems, covering accurate listings, the facilities available, and any idiosyncrasies.

As these are provided primarily for the end user, we will not cover the system utilities such as debugging tools, assemblers or complex text editors; neither will we go into great detail on the language — like facilities provided by certain operating systems.

In some computers, the language (usually Basic) and the operating system are intermingled, and the divisions between the two blurred; the PET and the Apple being well known examples of this aspect. The reason for this is that the language is an integral part of the machine, usually in ROM, and not loaded from disk.

In the next issue we will be printing conversion tables which summarise and provide a quick reference of the popular features that are commonly required. The following text will cover each operating system in turn and detail the features provided concentrating on those not covered in the tables and those that need greater amplification. A list of abbreviations are provided to enable compact text and tables to be produced.

Device:	Function:
LOGICAL:–	
CON:	console.
LST:	List information – printer.
PUN:	Send information – paper tape punch.
RDR:	Receive infarmation – paper tape reader.
PHYSICAL:–	
BAT:	Batch, console in from RDR: console out LST:
CRT:	Console (Cathode Ray Tube).
LPT:	Printer.
PTP:	Paper tape punch.
PTR:	Paper tape reader.
TTY:	Slow console.
UC1:	User defined cansole.
UL1:	User list device.
UP1:	User punch number 1.
UP2:	User punch number 2.
UR1:	User reader number 1.
UR2	User reader number 2.

Valid Assignments:

CON: = BAT: OR CRT: OR TTY: OR UC1:
LST: = CRT: OR LPT: OR TTY: OR UL1:
PUN: = PTP: OR TTY: OR UP1: OR UP2:
RDR: = PTR: OR TTY: OR UR1: OR UR2:
DIR – Displays all files on logged drive.
DIR d: – Displays all files on drive d.
DIR afn/ufn – Displays selected files.
ERA afn/ufn – File erase command.
PIP d: = d: afn/ufn [options]

Fig 1 CP/M 2.2 command functions and assignments

Apple

The DOS 3.3 operating system of the Apple is a simple system having a small number of commands. The machine has a unique 'slot', 'drive' and 'volume' disk accessing technique. The unit itself has a simple bus — the disk controller card can be in any of these seven sockets or 'slots', and each card can support two

B	– block Read.
Dn	– delete characters after column n.
E	– echa to screen.
F	– remove form feeds.
Gn	– get data (files) from user number n.
H	– check source proper hex.
I	– ignore hex at location 00 and turn on 'H'.
L	– convert upper to lower case.
N	– line number destination data.
O	– treat file as object data.
Pn	– page throw after n lines.
Qs^z	– quit copy after finding string s.
R	– read and copy sys files.
Ss^z	– start copy after finding string s.
Tn	– expand tabs to column n.
U	– convert lower to upper case.
V	– verify file copy.
W	– write over read only files.
Z	– zero high order bit.
REN new ufn = old ufn	File rename utility.
SAVEn ufn	Save n pages (256 bytes) to a disk file.

STAT	– displays disk drive unused space.
STAT DEV:	– displays actual devices assigned.
STAT VAL:	– displays command summary/ possible devices.
STAT log: = phy:	– assigns logical to physical devices.
STAT d: = R/O	– sets drive d to read only.
STAT d:afn/ufn	– displays files sizes and status.
STAT d:afn/ufn $R/O	– sets file(s) specified ta read only.
STAT d:afn/ufn $R/W	– sets file(s) specified ta read/ write.
STAT d:afn/ufn $SYS	– sets file(s) specified to system.
STAT d:afn/ufn $DIR	– sets file(s) specified back to dir.
STAT DSK:	– displays disk characteristics.
STAT USR:	– displays active user areas.
SUBMIT ufn.sub	– submit allows the batching of CP/M commands.
TYPE ufn	– displays the contents of file ta the screen.
USER n	– change to user number n (0–15).

Fig 2 PIP options

COPYSYS – copies CP/M system to a new disk – menu driven.
DATE – set and display date (see conversion)
DEVICE – the device command replaces the STAT facility for assigning logical and physical devices and adds port customization facilities.

Logical Devices:	*Device Type:*	*Usual Physical Assignment:*
CONIN:	CONSOLE INPUT	KEYBOARD
CONOUT:	CONSOLE OUTPUT	SCREEN
AUXIN:	AUXILIARY INPUT	NULL
AUXOUT:	AUXILIARY OUTPUT	NULL
LST:	LIST OUTPUT	PRINTER

DEVICE – display/change current logical and physical assignments.
DEVICE NAMES – displays physical devices and their characteristics.
DEVICE VALUES – displays current logical assignments.
DEVICE phy – displays the attributes of the named physical device.
DEVICE log – displays the assignment of the named logical device.
DEVICE log: = phy{[options]} – assigns devices.
DEVICE log: = null – detoches device.
DEVICE phy [options] – sets attributes.
DEVICE {[PAGE, COLUMNS = n, LINES = n]} – display and set console layout.

Device options are XON (sets XON/XOFF protocol), NOXON (turns off the protocol) and baud rate from 50–19200.
DIRSYS – The some effect as DIR but also displays files with the SYS attribute set.
DIR and DIRSYS have in CP/M 3.0 some extra options if used with the below syntax.
DIR {d:} afn/ufn [options]

DIR options:

ATT	– displays user attributes F1-F4.
DATE	– displays date and time stamping if set.
DIR	– displays file with dir option.
DRIVE = ALL	– acts on all logged drives.
DRIVE = (A,B,C,...P)	– acts on specified range of drives.
DRIVE = d	– acts on drive d.
EXCLUDE	– Displays files not matching the afn/ufn.
FF	– paper form feed.
FULL	– displays all available directory information sorted order, file name, size, attributes, password mode, time stamps and the drive label.
LENGTH = n	– displays n lines before a table heading.
MESSAGE	– displays drives and user numbers active during a search.
NOPAGE	– continuous scroll of listing.
NOSORT	– unsorted display.
RO	– displays only files set to Read only.
RW	– displays only files set to Read/write.
SIZE	– displays file names and sizes.
SYS	– displays only files set to sys.
USER = ALL	– searches all user numbers.
USER = n	– searches user number n.
USER = (0,1,...,15)	– searches all user number specified.

The ERA command is extended to incorporate a confirm option.
GET – redirects CP/M to take its console input from a file (see PUT).
HELP – on line help utility for the CP/M operating system and its commands with facilities to create your own help files.
INITDIR – initialize directory far date time stamping.
PIP – as CP/M 2.2, but includes the 'A' or archive option, and 'C' or confirm for selective file copy, and if the file is protected must include the password (such as PIP a: = b: afn/ufn :pass (options)).
PUT – opposite to get, allowing console or printer output to a disk file.
RENAME – this is extended to a menu driven option if just RENAME is entered.
SET – this option controls most of the attribute setting in CP/M 3.0. It has the following syntax.

SET [options]
SET d: [options]
SET afn/ufn [options]

Set Options:

DIR	– DIR attribute.
SYS	– SYS attribute.
RO	– read only.
RW	– read/write.
ARCHIVE = OFF	– archive mode off.
ARCHIVE = ON	– archive mode on (see PIP option 'A').
F1 = ON/OFF	– on or off user defined attribute 1.
F2 = ON/OFF	– on or off user defined attribute 2.
F3 = ON/OFF	– on or off user defined attribute 3.
F4 = ON/OFF	– on or off user defined attribute 4.
SET [NAME = ufn]	– disk label.
SET [PASSWORD = pass]	– password protect a disk label.
SET [PROTECT = on/off]	– enable/disable protection.
SET afn/ufn [PASSWORD = pass]	– password protection to a file(s), the disk must be password protected and enabled before this can be used.
SET afn/ufn [PROTECT = mode]	– protection mode for passwords, these can be read, write, delete or none.

Two of the following time and date stamping modes can be assigned.
SET [CREATE = ON]
SET [ACCESS = ON]
SET [UPDATE = ON]
SETDEF – This controls the disk search order and the console display of system messages.
SHOW – Show replaces many of the functions of STAT and adds a few of its own.
SHOW d: – displays logged drive, read/write access and space left.
SHOW [LABEL] – displays label and all attributes.
SHOW [USERS] – displays active users and their files.
SHOW [DIR] – displays free directory entries.
SHOW [DRIVE] – displays drive characteristics.

Fig 3 CP/M 3.0 commands

drives. At initialisation (formatting), a label and 'volume' number can be applied. If the numbering is used it will have to be specified when sending some types of commands to the disk. The directory lists files according to their types; a summary is illustrated:

Type:	*Description:*	*Creation method:*
I	Integer Basic program file.	SAVE
A	Applesoft Basic program file.	SAVE
T	Text file.	OPEN and SAVE
B	Binary memory-image file.	BSAVE

All the machines' main commands (INIT, CATALOG, RENAME and DELETE are covered in the conversion table. LOCK (and UNLOCK) is a simple delete protection, and is not a full password protection system. The two commands PR#n (directs output to a slot), and IN#n (directs input from a slot) offer simple device routing.

CP/M 2.2/ CP/M 3.0/CP/M-86

The single user/single tasking systems from Digital Research have many underlying similarities. 'DIR' has the same basic effect across the whole range; however in some varieties a command may have some extra facilities, CP/M 3.0 for example, expands this to the powerful DIR [FULL] option. A command may be replaced or enhanced — for example, the STAT command of CP/M 2.2 is superseded and expanded upon by the combination of SET and SHOW in CP/M 3.0. CP/M 2.2 is configured to have four logical devices, which perform conceptual functions — the user can address them without worrying about the inner workings (see Fig 1).

In addition there are 12 physical devices some of which will have been patched in with all the necessary and

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CHKDSK	– simple display of disk and memory status.
COMP {d:} {afn/ufn} {d:} {afn/ufn}	– compare files.
COPY {options} {d:} {afn/ufn} {options} {d:} {afn/ufn} {options}	– .
DATE	– display and enter date.
DEL {d:} {afn/ufn}	– file delete command.
DIR {d:} {afn/uln} {options}	– simple directory listing. Option '/P' pages the list and '/W' lists file names only across the screen.
PAUSE	– temporary halt in the process of a batch command.
REM	– remark in a batch command.
REN {d:} {old afn/ufn} {new afn/ufn}	– rename utility
TIME	– display and enter time.
TYPE {d:} {ufn}	– displays the contents of a file to the screen.

Fig 4 MS/PC-DOS 1/2 commands

CHDIR {d:}	– displays current directory path (CHDIR = CD).
CHDIR {d:}	– change current directory.
ECHO ON/OFF	– enable or disable screen display during batch operations.
FOR	– simple loop structure for replaceable parameters in the batch mode.
GOTO	– batch goto label.
IF	– batch if (or not) conditional
MKDIR {d:} path	– creates a sub directory (MKDIR = MD).
PATH {d:} path	– directory search.
PRINT	– print queue.
RMDIR {d:} path	– removes a sub directory, must be empty (RMDIR = RD)
SHIFT	– double up the number of replaceable parameters in the batch mode.
TREE {d:} {/F}	– lists out the tree directory, if '/F' is specified it also lists the file in each directory.
VERIFY ON/OFF	– disk write verify, toggle on or off.

Fig 5 Batch commands

E(DIT	– multi option text editor.
R(UN	– executes the current work file (compiling and linking if required).
F(ILE	– filer – see later.
C(OMP	– pascal compiler.
L(INK	– links in P-code subroutines.
X(ECUTE	– load and executes a Pascal code file.
A(SSEM	– assembles 6502 assembler.
D(EBUG	– not yet implemented.
U(SER	
RESTART	– retry last option.
I(NITIALIZE	– warm boot.
H(ALT	– cold boot.

Fig 6 P-System options

complex driver routines for whatever communications are required, whether they be printer, terminal or other ports. Therefore, the user can assign a pair of devices, one logical and one physical, and communicate with the minimum of problems.

PIP, the Peripheral Interchange Program (which is in most installations), is only ever used in its simplest form, as a file copying tool; however, as its name implies, it can be used in many more powerful ways: it can send a file to a device, receive data from a device and convert it to a file, and, lastly, transfer from device to device. (A list of PIP options is given in Fig 2).

CP/M 3.0 (Plus)

CP/M 3.0 (or CP/M Plus as it is also called) is the latest version of the 8-bit CP/M series following CP/M 2.2. It incorporates many improvements which bring it close to CP/M-86 and CCP/M, and some that set it apart. The basic DIR, ERA, PIP, REN, SUBMIT, TYPE and USER are the same; however, a number, such as DIR, are extended. In addition, some new commands are introduced, these are DIRSYS, COPYSYS, DATE, DEVICE, GET, HELP, INITDIR, PUT, SET, SETDEF and SHOW. We will cover each new command in turn after providing details of the extra options provided on the 'old' commands (given in Fig 3).

CP/M-86

This has many similarities to the other CP/Ms; the equivalents are DIRS to DIRSYS, COPYDISK to COPYSYS, and TOD to DATE. The following facilities have already been covered elsewhere. DIR, ERA, PIP, REN, SUBMIT, TYPE and USER.

CCP/M

Concurrent CP/M has many similarities to MP/M and CP/M Plus. A number of extra commands in addition to the DIR, DATE, ERA, HELP, INITDIR, PIP, REN, SUBMIT, TYPE and USER have been added. These are:

ABORT	— stops the execution of a program on the virtual console.
ERAQ	— erase with confirm.
SDIR	— like DIRS, includes system files in directory.
SYSTAT	— detailed system status display.
VCMODE	— displays and sets background/ foreground mode of the virtual consoles.

MP/M II

The main difference between the CP/M and MP/M, is that MP/M (Multi-Processing Monitor control program) is the former's multi-user brother. The first thing most users will notice is that the prompt is different. In a normal CP/M system the display for a user logged onto drive A would be:— A>; however, in the case of MP/M in addition to this, the area in which the user is logged is added; therefore a user on drive A in user area 5 would have the prompt:— 5A>. In addition to the facilities described, DIR, ERA, ERAQ, PIP, REN, SDIR, SET, SHOW, STAT, SUBMIT, TYPE and USER MP/M has some extra programs and commands, these are presented later.

MS/PC-DOS 1/ MS/PC-DOS 2

MS-DOS and PC-DOS are very similar, the only major differences being the machine specific commands, such as port attribute setting therefore these will be omitted from the discussion. To save space we will henceforth refer to both systems as MS-DOS. MS-DOS 1 is very similar to the basic versions of CP/M (2.2 and 86), but has fewer features.

MS/PC-DOS 2

In addition to the commands (in Fig 4) MS-DOS 2 incorporates many Unix-like features and an extended batch facility. The directory now incorporates a Unix type tree structure, and therefore if a file is to be accessed which is not in the current (or working) directory then to find it a 'path name' must be provided. This path name must proceed any file name in command, if required. The path name consists of the sub directory name separated by a backslash '\'. If the line starts with the backslash then the path begins at the root (top most) directory. DIR1 \ DIR2 \ DIR3 \ FILE-NAME.EXT—PATHNAME \ DIR1 \

B(AD-BLOCKS	– test disk black integrity.
C(HANGE	– renames file or disk.
D(ATE	– display and enter date.
E(XTENDED-DIRECTORY-LIST	– detailed directory listing.
G(ET	– gets a wark file.
K(RUNCH	– packs disk (removes unused space).
L(IST-DIRECTORY	– simple directory listing.
M(AKE	– produces dummy disk file.
N(EW	– clear work file.
P(REFIX	– change default work val.
Q(UIT	– exit from filer ta main menu.
R(EMOVE	– delete disk file.
S(AVE	– saves work file.
T(RANSFER	– copy (or list to screen/printer).
V(OLUME	– lists volume assignments.
W(HAT	– name and state of work file.
X(AMINE	– fixes or marks bod blacks.
Z(ERO	– erase and rename a disk directory.

Vol No:	*Volume Name:*	*Input/output Device:*
#1:	CONSOLE:	screen keyboard with echo.
#2:	SYSTERM:	keyboard without echa nat used
#3:		not used.
#4:	DISK NAME:	baot disk (slot 6, drive 1).
#5:	DISK NAME:	2nd disk drive (slot 6, drive 1).
#6:	PRINTER:	printer (slot 1).
#7:	REMIN:	remote input (slat 2).
#8:	REMOUT:	remate output (slot 2).
#9	DISK NAME:	5th disk drive (slot 4, drive 1).
#10:	DISK NAME:	6th disk drive (slot 4, drive 2).
#11:	DISK NAME:	3rd disk drive (slot 5, drive 1).
#12:	DISK NAME:	4th disk drive (slot 5, drive 2).

Fig 7 P-System commands

AUTO command	– auto lood after boot up.
BUILD ufn	– building of a batch command file.
CLOCK {(OFF)}	– toggle real time clock screen display.
DO ufn	– execute the file create by build.
DUAL {(OFF)}	– dump to printer of screen contents.
ERROR n	– displays description of an error number.
FORMS (WIDTH = n,LINES = n)	– forms set up.
FREE:d {(PRT)}	– disk free space map.
LIB	– command list.
LIST ufn {(PRT,SLOW,ASCII)}	– list a file to screen (ar printer).
MASTER (DRIVE = d)	– assign master drive.
PROT :d(PW,LOCK)	– use or change master password. pw = allows to change master password, lock assigns master to all unprotected users.
PURGE :d{(type)}SYS/INV/ ALL	– mass deletion.
ROUTE (orig = s, dest = s)	– input/output routing, substitute for sets of the two letters as below.

DO = display
PR = Printer
KB = Keyboard
RI = RS232 input
RO = RS232 output

SETCOM (OFF, WORD = n, BAUD = n, PARITY = n, MODE) – port setting.

OFF	– turns RS232 off.
WORD	– number of bits 5–8.
BAUD	– 50–9600.
STOP	– stop bits 1 or 2.
PARITY	– 1 = odd 2 = even 3 = none.
MODE	– wait or nowait.
WP (DRIVE = d)	– write protect drive d.
WP	– write protect off.

Fig 8 TRS-DOS additional commands

$AT time {(day)} {file}	– run command at specified time.
$CAL {(month)} year	– prints a calendar for a single month (month 1-12) or a full year (year 1-9999).
$CAT ufn	– display file to screen.
$CD	– Return to the login directory.
$CD dir	– change working directory to dir.
$CHMOD	– {who} op-code permission ufn.

Who:

u	– login owner (user).
g	– group.
o	– all others.
a	– all of above (default).

Op-Codes:

+	– add permission.
–	– remove permission.
=	– assign absolute permission.

Permissions:

r	– read.
w	– write.
x	– execute.
u	– user permission from present mode.
g	– group permission from present mode.
o	– other permission from present mode.

$COMM ufn ufn	– compore the similarities and differences between two sorted files.
$CRYPT key	– encode/decode using a encription key.
$FIND	– sophisticated file searching utility.
$GREP	– search file for a specified string.
$KILL n	– kill pracess number n.
$LPR	– optian unf Queue file for printing.
$LS	– directory list.
$MAIL loginname	– send or receive mail.
$MAN	– anline manual.
$MKDIR	– create directory.
$PR	– print a file.
$PS	– status of active processes.
$PWD	– path name of working directory.
$SORT	– sorting utility with many options.
$SPELL	– spell check (even an English option!).
$STTY	– full terminal port and options configure.
$TTY	– path name to users terminal.
$UNIQ	– removes multiple accurances in a sorted file.
$WC	– counter with character, word and line options.
$WRITE user	– writes on another terminal.

Fig 9 Unix operating commands

DIR2\DIR3\FILENAME.EXT— PATH NAME STARTING AT THE ROOT

The Batch command has been greatly extended with the addition of IF, GOTO replaceable parameters. A batch job is a file of DOS commands with the extension .BAT which is executed by typing the file name minus the extension. The extra commands will be described in the next section along with the other new MS-DOS 2 commands.

P system

This section on the UCSD P operating system will concentrate on the version installed for the Apple II, as this is the

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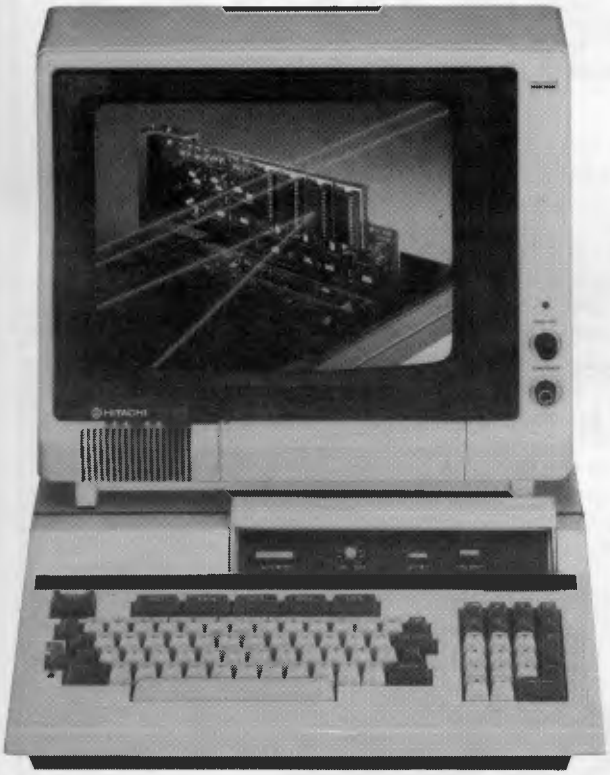

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machine most people are likely to come across. The system is menu driven, and therefore in the conversion chart the option required is given rather than the full command. On loading the system, the user is presented with a series of options. These are selected by pressing the first letter of the required option. If the Apple in use has a 40 column screen, then to view the last three a '?' has to be hit. The options are summarised in Fig 6.

The FILE option covers all the commands to be tackled in this series. The options available are outlined in Fig 7.

TRS-DOS

The Tandy operating system TRS-DOS has for a simple system many useful commands. It is especially unusual in having a help facility. In addition the system uses a '/' and not a '.' to mark the start of the file and the disk designator is ':d' and not 'd:'. The system has a range of password protection facilities, which can protect whole disks and individual files. On formatting a disk, a master password can be assigned, if an individual file can be accessed by the full command (if protected) by the command shown.

filename/ext.password:d

The password is set by the ATTRIB command:

ATTRIB ufn (vis,ACC=pass,UPD=pass, PROT=level)

Prot Levels:	Degree of access:
FULL	full access no protection.
KILL	kill, rename, read, execute and write — total access.
NAME	rename, read, execute and write.
WRITE	read, execute and write.
READ	read, and execute.
EXEC	execute only.

The BACKUP, COPY, DATE, DIR, ERROR, FORMAT, HELP, KILL, LIST, RENAME and TIME will be covered in the conversions tables next month. In addition there are the commands given in Fig 8.

PET

The Commodore PET, like the Apple, is a simple machine with few operating system commands; it also has its own peculiarities: not 'slots' in this case, but the IEEE 44B communications bus. All the systems commands, BACKUP, COPY, DATE, HEADER, RENAME and SCRATCH will be covered in the conversion table next month.

SOFTWARE Operating Systems

Unix

Unix is a complex and sophisticated operating system with many commands, some of which most people will never use. The majority of the commands have been summarised in the tables; however, there are quite a few extra options that do not fit in to the categories of the chart and some that do have extra options that need expanding upon. Unix has a tree directory structure and the ability to PIPE — send the output of one process to the input of another. The simple commands that will be covered in the table in next month's issue of *APC* are $CAT, $DATE, $CP, $MV and WHO. The rest are given in Fig 9.

Creating a program

Ever gazed wistfully at the name on a successful software package and wished it could happen to you? Dream no more. Mike Liardet begins a two-part lesson in producing your own mass-market software. This month: strategy.

The microcomputer revolution has put computer power within everybody's reach, spawning a new class of computer user unknown in the industry only a few years ago. Today's computer users are 'software consumers' with no training or deep knowledge of computers, but a huge appetite for easy-to-use games, educational and business software.

Programmers today face a unique opportunity. The time is ripe for fresh faces who understand the new medium and can feed the public what it wants. They won't need huge budgets and teams of programmers to obtain their success — just one or two individuals with the right idea can make it.

If you aspire to these giddy heights, then read on. I'll be describing some of the issues involved in producing a mass-market product, and some of the tricks of the trade to give your concoction an 'edge' over the opposition. This article is aimed at the home-worker with scarce resources and precious few people to call upon. Big budget projects are not catered for.

Of course, there is no simple formula for success — you can rest assured I'd keep it to myself if I knew it! — but it is possible at least to point yourself in the right direction.

Thousands of programmers spend thousands of hours and millions of dollars developing software for consumption by just one or a handful of users. This bespoke software is presently the backbone of the software industry and has nothing to do with writing mass-market software. If you're one of these aforementioned programmers you'll have to throw out a lot of old habits and preconceptions if you plan to write something for the masses. And if you've never programmed professionally, although you haven't learned any software skills at someone else's expense, at least you won't have picked up any bad habits.

In comparison to bespoke software, mass-market software must appeal to, and be eminently usable by, as many people as possible. With bespoke software, the occasional malfunction or misunderstanding can be dealt with on a one-to-one basis. With a mass-market product, every problem is literally multiplied (by the number of users). To have any reasonable chance of success, a mass-market product mustn't have these problems, and must be as close to perfection as is possible in a limited timescale.

Another major difference is that, initially, there are no users to define the requirement. Thus, when writing the software, you must invent a notional user and write the program for him. If you've only ever written software under the direction of others you might find this difficult, but when you get used to it, it's very refreshing!

Beginnings

The starting point for any product is an idea. Many people present a dearth of ideas as an excuse for not doing anything. I believe that getting an idea can be difficult for everyone, and that sometimes even Paul McCartney sits with a blank sheet, chewing his pencil.

Acknowledge that you're looking for an idea. As soon as a notion hits you, however silly it may seem, write it down. Some ideas might seem so derisory that you would cringe with embarrassment if anyone saw them. Still, write them down — you might need them later.

To stimulate ideas it can be useful to go to exhibitions, read magazines, talk to others, and generally soak up the current state of the micro world. Many ideas can be stimulated by thoughts of improving existing software, and so on. The main categories of software are: educational, games, business and personal, so you might choose to hang your ideas on these pegs. But don't let that stop you inventing a new category — that really would be a winner. If you have a collaborator, then a brainstorming session can be invaluable.

Eventually, you must call a halt to this ideas generation. How long you allow yourself is entirely up to you, but after a while you should be anxious to get started on something. Leave the decision-making too long and the era of garret

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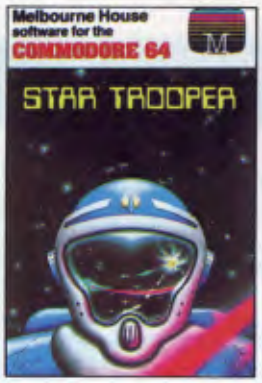

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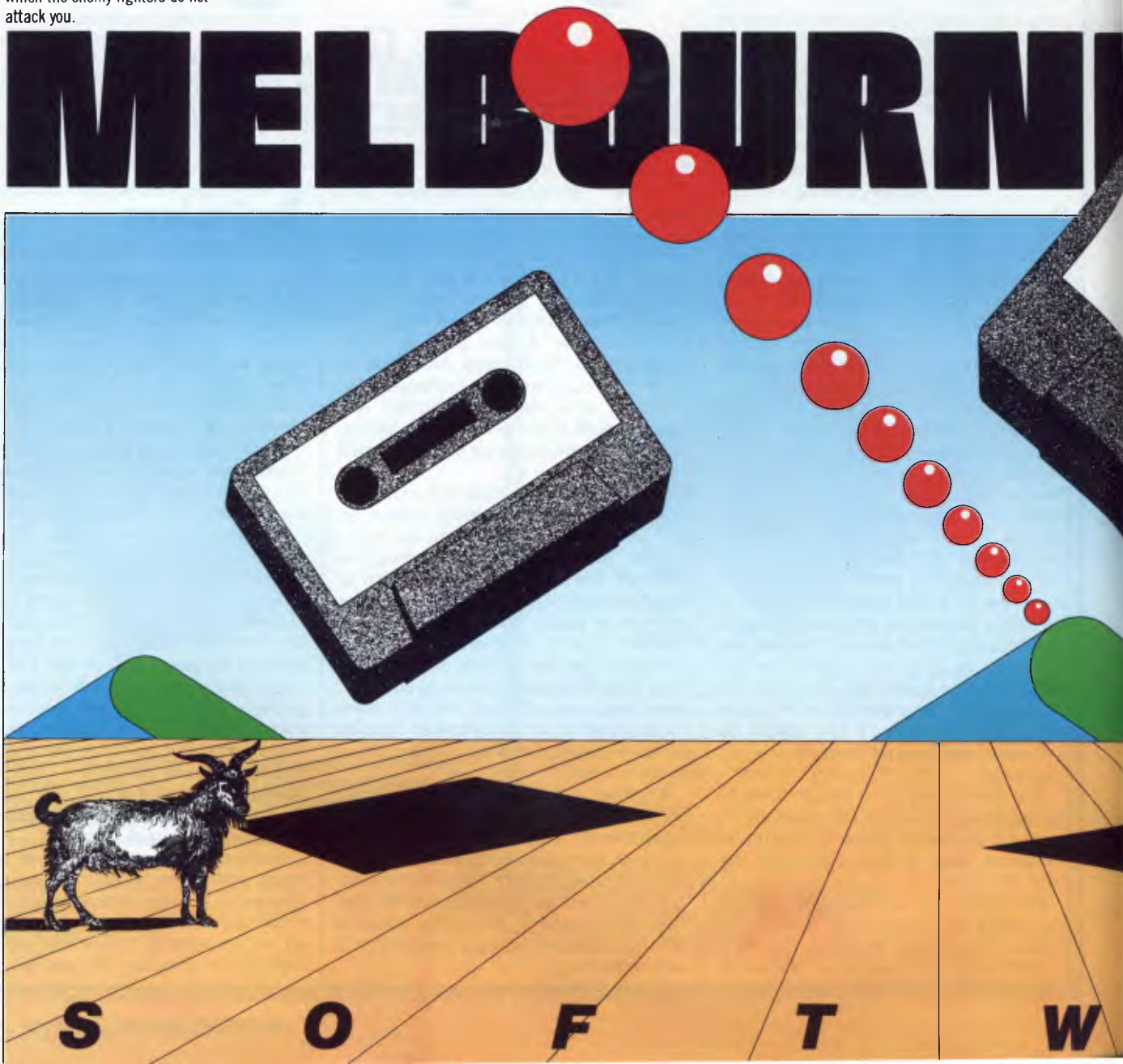

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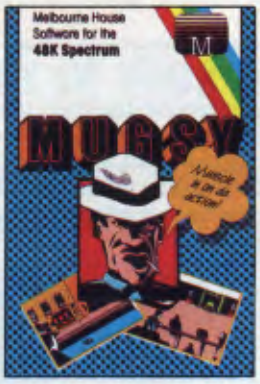

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All versions of 'The Hobbit' are identical with regard to the adventure program. Due to memory limitations, BBC cassette version does not include graphics.

* These programs incorporate PAVLODA

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software may be gone, and you'll have to go seeking massive venture capital to get anywhere at all.

Now comes the time to make a decision.

There are many decisions to make — what to do, which machine, in which programming language, and how long to spend on it. Build up a checklist of questions to pose for each idea. How well will it sell? Who will buy it? What will they use it for? Is it feasible to implement with the resources available (time, money, machine, the current state of technology). Is it specific to Australia, or an international product? Obviously, your own level of interest should figure highly in your list of criteria.

Whatever you choose, you will have to live with it for some time, through moments of great doubt and hard work. If it doesn't really interest you as a project, you won't see it through. Try to think into the future when making the decision. It's highly unlikely that whatever you do will see the light of day for 12 months or more, and where will micros be then?

Finally, avoid choosing a project that has already been well covered by the industry. Even if you can write a better word processor than anyone else, no-one will want to know about it. Your strength as an individual is to seize fresh opportunities quickly. In comparison, the industry giants are like lumbering armies. It's not easy for them to change direction, but if your product happens to be in their way they won't even notice as they trample all over you. Make doubly sure that you are somewhere else, where you can really make your presence felt.

Choices

It's possible that this decision is already made — you have a computer and it's all you can afford. However, you can always try to develop the software in a machine-independent fashion so that the choice of machine(s) can be delayed. The price you pay is that you cannot usually take advantage of the special features of your own machine.

The micro world currently offers six different types of computer: home computers, lap-held portables, transportables, desktop personal computers, local area networks and multi-user machines. You might hope that your software will be relevant to several types of machine. If you are working under one of the industry standard operating systems, like CP/M and MS-DOS, with only minimal effort it should be possible to design software that will operate on a great many machines in the latter four categories.

At the moment, all except the first two categories can be assumed to have disk drives. Their presence or absence will have a major impact on the design of the software. Some types of software are not practicable without them (database, for example).

You should identify the minimum capacity machine that will support your software, and estimate the minimal RAM, disk capacity, minimal screen size, printer paper dimensions, and so on. You should also itemise any optional extras, such as light pens and graphics hardware, that might be needed. Now ask yourself — would anyone want all this lot if it weren't for the program? If they must buy extra options just to run your product, it effectively puts the price up. Plan the product around a minimal machine, where the extra goodies can be bought later if the purchaser wants to use all the wonderful facilities you have in mind.

Bear in mind that you don't have to develop the software on the target machine. While recovering from an illness, a friend of mine developed a space war game on a cassette machine in hexadecimal machine code. If I were to try that, it would *cause* an illness! I much prefer to work with disks, text editors and assembly language, then hit the target machine at the end of the project, either by downloading the software or using a ROMwriter with a mutually compatible ROM chip. If you decide to develop on another machine, make sure you don't do the equivalent of developing a 35-foot yacht in the spare room: establish early on that you will be able to extract the fruit of your labours when you have finished.

If you are stuck for cash you might consider hiring a machine, but after a few months the bill can mount up to the cost of an original purchase. However, a short-term hire is a valuable option for checking out your software in special configurations. For example, performance testing your floppy-developed software with a hard disk.

There are four different types of programming language available: interpretive, compiled, intermediate and assembler (some languages are embraced by more than one category).

Interpretive: the code you type is the same as the executable image. An 'interpreter' continually translates code throughout the execution of your program. The best known such language is Basic but there are many others, like some versions of Lisp, Logo and Prolog.

Although it's easy to work with interpretive languages, I'd rule them out for product development. They are admirable for quickly checking ideas, learning programming, and, in the case of Basic, come free with many micros. But there are three problems: the purchaser may need to buy the interpreter to use your product; they run very slowly (because of the interpretive overhead); and they provide little or no security for your code. With an interpretive language, it would be easy for anyone to list all your hard work, change a few bits here and there and come out with a rival product that you would be hard-put to prove was a rip-off.

Compiled: the code you type is translated, by a compiler, into an executable image that can be understood immediately by the computer's processor. Compiled languages include C, Fortran, PL/M and Pascal. A lot of sanctimonious twaddle is written about Pascal in particular, but don't let this browbeat you into using it. With this proviso, I rate compiled languages as the preferred environment for most product development.

A good compiler will generate fast, secure, compact code, but because you are using a high level language you can maximise the portability of the software. Moving your software from an 8-bit to a 16-bit machine need involve no more than purchasing the new version of the compiler and transporting your source code onto the new machine, with little or no changes.

A word of warning about compiled Basic: All Basic compilers I have ever seen generate large program files, and provide disappointing improvements in execution speed. Some of the interactive techniques I'll be introducing later won't work in compiled Basic as it's too slow.

Intermediate: compromise between compilers and interpreters. A pseudo-compiler translates your original source code into a pseudo-machine language which must then be interpreted; of which UCSD Pascal and CBasic are the best-known languages. Language suppliers can implement intermediate languages across a wide range of machines more easily than any other type of language. This is often billed as an advantage, but like everything else concerned with intermediate languages, it's really a pseudo-advantage which accrues to the implementor and not the user. Intermediate languages offer the worst of both worlds.

Assembler: you develop your program directly with your processor's instruction set, albeit symbolically, and not in hexadecimal code. Assembly programming produces the fastest and most compact codes, but is the most difficult to work with.

Most micros use one of the following processors (or a compatible one): 8080, 6502, 8086, M68000. Unfortunately,

each of these processors has its own unique instruction set, and so once committed to a particular processor it's very difficult to translate your program for another.

There are translation programs available for converting code between processors, but they're not as easy to use as two different versions of a high level language compiler, for instance.

You might consider developing your program as a hybrid, using different languages for different bits. I did this to great effect with a product I've developed where the installation software was developed in compiled Basic and the rest in Assembler. As the installation software is only ever used once, and is not time or space critical, it was possible to develop sophisticated installation features quickly and easily using Basic. This enabled me to devote more time to the key part of the software, and optimise its time and space requirements by using Assembler.

Having just passed the ideas phase, it may seem rather early to start thinking about selling the software, but as it's the whole point of the exercise, it's best to keep it in mind from the earliest moment. I hold the view that only rarely do marketing and software design skills reside in the same head; unless you are one of these rarities you should acquire a partner to complement your skills.

There are now a number of software publishers in Australia, and although it's easier said than done, there's a lot to be said for a publication arrangement. Software publishers are analogous to book publishers, and in exchange for you signing away all or most of your rights to the software, they will do all the marketing and production, paying you a royalty for each unit sold. The deals offered can vary greatly, some publishers offering a percentage of the transfer price, and others on the retail price. If you are in the fortunate position of having several offers, it's impossible to predict which will be best as the big question is how many units each publisher might sell.

Without prior thought, it's easy to anticipate ludicrous royalty percentages which would put the publisher out of business. Consider a $100 product: if sold direct to a dealer, the publisher will only receive $70, perhaps even less, if it's part of a multiple order. Of that $70, perhaps $10 was spent manufacturing the product, $20 advertising it and $10 allocated for support. This leaves $30 to spare, which the publisher might generously agree to split down the middle with you, or not. So don't be surprised if you're offered a single-digit percentage. You won't be alone — most royalties in other industries are around this mark.

Of course, publication is not the only method of selling your magnum opus — advertising is another alternative. You might care to check out advertising rates at this early stage, too.

Campaign

Programmers are notoriously bad at estimating time-scales for projects, but it's essential to try. Even an inaccurate plan of campaign will get the project finished quicker than none at all, and next time round your planning will be better.

I consider it dangerous to attempt a first project that you anticipate will take more than 12 months. The micro market is moving rapidly, and unless you are very far-sighted you're likely to be left languishing with a software dinosaur.

It's easy to overlook the 'hidden extras' when drawing up time-scales. In the absence of any better ideas, use the following rule of thumb to plan your project right through from inception to product launch:

5%: total time to study the operating system and programming language.
5%: feasibility studies.
30%: implementation of program proper.
10%: implementation of peripheral supporting software (for instance, installation).
15%: writing documentation.
5%: alpha-testing; internal checking and debugging.
5%: beta-testing; independent checking and assessment.
5%: implementation of corrections and enhancements following testing.
5%: final beta-testing.
15%: publication; printing and advertising.

Note, in particular, that there is probably some core part of the program proper, perhaps a quarter of it, which encapsulates the original idea. The other three quarters comprise essential 'extras', such as file handling. Thus, only 7-8 per cent of the overall project is actually taken up with writing, hence the saying that genius is 95 per cent perspiration and 5 per cent inspiration!

Unless you are living with Mum or rich enough to support yourself on what might be a highly speculative venture, you will have to do the work alongside a regular job. Check the small print on your employment contract — you might have signed away all rights to the software already. Ideally, your job should be compatible with software work, which means NOT being a programmer already — you can't face another computer in the evening.

If you are working in collaboration, then aim for a good demarcation between you. The first 50 per cent of the percentage breakdowns can very easily be assigned to one, with the other handling the documentation onwards.

Finally, I pass on a tip which increased my productivity by 50 per cent. Decide where in the house you most like to sit, and put your computer there! In my case, that happens to be somewhere near the TV which produced not a few grumbles from the rest of the household, but stick to your guns, and good luck!

Next Month: Making mass-market software part II: tactics.

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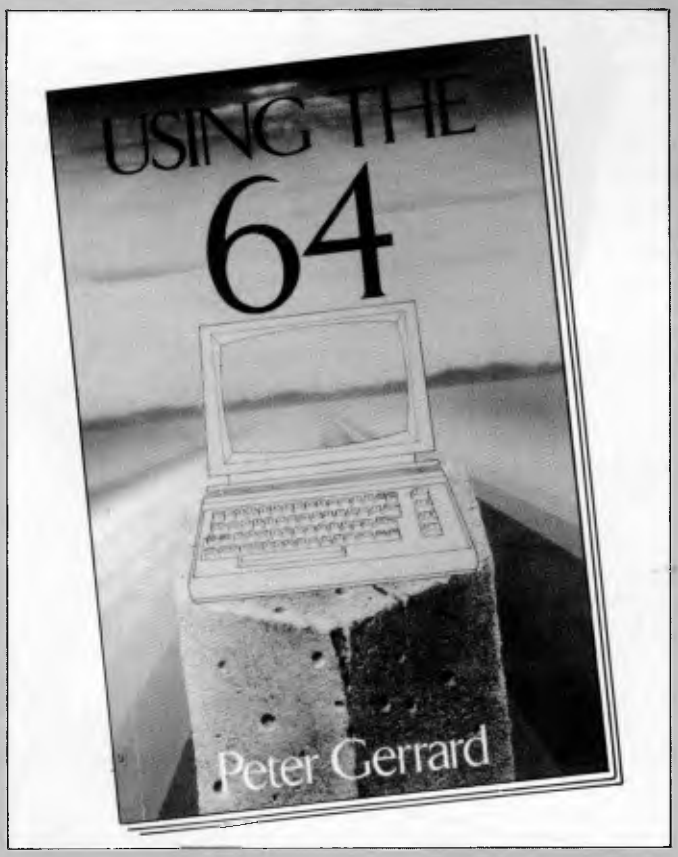
Steve Withers' selection from the bookshelf this month features a smorgasbord of literature on the Commodore 64.



Using the Commodore 64

What I particularly liked about this book is the way it really does describe the 64. Some of the books I have received make me think that some publishers are happy to produce multiple editions that describe a woolly dialect with just enough machine-specific details to justify the changing titles, but Peter Gerrard has come up with a book full of nuts and bolts information about this very popular home computer.

The first chapters contain the mandatory tour through Basic, written with more zip than most authors seem to manage. There are several interesting routines and programs, including one that allows you to scroll backwards or forwards through a program.

Things liven up considerably in Chapter Three, with the introduction of machine code programming. This chapter struck me as one of the least intimidating descriptions of assembly language programming I have come across. The examples used are commonplace (loading characters into the video memory and simple arithmetic), but Gerrard writes with a matter-of-fact style that should encourage most readers to try their hand.

The chapters on graphics and sound cover most, if not all the features of the 64. This isn't a "cookbook" (although there are several program fragments that could prove useful), the object seems to be to give the reader a clear understanding of the principles and techniques involved. It's as if the author is saying "here are all the things your computer can do, now go away and use your imagination to come up with an interesting or useful application."

A major section describes in considerable detail the principle chips inside the 64 — the 6566 video controller, 6581 sound generator, 6521 interface chip, and of course the 6510 cpu. These chapters include the kind of information found in manufacturers' data sheets (pin-outs, electrical characteristics, register definitions, etc), as well as a description of the chip in terms that can be understood by those of us without a background in electronics. The coverage of the 6521 is the weakest, but this is understandable as it will be of little interest to most users compared with the sound and video chips. Its most useful feature — the time of day clock — is described in detail.

In common with many books of this type, 'Using the 64' has a number of appendices containing "useful information". Along with the usual lists of Basic keywords and error messages, code charts and conversion tables, there is a very detailed memory map that includes hundreds of entry points to ROM routines. Something I don't recall seeing before is a list of timings for Basic elements (eg, 27 milliseconds to evaluate a cosine, 0.9ms to perform a RETURN, etc). It's arguable how useful this is, but I found it intriguing. I won't bother with the other appendices, except to mention that there is a listing of the 'Extramon' machine code monitor. The author admits that much of this information is available elsewhere, but I agree with him when he suggests that saving the reader from "diving about from book to book in an effort to find [a] particular bit of information" is worthwhile.

I spotted one or two minor errors, for example a delay loop on page 90 is actually an infinite loop. Despite this I can best sum up the book by saying that I would be happy to buy it with my own money. It's not a book for beginners (although they would find some of the complete programs interesting), but it is a great reference source for anyone seeking to write programs that fully utilise the power of the 64.

Using the Commodore 64

Author: Peter Gerrard
Publisher: Duckworth, London
Price: $29.95

Your Commodore 64

'Your Commodore 64' is one of the most comprehensive books describing this computer. As well as extensive coverage of the 64 itself, there is information about the 1541 disk drive, 1525 printer, and the Commodore cassette drive. While some of the material is along the lines of "how to connect a printer", most of it is aimed at the Basic programmer.

In common with so many other books, the chapter that purports to be an introduction to programming is actually an introduction to Basic. I'm sorry if that statement is becoming a cliche, but there are a lot of people that need to be shown how to turn an idea into a program before worrying about the

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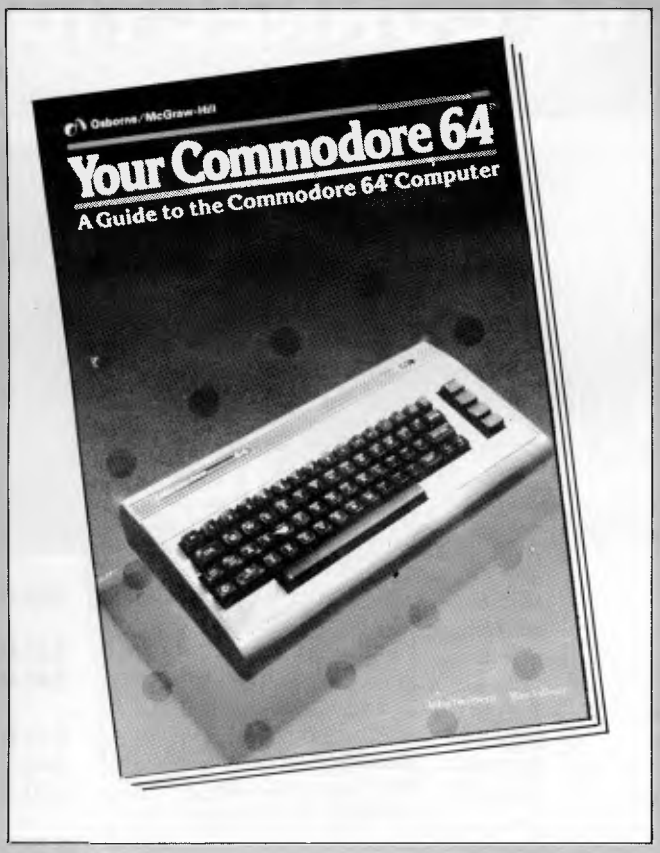


syntax of any particular language.

Anyway, once you've got the hang of programming there's plenty of material in later chapters. There are routines to handle game controllers and others that illustrate the animation of character-based displays. As you might expect, there is a major section on graphics programming including the use of customised character sets, bit-mapped graphics, and sprites. If you explore these features you will probably appreciate the routines that save and load chunks of memory to and from tape or disk — it's claimed to be much faster than using a combination of DATA and POKE statements to create character sets, sprites, and bit-maps.

A problem often experienced with colour graphics is 'fringing' or one colour bleeding into another. The authors explain that this occurs because a TV set can draw dots faster than it can change from one colour to another. This effect can be minimised by a careful choice of horizontally adjacent colours, so Heilborn and Talbott prepared a table showing the compatibility of various colours. Their efforts were in vain, as the table is nowhere to be seen. I noticed a couple of other editorial slip-ups, including a misaligned table and a circular reference in the index ("Clock, real-time. *See also* Jiffy Clock" and "Jiffy. *See* Clock").

While 'Your Commodore 64' isn't the best introduction to programming I've seen, it does contain a wealth of information for the Basic programmer, including an extensive collection of reference material in the appendices.

Your Commodore 64

Authors: John Heilborn and Ron Talbott
Publisher: Osborne/McGraw-Hill
Price: $25.45

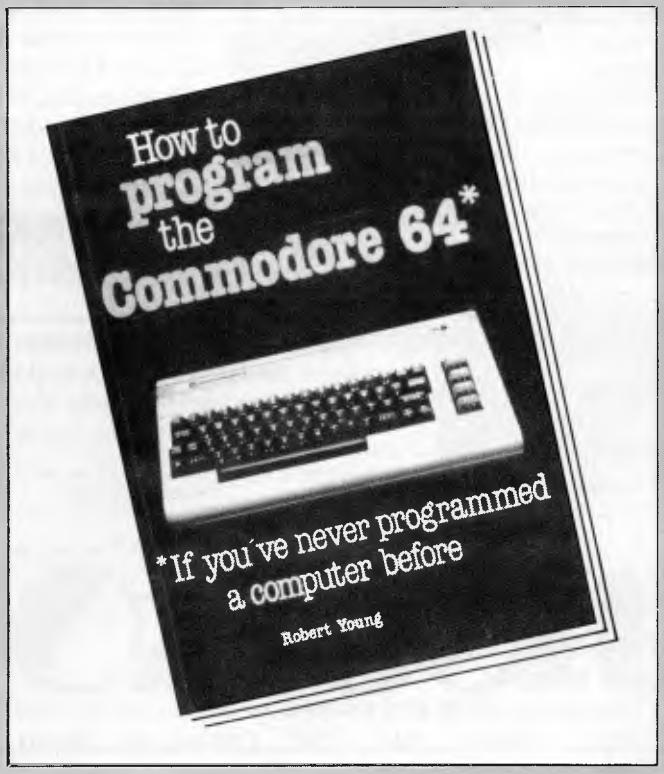
How to program the Commodore 64

I wonder how many books have been published with titles like "How to program the Zit PC"? Quite a few, I suppose, but how many are really good? My guess is that there would be a much smaller number. This particular book is OK, but not outstanding. It is, however, an honest book — it doesn't claim to teach the reader everything about programming, or to describe the advanced features of the 64. This limited scope is at once the book's strength and weakness.

The advantage is that there is no extraneous material. A specific dialect of Basic is presented, so there are none of the problems that face novices using more general text. For example, many books that set out to teach a non-specific version include the matrix arithmetic statements that are rarely found on micros. When working from a book designed for use with your computer you can be quite confident that the examples will work (although mistakes sometimes slip through, I didn't notice any in this particular book).

On the other hand the narrow scope of the book limits its useful life. By working through the chapters you would gain a reasonable knowledge of Commodore Basic along with some good programming habits — my main criticism is the lack of comments in the sample programs — but you won't know very much about the machine itself. Another drawback is that Young's book isn't suitable as a reference book for two reasons — there's no index, and the material isn't there anyway. To be fair, it's only meant as a tutorial, but is that all you want?

Perhaps the best thing about the book is that it doesn't concentrate on numeric calculations at the expense of other aspects of computing that are of interest to many users. As it's relatively inexpensive, maybe the complete beginner



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would be well served by this book as a prelude to something more detailed ("Using the 64" perhaps?).

How to program the Commodore 64

Author: Robert Young
Publisher: Interface
Price: $14.95

More on the Sixtyfour

As this book is a collection of assembly language routines for the 64 it isn't very reviewable, but I thought it deserves a mention. If you are interested in assembly language programming, there's something here for you — disk and tape I/O, adding commands to Basic (with some useful examples), turning the user port into a Centronics interface that Basic can use. There's also a flexible terminal program. In my opinion, this book is definitely worth a look.

More on the Sixtyfour

Author: HC Wagner
Publisher: Hofacker, Holzkirchen, West Germany
Price: $19.95

END

COMMUNICATIONS

APC welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Address letters to: 'Communications', APC, 77 Glenhuntly Road, Elwood, Victoria 3184.

Mail order reply

The managing director of Micromail has written to APC in response to last month's letter from R Byrne headed "mail order hazard" on the basis that "although the name 'Micromail' was not stated in the article it clearly makes apparent who the company is by using wordage that identified Micromail."

For the past eight months, Micromail, the Sydney based Microcomputer Mail Order Club has satisfied the microprocessing needs of over 2000 new club members. In fact, the demand has been so strong that Micromail has moved to a newly built location at 1/303 Pacific Highway in Lindfield, NSW. The new location allows club members and nonclub members alike to visit, browse, get advice, and purchase products of their choice.

But there is more to Micromail than meets the eye. The staff consists of former Commodore, Apple, ComputerLand, and Tandy managers and executives. And club members get to use this expertise at any time. This experienced team of professionals is leading the retail microcomputer industry by providing the greatest services to its members — some of these include: a 24 hour toll free order line, extremely competitive pricing, training, service and maintenance, courier delivery, direct overseas ordering — US, UK, the latest products, the latest information, and the best staff to satisfy customer needs. Micromail also allows its customers to purchase goods over the telephone and charge these purchases to a credit card. This service helps speed delivery time.

Micromail is having its Grand Opening on July 28th and invites all to come along and meet the staff of the most progressive microcomputer retailer in Australia.

Letters like the following are an inspiration to the staff of Micromail to continue providing this unique service —". . . thank you for your letter of 28 March . . . I wish to take this opportunity to thank your company for the excellent service you have so far afforded me . . . looking forward to many years of association with your company." — RJ Fletcher. ". . .I wish to thank you for your excellent help, prompt service, and beaut prices . . . The new US made Cardco + G interface really makes my Gemini 10x hum . . . I'm really looking forward to getting that new Video Pak 80 column card too . . . Keep that Yankee stuff coming in! Thanks again." — KL Robertson.

Justin C Beck
Managing Director
Micromail

Post-hypnotic suggestion

The letter from W Harrison (*APC* May, page 69) on hypnosis has greatly intrigued me. Although the letter was of a humorous nature it had a ring of truth about it. Was there, perhaps, a PHS (post-hypnotic suggestion) contained within the letter to which I have responded?

I too have watched several hypnotists's shows and was so amazed by them that I have since delved into various techniques for inducing trances. The approach of CAH (computer aided hypnosis) adopted by Mr Harrison is most interesting as it's known that television is an ideal medium for hypnosis (*Hypnosis: Fact & Fiction* by FL Marcuse, Publ Pelican), since the focus of attention is often completely captured and the normal censor mechanism can then be sidestepped. Indeed, if this were not so, commercial television would soon collapse as its revenue from advertising (based on 'suggestion', which has close links with hypnosis) would dwindle quickly.

Obviously, as Mr Harrison has already discovered, two people are required when modifying CAH programs: the operator in front of the console and an observer behind it watching for the glassy stare to appear in the eyes of the operator, often heralded by the eyelids dropping fractionally.

If Mr Harrison & Co really do have a computer tape available which they believe will induce a simple trance state, I would be very interested to see it.

Dr R Evans

(So would we! — Ed)

Helpful suggestions

With reference to Mr Harrison's hypnotic problems (Communications, *APC* May).

Being a fully qualified psychoanalyst, I make the following suggestions to improve his team's situation:

1 Throw the micro in the bin.

2 Go on a long holiday to help clear the mind.

D Maclean

End user copyright interests

In the discussion of software copyright and protection, too much attention is given to the interests of suppliers and manufacturers, and too little to the interests of end users.

I note with some amazement that some suppliers of compilers claim an interest in the sale of software produced using those compilers. The logical conclusion to this argument would be a situation in which the designers of (for instance) the Z80 would expect to receive royalties on every profit made with the assistance of a Z80. This is plainly ridiculous.

On a slightly different tack, I am as concerned as most about the difficulty buyers of multiple machines have in complying with the 'single-use' limitation imposed by software licenses. However, I do not see the remedy lying in attempts to rigidly enforce single user licensing in these situations, but rather in the issue of suitably worded licenses for multiple use of the software, accompanied by a suitably higher charge. The present situation makes criminals of us all.

May I bring to your attention an astonishing clause in the standard DEC software warranty which, while dis-

claiming all responsibility for 'loss of data and profits' (the sort of effect which reliance on faulty software might very well have), indemnifies the user massively against 'direct damage to property caused by defects in the software'. How on earth can faulty software *directly* damage property? I don't wish to imply any shortcomings in DEC products, but is it surprising if people find it hard to take such inequitable contracts seriously?

M Taylor

(Maybe DEC's worried about its stuff being used for missile guidance! — Ed)

Keyboard impressions

I'd like to correct two 'wrong impressions' in Conall Boyle's 'History of the Keyboard' *(APC* June).

The French government and the French telecom company PTT *have* been stepping up the installation of free online directories (Minitels) and it's the subscribers who scorn them!

Your writer shows a startling ignorance of keyboard instrument procedures when he remarks: 'On the piano, notes are usually struck together in the form of chords.' *Most* piano music is separate notes with mandatory fast action:

'Michael H Adler *(The Writing Machine,* Allen & Unwin, 1973) argues persuasively for a new standard keyboard that puts the 10 most common letters — ETAOINRSHD — on a single row, curved in such a way that each of the 10 fingers (thumbs included) rests comfortably on one of the keys . . . Adler delegates the space bar, the shift key and carriage return to the feet . . . This somewhat piano-like arrangement should result in much faster typing. As Adler points out: "After all . . . a pianist can comfortably handle over 1500 to 2000 keystrokes a minute (the equivalent of 300 to 400 words per minute) on a much less compact keyboard than the one described, and without trying to break world speed records either." '

This is from Phil Lemmon's *Short History of the Keyboard (Byte* November 1982, page 386). Incidentally, someone came up with a keyboard concept involving both relabelling of the keys (as in the Dvorak layout) and remodelling of the typewriter (as in the Norden or Adler concepts), and all that in the late 1970s! It was called, I think, the Maltron, and had a slightly curved squarish keyboard with ancillary functions (shift, C/R, space bar, and so on) on large contoured keys to the right and left of the main letter cluster. Unfortunately, it appeared a bit too early, before micros and daisy wheels, at a time when flat-top keyboards (Olivetti) were fashionable. Apparently, it sank without trace.

B Sigaud

(The keyboard's days seem to be numbered, don't they? — Ed)

The spirit of discovery

Thank you for Surya's preview of Atari research on QLogo *(APC* April). From those pages I sense an attitude toward computing that is intellectual, practical, and realistic as well as open and completely undefeated by short-term markets. That is refreshing!

I have used [TLC] Logo in University of California Extension courses since June 1983. I believe it has somewhat anticipated others and combines Logo and Smalltalk ideas to offer users a sophisticated, interactive environment. Versions of [TLC] Logo, as it has been implemented on a succession of micros, bring it even closer to achievement of a notation giving freedom to work with any type of object in a general way. Lists, vectors, and strings are all possible. Turtle is not a special case, and I can hatch as many turtles, or as few, as I wish, and send each my message. Each may swirl and dance in either unique or orchestrated ways. A descriptive approach keeps attention drawn to the application in particular situations — the actual functions and relations are kept in mind and not lost in the bureaucracy of prescriptions and procedures. Thinking is close to notation, and Logo work becomes alive and even beautiful!

It's important to remember that the idea of Logo is to present environments in educational settings appropriate for mathematics and science, not only in the area of concepts, but also of notation. It is very much that we educators want to bring the spirit of Soho, James Watts and discovery into its rightful place in the mathematics, science and computing curriculum alongside directed and prescriptive methods.

TLC Logo is a product of The Lisp Company, PO Box 487, Redwood Estates, CA 95044, USA. Attn: John R Allen

G Mason

Don't leap 2000

In Communications in the May issue D Nowlan refers to the year 2000 as being a leap year. This is not correct. As you know we have leap years in order to enable the clocks to catch up with the sun, but a whole day every 4 years is just too much, so every 400 years the leap year is left out. The last time this happened was in 1600 and so the year 2000 will not have a February 29.

W White

Challenger Benchtest challenged

We greatly appreciate your interest and subsequent "Benchtest" on the "Challenger" reviewed on pages 46–54 of the May 1984 edition of *Australian Personal Computer.*

Some of your constructive criticisms were valid and almost certainly applied to the unit under test which, as you implied, was an early release. However we would like to make the following comments on sections of the evaluation:

1. Page 49/50 Keyboard.
The keyboard described has every symptom of the pre-release keyboards. Sticking keys have been cured by completely retooling the key-matrix moulds. Key bounce has also been cured by replacing the original nickel-tin contacts with gold. We believe the lack of tactile feed back was caused by the original tight mouldings. Please feel free to fully test the enclosed latest version of the keyboard.
2. Page 51.
The missing DOS programs could not be provided with the Challenger as they are IBM copyright programs. A Challenger version of the MODE program has now been developed and will be supplied with all future machines.
3. Page 51.
Technical information at this stage has largely been omitted from user manuals and will be included in two other manuals, a Programmer Manual and a Technical Manual both of which are now being developed in the UK.
4. Page 51. Switch Settings.

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All switch settings for the System Unit are detailed in Appendix G of the System Unit manual.
5. Page 54.
The Challenger *must* be set for either RGB video or composite PAL video. Failure to do this results in incorrect colours and loss of intensified characters. This setting is detailed in Appendix G of the manual.
6. Vertical Synch.
Screen 1 and Screen 2 are always in 60Hz mode.
Screen 0 (Text screen) can be set for 50Hz or 60Hz. If set for 50Hz and connected to a monitor that is adjusted to 50Hz then vertical synch. may be lost when screen 1 or 2 is entered, although most monitors can be adjusted to lock in both modes. Dip switches are now set so that video is always 60Hz. The IBM PC is always 60Hz unless reprogrammed by Australian Software.

We would like you to take the opportunity of re-evaluating the Challenger in light of the above factors and assure you of our co-operation at all times.

Michael Wilson
General Manager
Dick Smith Electronics

Ian Davies, who conducted the Benchtest, will reply in the next issue — Ed.

Microchess

Congratulations on your excellent article in Microchess concerning the Scisys Superstar chess computer. The article truly reflected the chess computer market in 1983 where stronger chess computers were released at much lower prices than in previous years.

Of particular interest was the results of the tournament games between Scisys Superstar and Novags' Constellation and the reference to the "End game" strength of the Superstar. In chess, the openings can be learned from books, the middle game is a matter of not making mistakes but it is the quality of the "End game" which separates club players from grandmasters as the moves in the "End game" are virtually infinite. To create a strong chess end game is the greatest challenge to programmers of chess computers.

Scisys introduced the first strong "End game" chess computer with the MK V which won the micro chess world championship in September 1981. The Superstar is the latest continuation of the programming techniques used in the MK V.

The version in your article was Superstar version 21. The current version on the Australian market is Superstar version 25 which is about 10% stronger. In your article you mentioned Gary Kasparov was assisting Scisys in the development of a 36k upgrade module. It is worthy to note that this module will be released in Australia in September, the same month that Kasparov is challenging Karpov for the human world chess championship in Moscow. Kasparov is rated higher than the world champion and is expected to win the championship. It is therefore quite a coup for Scisys to obtain his services, and players interested in the continuing increase in strength of computer chess programs will be in for a treat when the Kasparov 36k Superstar chess computer is released.

I thought this information would be of interest to your chess playing readers and look forward to more unbiased reports on chess computers in Microchess.

Kerry Harrison
Computerplay

Quicker labels

Reference is made to two recently published programs in *APC* designed to print labels for cassettes.

I fail to see why it should be necessary to go to such lengthy programs when it can be cut quite short.

Attached hereto please find a program that will do the same job with a lot less effort. It was done on a System 80 computer and printed on a CE 60 Brother printer/typewriter.

I trust it will be of some interest to you. As it is based on the last month program I can take no claim for the originality of the program.

K Nutt

We were wrong

The excellent Benchtest review of the HP150 published in the May issue of *Australian Personal Computer* was unfortunately marred by an erroneous reference to pricing at the end of the article.

Hewlett-Packard Australia Limited, has carefully priced the HP150 to be competitive, particularly with the IBM PC.

A similarly configured IBM PC would, I believe be more expensive than the HP150

```
80 CLEAR 200
110 A$=STRING$(47,"=")
120 B$=STRING$(20,"-")
130 D$=STRING$(47,"-")
140 LPRINT CHR$(27);(50)
160 FOR Z=1 TO 2
170 LPRINT D$;" "
180 FOR I=1 TO 15
190 LPRINT USING "**";I;
200 LPRINT B$;":";C$;" ";
210 LPRINT USING "**";I;
220 LPRINT B$;":";C$
250 NEXT I
255 LPRINT A$;" "
260 FOR I=1 TO 15
270 LPRINT USING "**";I;
280 LPRINT B$;":";C$;" ";
290 LPRINT USING "**";I;
300 LPRINT B$;":";C$
310 NEXT I
320 LPRINT:LPRINT
330 LPRINT A$;" "
340 FOR X=16 TO 21
350 LPRINT USING "**";X;
360 LPRINT B$;":";C$;" ";
370 LPRINT USING "**";X;
380 LPRINT B$;":";C$
390 NEXT X
400 LPRINT D$;" "
410 LPRINT:LPRINT:LPRINT
420 NEXT Z
430 END
```

Cassette label printing program

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5. Onboard loudspeaking conference telephone. Software controlled — also audibly indicates call progress.

6. Senses true dial tone, ring tone and busy tone. Generates error messages.

7. Pulse or DTMF (tone) dialling. When used with DTMF telephone exchanges, connection to the called party can be established in less than one second.

8. Has onboard colour Videotext (Prestel) system in firmware. Eventually will also support NAPLPS.

9. Can emulate hayes Micromodem, Hayes Smartmodem, Apple serial card, Prestel terminal as well as its own modes, some of which include automatic error correction based on the Christansen Protocol. A fully transparent mode is available.

10. Default operating parameters are stored in battery backed RAM & can be changed at any time under software control.

11. 2Kx8 CMOS RAM powered by an eight year lithium battery stores default parameters, phone numbers and log on strings, allowing single keystroke call establishment.

12. Provision for EPROM up to 16Kx8.

13. Onboard battery backed clock can time & initiate calls. Also accessible for other uses including PRODOS. Emulates Thunderclock.

14. Optional standard telephone connection on the modem allows easy installation into existing phone plug. When the modem is not engaged the telephone acts in the normal manner.

15. Firmware will eventually contain most communication facilities, making additional communication packages unnecessary. Virtual disk transfer and direct read/write to disk is envisaged.

16. Has socket for installation of DES data cypher chip for security identification and EFT applications. Permission is required from the American State Dept. for purchase of cypher chip.

17. Optional search and setting to incoming baud rate and word format.

18. Can act as an automatic telephone dialler with multiple redial and 'dial alternate number' features.

Note: The hardware is final and is capable of all of the above but the complete firmware may not be available initially. We will exchange the EPROMS when the final firmware is available.

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Industry News: — Round two to Apple. Apple won their Computer Edge appeal on May 29. This effectively returns copyright protection to software. Bye-bye Mr Langer. And Unggar Soemardjo!

Component shortages are soaring the exponential growth in the computer industry. Delivery times of 30 weeks and up are being quoted on certain chips so expect to see total shortages by Christmas of drives, printers, monitors, everything. Moral: Buy it now. Remember, you heard it here first.

New Products. Well it's arrived! Dennis' modem. And it's fantastic so aren't you glad you waited 2 years? Limited quantities now available. Go on. Spoil yourself!

Coming soon: AMUST 120 Super printer. 100 c.p.s. $349 ex, $399 inc. 8" Disk boxes — hold 50 — $50.

Now working: AMUST 10Mb hard disk for Apple. $1995 ex. Great value. Runs everything.

Top sellers: DT80 printer. Hundreds in stock. Thousands sold. Top value at $268 ex, $315 inc. DISKS. Selling 5000 per week and no wonder at the price. Top quality Control Data Storage Master, MicroEd logo disks $32 per library box.

Well that's the news. Next time you're in Newcastle why not drop into our Laman St office for a cup of coffee.

George

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100-499	$2.90	$2.49
500+	$2.80	$2.35
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10-99	$3.00	$2.60
100-499	$2.70	$2.29
500+	$2.60	$2.15
Disk boxes, Lockable, hold 100	$ 35	$ 35
PRINTERS		
Dot-Matrix printer, Micro-Eductional DT80	$315	$265
Serial option for DT80	$ 95	$ 95
DT80 printhead	$ 65	$ 55
DT80 ribbon	$ 12	$ 10
C.ITOH 1550 dot-matrix printer	$985	$875
CABLES: IBM, OSBORNE, TRS80, TI 99, BBC, etc	$ 35	$ 35
MicroBee cable	$ 50	$ 45
Silver Reed 500 Daisywheel	$825	$695
AMUST Super 120	$399	$349
DRIVES (Apple compatible)		
TEAC Slimline drive	$339	$299
Atlas Slimline Drive	$265	$235
Chinon slimline	$275	$275
MONITORS		
BMC Green Screen (Japanese)	$195	$170
Yang Jen 12" monitor, amber	$195	$170
BMC Amber	$195	$170
EA 9" Amber	$195	$170

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APPLE PERIPHERALS		
Disk drive controller card	$ 90	$ 80
Automatic Ice parallel I/F and cable	$110	$ 99
Automatic Ice Direct Connect	$399	$349
Apple Modem		
Down-Under Clock	$ 99	$ 99
Z80 card	$ 90	$ 80
Vision-80 80 col card for Apple II or IIe (spec)	$199	$179
Vision-80 128K Ramcard	$395	$345
16K ramcard	$ 90	$ 80
Music Machine includes speakers	$145	$120
S.A.M. Speech Sythensiser	$ 65	$ 65
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Game Port Extender (2 socket)	$ 35	$ 35
Game Port Extender (2 socket Vision80/Zardax mod)	+$ 50	$ 50
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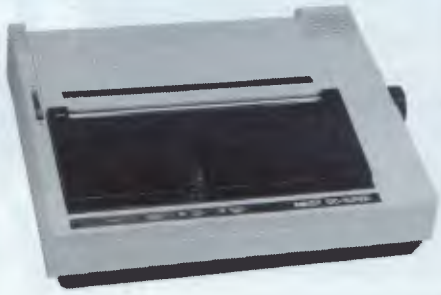

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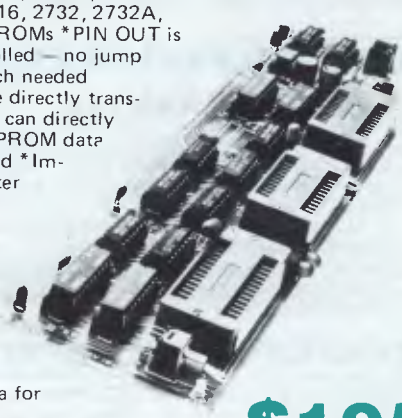

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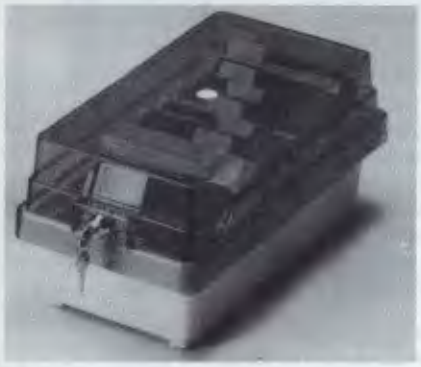

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Anyway, despair not. Good old George has come to the rescue again. Being the boy scout that I am i have managed to rescue a pile of mint, unused, uncirculated one dollar notes stashed away against the day they'll be worth more than the paper they're printed on. Maybe much more.

I'm hanging on to most of them for posterity, but I've decided to give a few away to friends of the family as fond keepsakes of a gentler past. If you would like me to send you one (Nicely packed in its own plastic wallet) just drop me a line on the enclosed order form.

Oh yes, to qualify as friend-of-the-family just buy a lockable disk box a $35, +2 post or a box of our new Storage Master disks (Same price of $32 plus post and now with 5 year warranty) or any order over $30 using the enclosed order form and we'll call the dollar "change" to keep the taxman happy. I'll only be giving away 500 (one per box) so if you would like to rescue your little piece of Australiana (Available only to mail order customers) better be quick. If you miss out because you're too slow I'll send you a mint uncirculated dollar coin as consolation. Scout's honour.

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COMMUNICATIONS

configuration to which you refer.

As a result, your readers could get the impression the HP is more expensive when it is not.

Russell Lea
Marketing Communications Manager
Hewlett-Packard Australia

You are correct. The sales tax inclusive price of an IBM PC with the 5 inch floppies, 256k of RAM and a green screen monitor is $6446 (as opposed to the HP150's price of $5739).

I would like to state that the error was not that of the Benchtester, but of a sub editor (who has been suitably scolded). — Ed.

Compatibility questions

I am most concerned with the implication drawn in your recent Benchtest report regarding IBM-PC compatibility of products on display at the *Australian Personal Computer* Show in Sydney.

I heartily applaud your stance regarding the many suppliers claiming compatibility. However, I am most concerned that the TeleVideo Tele-PC by implication has been ranked with the less than compatibles.

There were five Tele-PCs on display at the show, on our stand and our dealers — ADE, Arcom Pacific, Osborne Sales and The University Co-Op Bookshop. There was no excuse to miss it. All stands were *offering* standard Lotus 1-2-3 for $299 as an introductory offer and we were *demonstrating* colour output from Lotus 1-2-3 on a Tele-PC to both a three pen plotter and an 8 colour ink jet printer. Not all machines on display had the 192k memory compliment to run Lotus 1-2-3.

In surveys and tests by US PC World, Computerworld, Pacific Computer Weekly and others, the Tele-PC has always scored the highest level of compatibility.

I trust that your reviewer would be prepared to ensure that this oversight is corrected in the minds of your readers.

Brian Killin
Managing Director
Data Peripherals

Spectravideo vs BBC

OK, how much do I get to sue Spectravideo for, or do I have to take my place in the queue? Upon opening the November issue of *APC* I saw an ad on page 177 comparing the Spectravideo computer to the BBC model B. Under the assumption that companies don't place full-colour page ads in national magazines to embarrass themselves I read the ad and found Spectravideo comparing the two computers the only way they favourably could, by lying through their teeth. A few points:

1. The BBC has 32k ROM expandable to around 16 x 16k ROMs (256k) each of which may be used separately. Not 16k expandable to 64k as claimed in the ad.
2. The BBC can be expanded to 96k memory, not 32.
3. It can have, to my knowledge, at least 32 user definable functions, not 10.
4. It has a separate cartridge slot.
5. It can have sprites with the purchase of a graphics ROM.
6. The BBC has 4! F-O-U-R channels of 7 S-E-V-E-N octaves, not 1 channel of 3 octaves.
7. Spectravideo claim the BBC has 100k disk capacity. I suppose the dual 400k drives in my living room officially ceased to exist as of November? And the 1Mb hard drives available in England too? Low-profile drives ARE available.
8. Can anybody tell me what "Special word processing" is under keyboard features?

These are all mistakes from only one of the seven computers compared. Are they all as error-ridden? Would someone from Spectravideo mind replying to this letter explaining just where they got their facts from?

B Hyslop

We would like to reply to Mr Ben Hyslop's allegation.

1. BBC is only expandable to 64 ROM 4 x 16 (see paragraph 4 of BBC's own brochure).

2. Please refer to "Memory" paragraph 2 in the BBC instruction book.

3. Please refer to "Key Board" re user definable function keys.

4. The BBC M/- does not have a separate games cartridge slot, it has only cassette interface. RS 423 (RS 232C) ETC. slots. See diagram on page one. If you want to interface cartridges you must buy a separate "Cartridge ROM pack interface".

5. The BBC has definitely no sprite built into the computer. This was confirmed by BBC on June 14.

6. The BBC has only 3 music channels (NOT FOUR) see "tone generation".

As you can see either Mr Ben Hyslop does not know his computer or Barsons and BBC are short selling their own computer.

P.S. The Spectravideo does have special word processing keys "CLS/HM, copy, ins, paste, del, cut, select and print.

M Myer
Spectravideo

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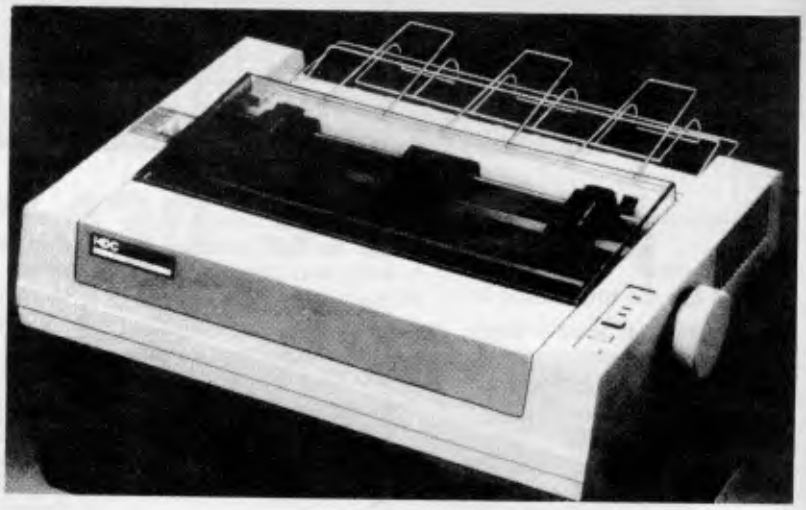

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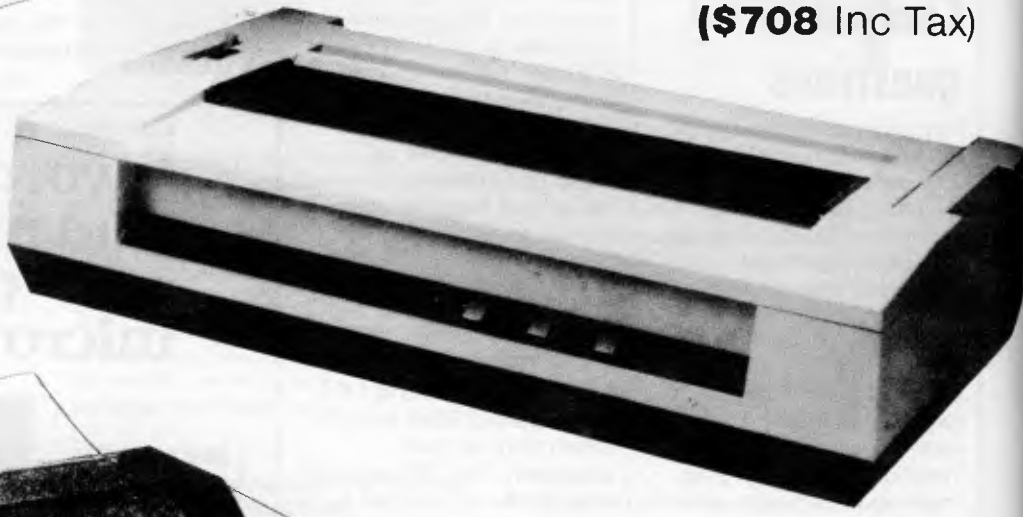

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COMMUNICATIONS

Commodore backlog

Having had two recent experiences of long delays in (warrantee) repairs, along with several unsuccessful attempts to find out information, I am hoping you will publish my complaint about the excessive time that Commodore is taking these days.

My first experience was back in October last year, when I wrote to Commodore about a new ROM chip for my 1526 printer. The reply stated that a replacement "will be supplied as soon as possible", and mentioned a delay of about 4 weeks. That was six months ago, and I have only now received the replacement ROM after my dealer went in personally.

Complaint number two concerns my 1541 disk drive, which misbehaved at the youthful age of ten weeks. It was returned by my dealer on February 24 for repairs. A letter from me and a visit from my dealer on Friday April 6 have still not discovered any trace of it.

I keep hearing rumours of a massive backload of repairs. I know of one other hapless user who had his machine in the repair shop from just after Christmas until late February.

Just what is going on at the Commodore repair shop? Why is a generally fine computer being spoiled by such frightfully inadequate service?

P Stanhope
Secr. Wollongong Users Group, NSW.

Your frustrated correspondent, raises concern (which previously we have shared) about the servicing of Commodore computers.

The overwhelming response of Australians to the Commodore 64 and the VIC 20, both of which have become the most popular computers in Australia, resulted in unfortunate delays in our servicing. But the difficulties we faced in trying to keep up with the success of our Commodores have become a matter of history rather than of current fact.

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Certainly the days of a six week delay are gone. Most serviced hardware is turned around in a matter of only a few days.

We're sorry for the inconvenience experienced by P Stanhope or any other Commodore users who faced long delays in service.

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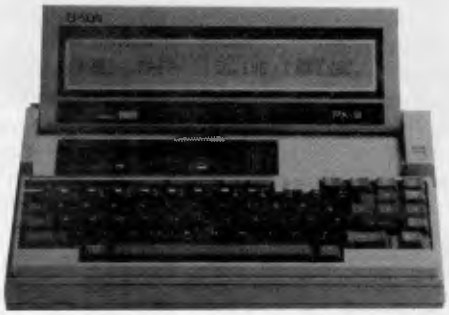

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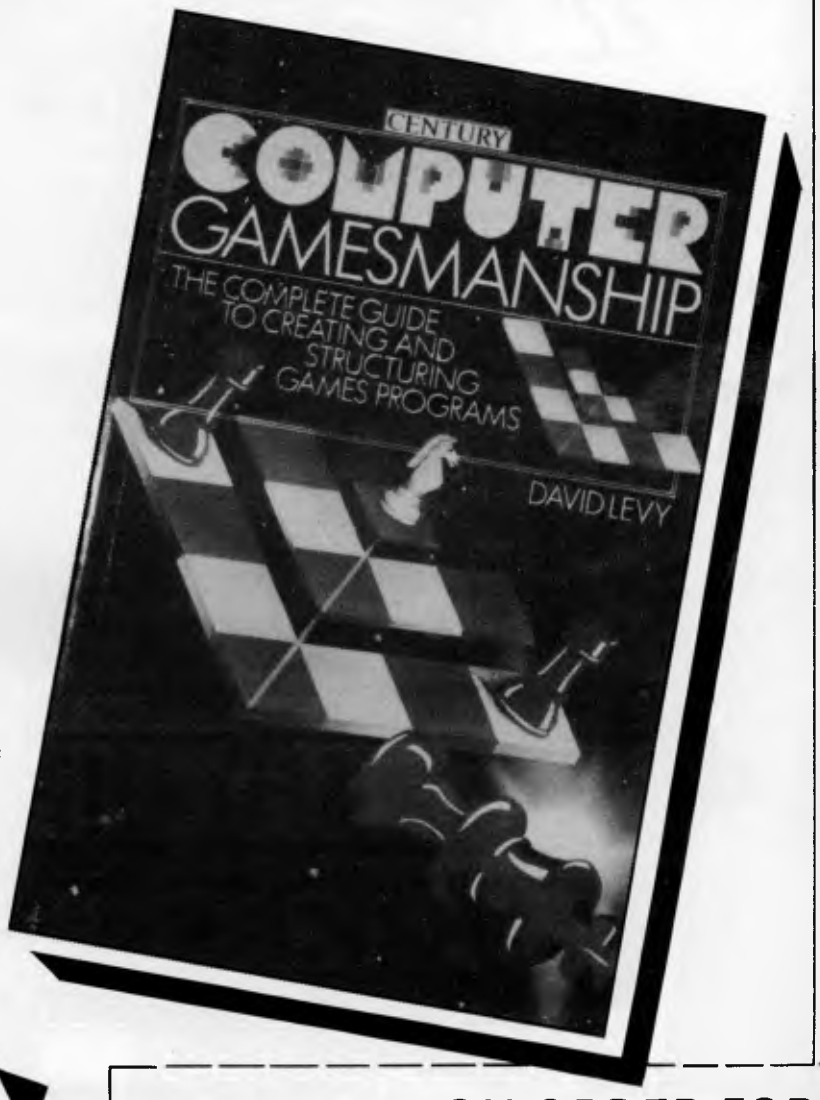

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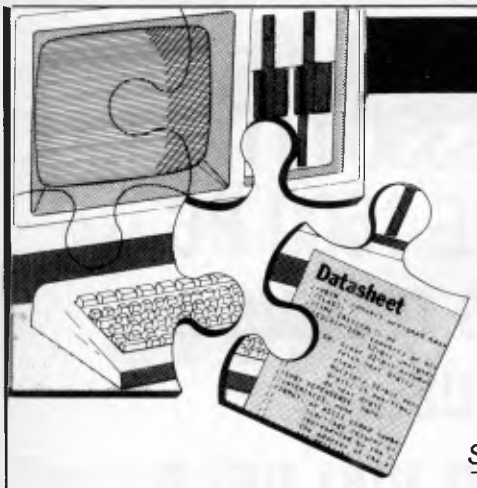

Alan Tootill and David Barrow present more useful assembler language subroutines. This is your chance to build a library of general-purpose routines, documented to the standard we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate 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, 77 Glenhuntly Road, Elwood, Vic 3184.

Relocatable code

Rois Harder thinks that machine code documentation should indicate whether or not the code is relocatable and that, if it isn't, the addresses that would need changing, on moving the code, be clearly marked.

SubSet documentation standards (last printed in full in June '83) state whether a routine is Class 1 or Class 2. Class 1 routines are re-entrant (usable by part of the program interrupting another part of the program that was using it), operate correctly wherever they are located in memory, do not alter their own instructions and return unaltered all registers and flags except those declared as being used to pass information to and from the routine. Other routines are Class 2.

All Class 1 routines are, therefore, relocatable but so are most of our Class 2 routines. No actual addresses are given in SubSet routines because it's simply not practicable to allocate memory for them to suit many readers. The only SubSet routines not relocatable are those containing jumps to absolute addresses, which are shown as YYYY in the machine code.

2040-bit conversion

LNGIBD is part of a 'family' of large number routines with a consistent interfacing protocol written by Andrew Stephenson. The 'LNGxxx' family includes 'clear', 'copy', 'add', subtract', 'multiply', 'ASCII decimal to binary' and 'binary to ASCII decimal' — LNGIBD.

The action of LNGIBD is interesting. Instead of left-shifting the binary value to get the next bit — as most conversion routines do — it sets up a bit mask. The mask is rotated right every iteration to cover the next bit for processing. When it wraps around to cover bit 7, the next byte down is indexed. The entire binary value is processed bit by bit, without being disturbed — a far quicker method than a 255-byte shift.

The conversion is done in two stages. The first stage produces an intermediate result which is *unpacked* BCD — one decimal digit per byte — stored 'lo-digit-lo-address'. This is the normal order of storing binary values in the 8080/Z80 processor family. In the second stage, the order of the digits is reversed and, at the same time, the ASCII hi-nibble for decimal digits is added. The end result is a normally ordered ASCII string.

LNGIBD is written to convert to ASCII decimal but will convert to any base 2 to 10 by changing the variable 'BASE'. It can be altered to convert to any base 2 to 36 (using letters up to Z for these new digits) by substituting CALL BASASC for each of the occurrences of OR 30H at eight and five lines from the end. BASASC is an 8-byte subroutine tacked onto the end.

Andrew's interfacing protocol does not include returning the addresses in the registers used for input. HL and DE both point to the middle of the ASCII string on exit so you will need to save the addresses used before calling LNGIBD.

```
BASASC:  ADD  A,30H  ;add ASCII decimal high   C6 30
         CP   3AH    ;nibble and test if 0 to 9, FE 3A
         RET  C      ;exiting if ok, else      D8
         ADD  A,7    ;step up to ASCII letters C6 07
         RET         ;and exit                 C9
```

DATASHEET

```
;* LNGIBD - Long Integer Binary to Decimal conversion.
;/ CLASS:  2 (registers not saved, direct addressing used).
;/ TIME CRITICAL:  No.
;/ DESCRIPTION:  Converts a binary integer, stored in-byte-
;/               lo-address to ASCII decimal string stored
;/               hi-digit-lo-address in different storage area.
;/ ACTION:   IF value = 0 THEN write "0" and end.
;/             ELSE index most significant bit of MSByte
;/               FOR each bit of binary value
;/                 Set Carry if bit set
;/                 FOR each digit of intermediate result
;/                   Double digit adding in Carry
;/                   IF digit < 10 THEN clear Carry
;/                     ELSE subtract 10 and set Carry
;/                 NEXT digit
;/                 IF overflow from partial result THEN form
;/                   new high order digit = 1
;/               NEXT bit
;/               Reverse digit sequence, add ASCII hi-nibbles.
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  Binary value in RAM or ROM.
;/              Output area in RAM. 2-byte storage in RAM.
;/ INPUT:    BVAL = address of 1st byte of binary value.
;/           DVAL = address of 1st byte of output area
;/           (output area = 2.42 * binary byte length + 1)
;/           HL = BVAL, DE = DVAL, A = binary byte length (1 to 255)
;/ OUTPUT:   ASCII decimal string at DVAL with null terminator (0)
;/ REGs USED:  AF BC DE HL
;/ STACK USE:  2
;/ LENGTH:  code: 114   temporary storage: 2
;/ PROCESSOR:  8080/8085/Z80
;
BASE    EQU  10         ;conversion base (decimal)
```

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```
VPTR:   DEFW 0          ;temporary storage space.       ?? ??
LNGTHD: LD   C,A        ;byte length as 16-bit value    4F
        LD   B,0        ;in BC for adding to pointer.   06 00
        DEC  HL         ;DVAL - 1 for indexing and      2B
        LD   (VPTR),HL  ;save for use in main loop.     22 YY YY
        LD   A,0FFH     ;mark temporary end of          3E FF
        LD   (DE),A     ;decimal output area.           12
;find most significant byte. Else deal with zero value.
        ADD  HL,BC      ;index binary highest byte.     09
NXTMSB: LD   A,(HL)     ;loop: get byte and test for    7E
        OR   A          ;zero, exit loop when           B7
        JP   NZ,MSBFND  ;MSByte found, with C as        C2 YY YY
        DEC  HL         ;no. of significant bytes       2B
        DEC  C          ;and HL pointer to hi-byte,     0D
        JP   NZ,NXTMSB  ;or all bytes zero so           C2 YY YY
        EX   DE,HL      ;index DVAL and put             EB
        LD   (HL),'0'   ;default ASCII 0                36 30
        INC  HL         ;followed by                    23
        LD   (HL),0     ;null terminator                36 00
        RET             ;then exit.                     C9
;find most significant bit, initialise bit-select mask.
MSBFND: LD   B,A        ;MSByte to B for comparison.    47
        LD   A,80H      ;start bitmask.                 3E 80
NXTBSK: CP   B          ;loop: shift bit down           B8
        JP   C,MSKFND   ;until in same place            DA YY YY
        JP   Z,MSKFND   ;as highest set bit in          CA YY YY
        RRCA            ;MSByte, covering most          0F
        JP   NXTBSK     ;significant bit.               C3 YY YY
;main loop. Get next bit into intermediate decimal result.
MSKFND: LD   B,A        ;B = bitmask, C = byte index    47
        PUSH BC         ;save both on stack.            C5
        LD   HL,(VPTR)  ;get DVAL - 1 and add           2A YY YY
        LD   B,0        ;current byte index to          06 00
        ADD  HL,BC      ;address current byte.          09
        AND  (HL)       ;get current bit, masking out   A6
        ADD  A,0FFH     ;others, propagate to Carry.    C6 FF
;partial result * 2 + current bit. Adjust each byte using
;Couleur's criterion to one BCD digit per byte.
        LD   L,E        ;move DVAL to HL.               6B
        LD   H,D        ;                               62
NXTOPV: LD   A,(HL)     ;loop: get intermediate         7E
        INC  A          ;result byte, test for end      3C
        JP   Z,OPVDON   ;mark (0FFH), exit if found     CA YY YY
        DEC  A          ;else correct back and double   3D
        ADC  A,A        ;it, adding in current bit.     8F
        CP   BASE       ;skip if digit is valid         FE 0A
        JP   C,NOCOUL   ;else make it valid and have    DA YY YY
        SUB  BASE       ;a carry over to next digit.    D6 0A
NOCOUL: CCF             ;correct state of Carry.        3F
        LD   (HL),A     ;store digit and repeat until   77
        INC  HL         ;end of current partial         23
        JP   NXTOPV     ;result reached.                C3 YY YY
OPVDON: JP   NC,EXTDON  ;skip if no result overflow     D2 YY YY
        LD   (HL),1     ;else new high digit can        36 01
        INC  HL         ;only be 1. Point to next       23
        LD   (HL),0FFH  ;byte and put new end mark.     36 FF
;rotate bitmask to cover next bit, next byte if necessary.
EXTDON: POP  BC         ;restore mask and byte index    C1
        LD   A,B        ;move mask to A and shift set   78
        RRCA            ;bit down. If not in bit 7      0F
        JP   NC,MSKFND  ;then loop for next bit         D2 YY YY
        DEC  C          ;else index next byte and       0D
        JP   NZ,MSKFND  ;loop if not finished.          C2 YY YY
;reverse digit order and add ASCII digit hi-nibbles.
        LD   (HL),0     ;terminator replaces end mark.  36 00
NXTCNV: DEC  HL         ;decrement high pointer and     2B
        LD   A,L        ;test if hi-pointer and         7D
        SUB  E          ;lo-pointer have passed each    93
        LD   A,H        ;other yet, setting Carry if    7C
        SBC  A,D        ;they have, exit conversion     9A
        RET  C          ;complete if they have.         D8
        LD   A,(DE)     ;else pick up lower digit       1A
        OR   30H        ;convert it to ASCII and        F6 30
        LD   B,A        ;save in B while                47
        LD   A,(HL)     ;getting higher digit           7E
        OR   30H        ;converted to ASCII.            F6 30
        LD   (HL),B     ;replace ASCII digits in        70
        LD   (DE),A     ;reverse order.                 12
        INC  DE         ;move lower pointer up 1        13
        JP   NXTCNV     ;and repeat until all done.     C3 YY YY
```

6809 random numbers

A perennially recurring subject is that of pseudo-random numbers.

The conclusion drawn in SubSet was that a 16-bit generator based on the algorithm, or series $R_{(i+1)} = (1509R_i + 41) \bmod 2^{16}$ and a 32-bit generator based on $R_{i+1} = (69069_i + 41) \bmod 2^{32}$ would produce sequences that ought to satisfy all but the absolute perfectionist.

Z80 implementations of these generators, by Kevin Smith and John Kerr, were published in SubSet, March 1983. RAND16 and RAND32 are versions written for the 6809 by Dr Paul Beale.

DATASHEET

```
;= RAND16 - 16-bit pseudo-random number generator.
;/ CLASS:  1.
;/ TIME CRITICAL:  No.
;/ DESCRIPTION:  Generates a 16-bit number from the series
;/               R = (1509 * R + 41) mod 2**16
;/ ACTION:   1509 = 5 * 256 + 229
;/           R-temp := (41 + 229 * R) mod 2**16
;/           R := (R-temp + 5 * 256 * R) mod 2**16
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  Stack RAM.
;/ INPUT:    Seed or previous random number in user stack
;/           U:U+1 = RAND.
;/ OUTPUT:   New RAND in U:U+1.
;/ REGs USED:  U.
;/ STACK USE: Hardware stack (S): 3.  User stack (U): 2.
;/ LENGTH:   37.
;/ TIME STATES:  116.
;/ PROCESSOR:  6809.

RAND16: PSHS A,B,CC     ;save registers and flags.      34 07
        LDA  1,U        ;get RAND low order byte,       A6 41
        LDB  #$E5       ;multiply it by 229             C6 E5
        MUL             ;and                            3D
        ADDD #$29       ;add 41 and store in user       C3 00 29
        STD  ,--U       ;stack as accumulator.          ED C3
        LDA  2,U        ;multiply RAND high order       A6 42
        LDB  #$E5       ;byte by 229, add product       C6 E5
        MUL             ;to high byte                   3D
        ADDB ,U         ;of accumulator.                EB C4
        STB  ,U         ;'R-temp' now complete.         E7 C4
        LDA  3,U        ;get RAND low order byte,       A6 43
        LDB  #5         ;multiply it by 5, add it       C6 05
        MUL             ;not to 'R-temp' lo-byte but    3D
        ADDB ,U         ;to 'R-temp' hi-byte for        EB C4
        STB  ,U         ;'* 256' by single byte shift.  E7 C4
        LDD  ,U++       ;replace old RAND by new        EC C1
        STD  ,U         ;RAND, correcting user stack.   ED C4
        PULS A,B,CC     ;restore registers from         35 07
        RTS             ;system stack and return.       39
```

DATASHEET

```
;= RAND32 - 32-bit pseudo-random number generator.
;/ CLASS:  1.
```

```
;/ TIME CRITICAL:  No.
;/ DESCRIPTION:  Generates a 32-bit number from the series
;/               R = (69069 * R + 41) mod 2**32
;/ ACTION:   69069 = 65536 + 13 * 256 + 205
;/           R-temp := (41 + 205 * R + 13 * 256 * R) mod 2**32
;/           R := (R-temp + 65536 * R) mod 2**32
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  Stack RAM.
;/ INPUT:    Seed or previous random number in user stack
;/           U:U+1:U+2:U+3 = RAND.
;/ OUTPUT:   New RAND in U:U+1:U+2:U+3.
;/ REGs USED:  U.
;/ STACK USE: Hardware stack (S): 7.  User stack (U): 5.
;/ LENGTH:  59.
;/ TIME STATES:  322.
;/ PROCESSOR:  6809.

RAND32: PSHS A,B,X,Y,CC ;save registers and flags.      34 37
        CLR  -3,U       ;clear part of accumulator at   6F 5D
        CLR  -4,U       ;U-5 to U-1 and initially       6F 5C
        LEAX -2,U       ;index it by X at low 2-bytes.  30 5E
        LDA  5,X        ;get RAND lowest byte,          A6 05
        LDB  #$CD       ;multiply it by 205             C6 CD
        MUL             ;and                            3D
        ADDD #$29       ;add 41 and store in low        C3 00 29
        STD  ,X         ;2-bytes of accumulator.        ED 84
        LDY  #3         ;count 3 remaining bytes.       10 8E0003
LOOP:   LEAX -1,X       ;address next byte.             30 1F
        LDA  5,X        ;multiply RAND current byte     A6 05
        LDB  #$CD       ;by 205 and add to              C6 CD
        MUL             ;correct position in            3D
        ADDD ,X         ;accumulator.                   E3 84
        STD  ,X         ;                               ED 84
        LDA  6,X        ;multiply next lower byte by    A6 06
        LDB  #$0D       ;13 and add to accumulator      C6 0D
        MUL             ;at one byte higher up for      3D
        ADDD ,X         ;'* 256' by single byte shift.  E3 84
        STD  ,X         ;                               ED 84
        LEAY -1,Y       ;on exit from loop              31 3F
        BNE  LOOP       ;'R-temp' is complete.          26 E8
        LDD  2,U        ;'* 65536' done by double       EC 42
        ADDD -4,U       ;byte shift, add to 'R-temp'    E3 5C
        STD  ,U         ;replace old RAND               ED C4
        LDD  -2,U       ;by new RAND from               EC 5E
        STD  2,U        ;accumulator.                   ED 42
        PULS A,B,X,Y,CC ;restore registers from         35 37
        RTS             ;system stack and return.       39
```

'At last! A keyboard for the two-fingered typist!'

EXPERT SYSTEMS

Expert-Ease

Expert Systems have been successfully used in diagnostic medicine. They also have much to offer businesses but installation time and costs are often prohibitive factors. Expert-Ease is designed to enable even the most inexperienced user to create his own 'intelligent' model. Surya reports.

Artificial intelligence (AI) has long been considered solely the domain of computer scientists, but with the introduction of expert systems, AI could at last make its mark on non-specialist users. Expert-Ease is an expert systems generator which enables people with little or no programming experience to create and interrogate expert models.

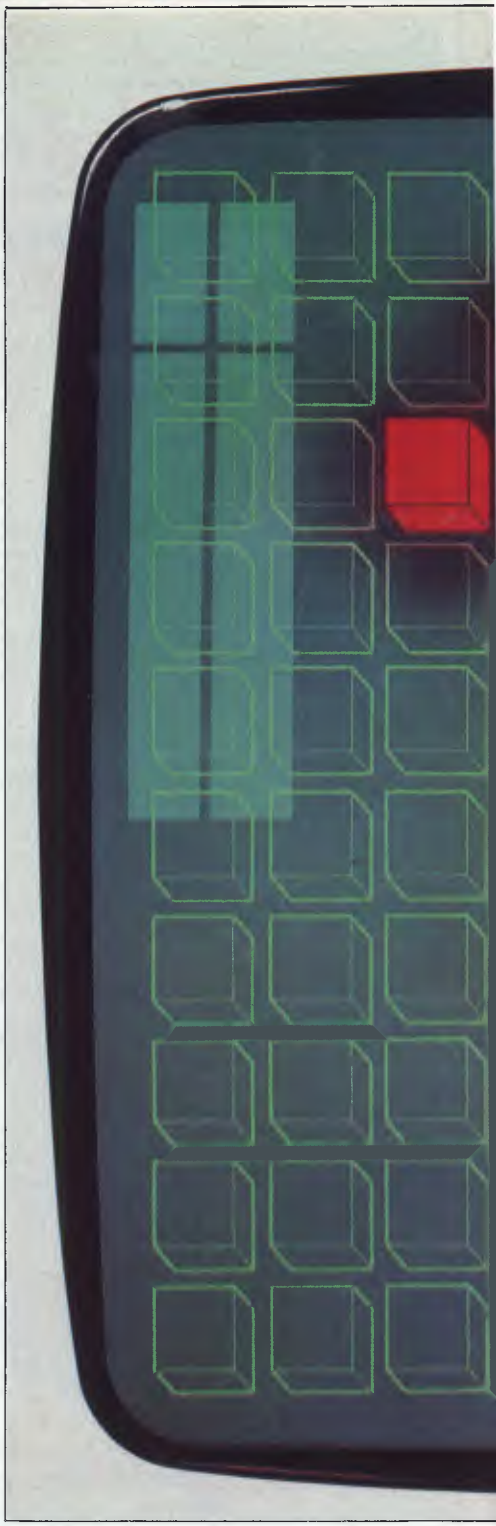
The term 'artificial intelligence' conjures up a variety of images, from programs which play chess to the HAL of Arthur C Clarke's *2001*. To date the most practical application of research into AI has been the development of computerised 'models' of intelligent thought: expert systems.

Theory and practice

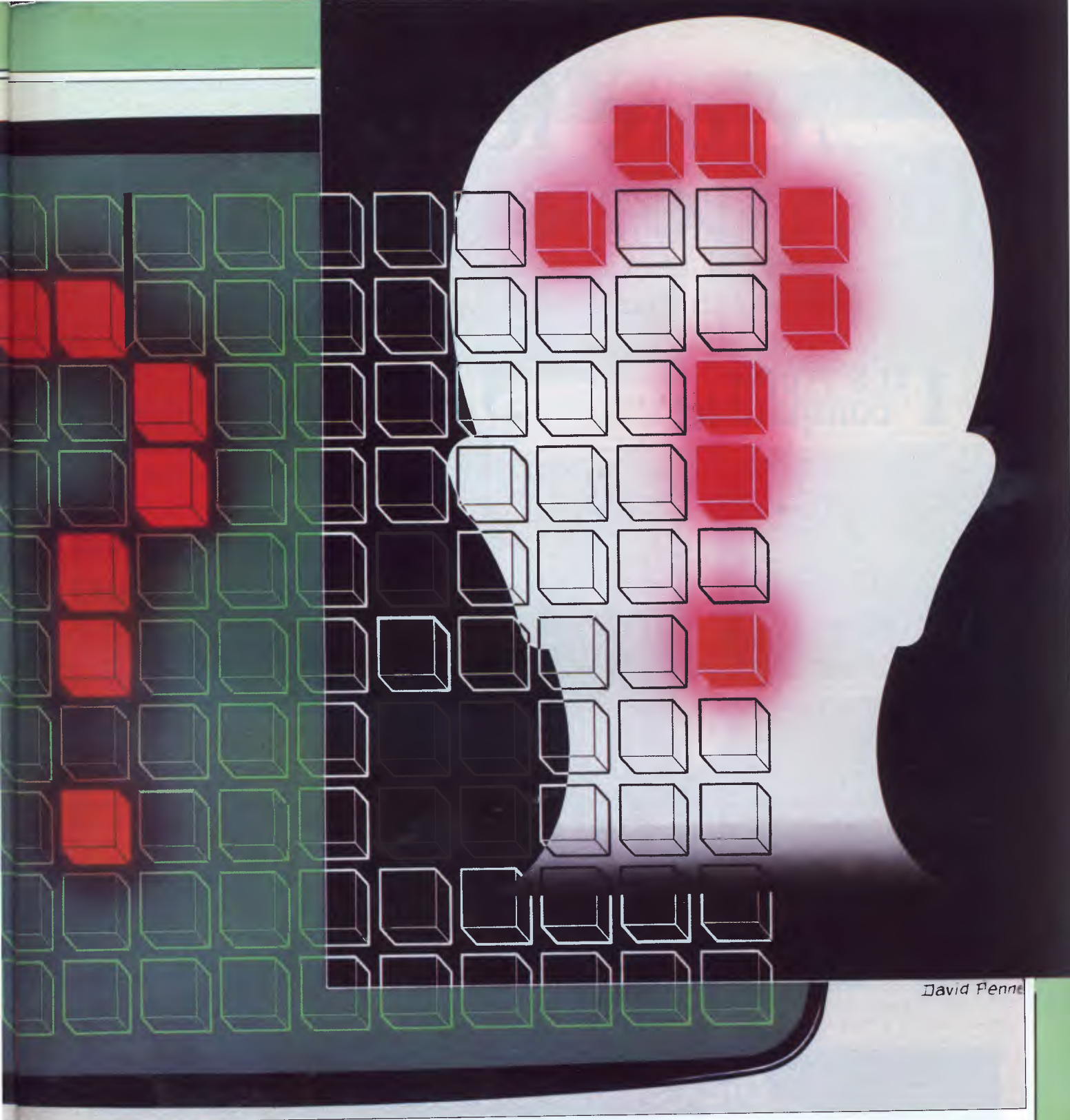
Expert systems are based on the principle that an expert is simply a person who has access to specialised knowledge, and can apply this knowledge using a set of logical rules. Given both the knowledge and the rules, a computer is capable of modelling the thought processes of the expert. To see how this might work in practice, let's take the example of a motor mechanic.

A mechanic, faced with a faulty car, looks first of all at the observable symptoms. These might range from no response when engaging the ignition, to a slight tapping sound at high speeds. Based on these symptoms, the mechanic will immediately be able to narrow down the range of possible problems. If there is no response when the ignition key is turned, then the problem obviously lies in the electrical system. The mechanic would then carry out various tests (checking electrical connections, battery level, and so on), until the problem is identified.

To someone who knows nothing about motor mechanics, the process of identifying and correcting a fault might seem the result of inspired guesswork. In reality, of course, the mechanic simply observes, tests and makes deductions by using a set of specialised knowledge (with perhaps a touch of inspired guesswork!). Someone with little or no knowledge of mechanics is quite capable of carrying out the tests and observations; they just need the expert mechanic to tell them which tests to make — and to draw conclusions from the results. The basis of an expert system is to take this reasoning one stage further: the mechanic becomes superfluous and only the mechanical expertise is required.



On its simplest level, an expert system simply presents the user with a set of questions and uses the answers to indicate likely solutions. This in itself is nothing new; there have been books available for years based on this principle — not least for DIY emergency car repairs! You work through a checklist and — depending on the results of the tests to be executed — are referred to a page or section which reveals the likely problems and how to correct them. A com-



puterised version of this process is easy to write, even in Basic. But a true expert system does more than simply store a set of information and rules for manipulating them; it should act 'intelligently', both when accepting the information and rules, and when interrogated by the end user. It is the degree of 'intelligence' an expert system can demonstrate that determines its usefulness.

The beauty of an expert system is that someone's expertise can be made available as required without the need for the expert to be present. This is invaluable when a specialist's time may cost several hundred dollars per day. But true expert systems take time to write, and are costly, requiring the services of a skilled programmer. This is what prompted Export Software International to produce Expert-Ease.

Expert-Ease allows a user to create and interrogate expert systems or 'models' easily and without programming skills. At present it runs on the IBM PC and the Sirius in 128k minimum RAM.

Based around a 'spreadsheet', it provides an easy — if a little tedious — method of creating an expert system.

APC created a simple model to identify the language in which a piece of text is written by presenting the user with a series of questions, primarily concerning the type of accents in evidence. I'll begin

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by describing the way in which our model would look to the user, then go on to examine the process of creating it.

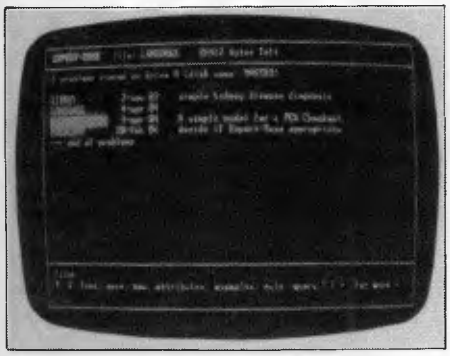


Fig 1 Filer screen showing disk directory

Running an Expert-Ease model

To run Expert-Ease, the main disk is placed in the left-hand drive. This disk contains MS-DOS system tracks, the program itself and three demonstration files. The disk takes one minute and 20 seconds to boot and load Expert-Ease, during which time the software licence number, copyright notice and disclaimer are displayed. The last recorded date is then displayed, and you can either press <CR> to leave it as it is, or enter a new date. This is to allow date stamping of files.

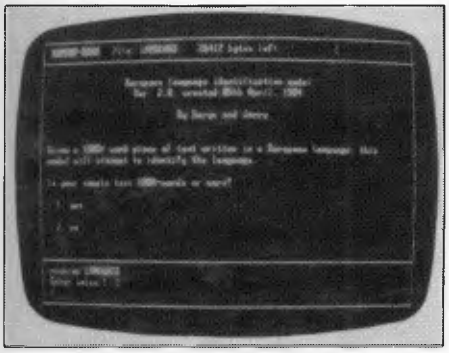


Fig 2 First screen of language-identification model

Expert-Ease is based around five screens: filer, query, attribute, example and rule; all of which are divided into three areas. The top status line always displays the name of the currently loaded model and the amount of free RAM. The main area of the screen consists of seventeen lines of work-space, and the bottom three lines show the title of the screen, a menu of valid single-key commands and a prompt line. After entering the date, you are taken into the filer screen.

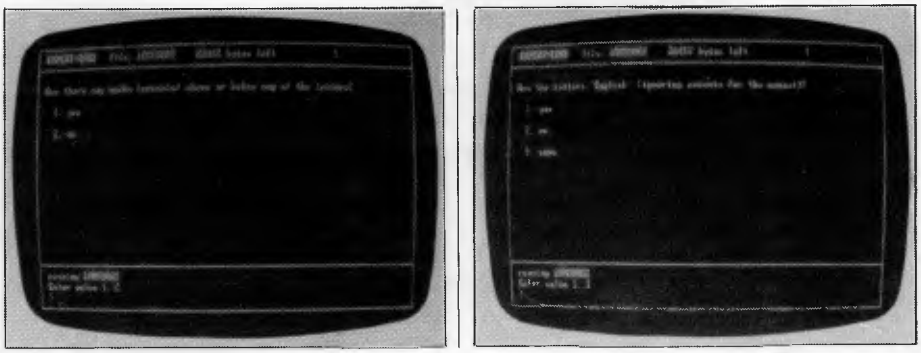
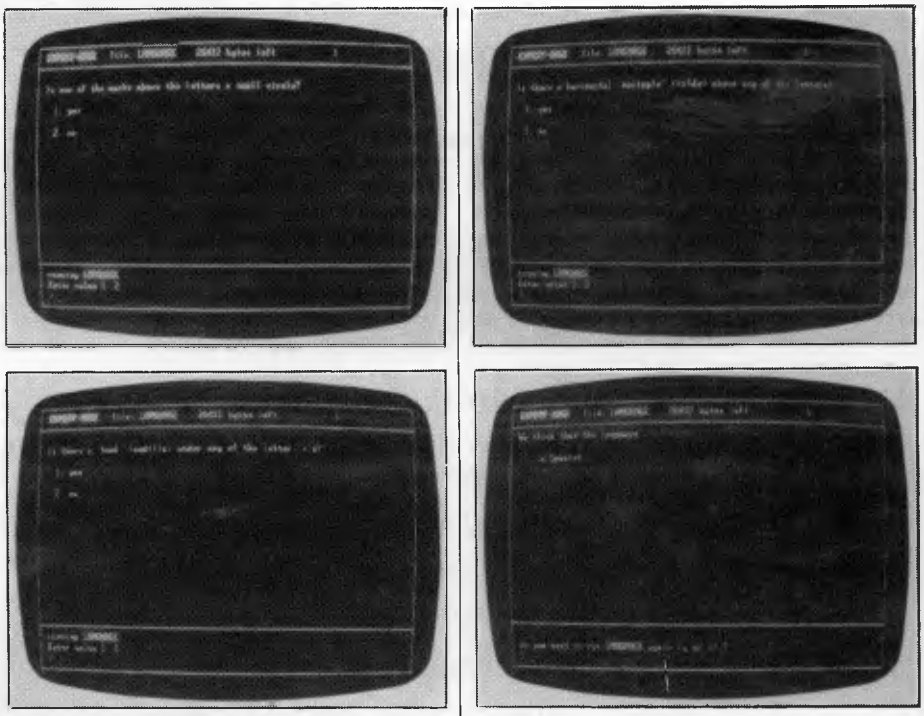


Fig 3 The series of questions shown in the screenshots above and below illustrate the way in which a language is identified using Expert-Ease



The filer screen displays the models present on the currently logged disk, the currently loaded model, the amount of free RAM and the file menu (see Fig 1). Each model is displayed by its title (standard MS-DOS, one to eight characters without an extension), the date the file was created or last updated and an optional 1-47 character description. The first file is highlighted. To move the highlight up or down a file, the cursor control keys are used. Once you have highlighted the model you want to work on, '1' loads the model. When the model has been loaded, <q>uery interrogates the model. After unnecessarily asking 'Do you want to run <filename> (y or n)?', Expert-Ease clears the screen and displays the first question in the model.

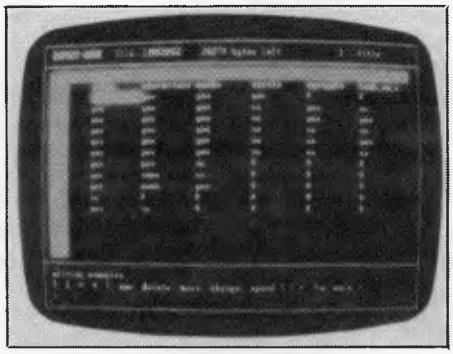


Fig 4 Attribute screen is created first

In the case of our language identification model, the first question is: 'Is the sample text 1000-words or more? (see Fig 2). If the answer is no, nothing else matters since the sample text is not large enough to allow accurate identification. The model therefore jumps to the 'no-can-do' screen. If the answer is 'yes', the model proceeds to the next question:

```
EXPERT-EASE Attribute Listing, Problem: LANGUAGE    Date:  4-apr-84
title      :                European language identification model
                                Ver. 2.0, created 05th April, 1984
                                          By Surya and Jerry
            Given a 1000+ word piece of text written in a European language, this
            model will attempt to identify the language.
            Is your sample text 1000-words or more?
     yes       :
     no        :

characters : Are the letters 'English' (ignoring accents for the moment)?
     yes       :
     no        :
     some      :

marks      : Are there any marks (accents) above or below any of the letters?
     yes       :
     no        :

circle     : Is one of the marks above the letters a small circle?
     yes       :
     no        :

squiggle   : Is there a horizontal 'squiggle' (tilde) above any of the letters?
     yes       :
     no        :

hook_on_c  : Is there a 'hook' (cedilla) under any of the letter 'c's?
     yes       :
     no        :

capitals   : Does there seem to be a large number of capital letters in mid-sentence?
     yes       :
     no        :

slope_down :
     yes       :
     no        :

conclusion : We think that the language ...
     scandanavi : ... is Scandanavian (Norwegian or Swedish)
     spanish    : ... is Spanish
     portuguese : ... is Portuguese
     german     : ... is German
     french     : ... is French
     italian    : ... is Italian
     english    : ... is English, you illiterate wally
     greek      : ... is Greek to me, guv
     russian    : ... is Russian
     no_can_do  : ... cannot be accurately identified from the sample text available.
                  If you'd like to try anyway, press 'y' to run again and answer 'yes' to
                  the first question.  Please note, however, that the conclusion reached by
                  this system may not be accurate with a small sample of text.
     not europe : ... is not a European language
```

Printout 1

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4. PCDOS 2.0 operating system

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```
EXPERT-EASE Rule Listing, Problem: LANGUAGE      Date:  4-apr-84

title
       yes : characters
             yes : marks
                   yes : circle
                         yes : scandanavi
                          no : squiggle
                               yes : hook_on_c
                                     yes : portuguese
                                      no : spanish
                                no : hook_on_c
                                     yes : french
                                      no : capitals
                                           yes : german
                                            no : italian
                          no : english
                    no : null
                  some : marks
                         yes : russian
                          no : greek
              no : no_can_do
```

Printout 2

'Are the letters "English" (ignoring accents for the moment)?'. The options are yes, no and some. Again, if the answer is 'no', we need go no further since the language is obviously not European. Fig 3 illustrates the way in which a language is identified.

To create an Expert-Ease model, the user must first of all create the 'attribute' screen. This defines the different questions to be presented to the user, the text that will be displayed on the screen and the options available. In our language model, the attributable screen looks like Fig 4.

Expert-Ease allows this to be dumped to a printer, with or without the text (see Printout 1).

Creating the attribute screen is straightforward using the spreadsheet-style format. The attributable screen merely defines the different sections of the model. Once this has been done, 'e' selects the <e>xample screen.

If we were writing an expert system in a high level language, the most obvious approach would be to work out a flow-chart for the system. While anybody who is able to program will be quite at home with flow-charts (even if they never use them!),non-programmers might find them a little daunting. For this reason, Expert-Ease doesn't ask the user to work out the logic of the model, but only to show it by example. Hence the example screen.

On the Printout of the example screen for the language model, you can see how the logic is built up. Under each heading, we have entered yes, no or asterisk (the 'don't care' symbol). Under title (the title screen containing the '1000-word+' question), we need look no further if the user does not have a large enough sample. So this 'route' comprises 'no' in this column, and asterisks under the rest leading to a 'no-can-do' message. To identify a Scandinavian language, the model needs to check as far as the 'circle' question ('Is one of the marks above the letters a small circle?') On Printout 3 you can see how each language is similarly identified.

So far, Expert-Ease has not done anything particularly clever. The clever bit comes next. Using the data you have entered in the example screen, Expert-Ease will attempt to 'induce' the logic behind the data. Induction is called by pressing '!' from the example screen.

The induction routine is known as the Analogue Concept Learning System. It was developed as a stand-alone routine and correlates the example data to produce a 'rule' (flow-chart):

If the example data is inconsistent (two or more paths leading to the same

```
EXPERT-EASE Example Listing, Problem: LANGUAGE     Date:  4-apr-84

    title      characters marks      circle     squiggle   hook_on_c  capitals   slope_down conclusion
    logical    logical    logical    logical    logical    logical    logical    logical    logical
    -------    -------    -------    -------    -------    -------    -------    -------    -------
 1  yes        yes        yes        yes        *          *          *          *          scandanavi
 2  yes        yes        yes        no         yes        no         no         no         spanish
 3  yes        yes        yes        no         yes        yes        no         no         portuguese
 4  yes        yes        yes        no         no         no         yes        no         german
 5  yes        yes        yes        no         no         yes        no         no         french
 6  yes        yes        yes        no         no         no         no         yes        italian
 7  yes        yes        no         *          *          *          *          *          english
 8  yes        some       no         *          *          *          *          *          greek
 9  yes        some       yes        *          *          *          *          *          russian
10  no         *          *          *          *          *          *          *          no_can_do
11  yes        no         *          *          *          *          *          *          not_europe
```

Printout 3

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LIBRARY, STUDENTS, TIMETABLES, SCORES, BOOKS, BORROWERS, PAPERS, AUTHORS, REFERENCES, LECTURES, FORMULAE

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conclusion) or ambiguous (insufficient data), a rule is formed and a message displayed to the effect that, for instance, 'examples 4 6 9 contradict the rule'. Once a rule has been formed, with or without contradictions, it can be displayed or printed as in Printout 2. Using this printout, it is a simple matter to see where the contradictions and/or omissions lie and to edit, or add to, the example data. When a rule is induced without contradictions, the model is ready to be interrogated.

The accuracy of a model obviously depends on the accuracy of the example data, but equally important is that the text presented to the user is comprehensible and unambiguous. This can be effectively tested only by 'field-testing' the model on inexpert users and modifying it in the light of their comments. If this is done, the models produced are extremely easy to use even by someone who has never used a computer.

Documentation

The documentation received with the review copy was inadequate — considering the package costs about $2300. Supplier Export Software International (ESI) claims the documentation has since been improved and will be supplied to all purchasers as soon as it has been printed.

The existing documentation takes the form of a tutorial. It is clear and easy to follow: with plenty of screendumps to show exactly what the screen should look like at each stage. Without an index, though, it is absolutely useless as a reference manual; I found it quicker to learn by trial-and-error than to look things up in the manual.

Sirius version

This review was carried out on a pre-release version running on the Sirius. Unlike the IBM version, the Sirius implementation did not have proper screen-addressing. Because of this, there were no scrolling facilities: the entire screen was re-written whenever it was necessary to move the current 'window'. This made the package very slow.

The Sirius is notorious for having powerful screen-handling facilities that nobody understands! ESI says it is working on proper screen-handling for the release Sirius implementation.

Conclusions

Expert-Ease is not cheap. At $2350, it costs more than half as much as the machines it runs on. But expert information is expensive. Specialists in many fields may charge $500, $1,000 or even more per day for their services. And, in many cases, an expert system could replace the expert to a significant extent — perhaps needing the expert only for a few days instead of a fortnight.

There are, of course, areas where an expert system cannot be used: for example, when subjective decisions are required, or when the decisions are too important to be entrusted to a computer! But in many areas where an expert system is appropriate, Expert-Ease represents a convenient and cost-effective means by which to generate them.

Expert-Ease will not be available in Australia for about another month (from the time of publication of this issue), so if you're interested in purchasing the product immediately you can ring ESI directly in Scotland on 0011 44 31 556 3266. The price of Expert-Ease in Britain is £1,480 which translates to $2,350 at the present rates of exchange. We have been assured that we will be advised of the Australian distributor within a month and therefore hope to publish details in the next issue.

NUMBERS COUNT

Quotients

This month Mike Mudge examines the quotients of Fermat and Wilson.

Notation

We write $A \equiv B \pmod{C}$, read as A is congruent to B modulo C, if A and B leave the same remainder when divided by C. For example, $16 \equiv 21 \pmod{5}$, $64 \equiv 0 \pmod{16}$.

The Fermat Quotient

A famous theorem in classical number theory, Fermat's Little Theorem states that if p is prime and does not divide a, then $a^{p-1} \equiv 1 \pmod{p}$. The number $F_p = \frac{a^{p-1}-1}{p}$ is Fermat's Quotient.

Computations by Fröberg for $a=2$ and p less than 5000 have revealed only two solutions, $p=1093$ and $p=3511$, to the equation $F_p \equiv 0 \pmod{p}$. It is still an open question whether any more solutions exist for $a=2$ with p greater than 5000, and the nature of any solutions for $2<a\leq 31$; this range being relevant to the proof of Fermat's Last Theorem.

The Wilson Quotient

A well-known theorem by Wilson states that if p is prime, then $(p-1)! = -1 \pmod{p}$. The number $W_p = \frac{(p-1)!+1}{p}$ is known as Wilson's Quotient.

Computations by Fröberg for $3 \leq p \leq 50000$ have revealed only three solutions, $p=5$, $p=13$ and $p=563$, to the equation $W_p \equiv 0 \pmod{p}$. It is theoretically probable that there are more solutions to this equation.

Large tables of $W_p \pmod{p}$ would be useful in empirical number theory. At the present time, only two small tables are known: p less300, and p less than or equal to 211, due to NGWH Berger (1920) and ET Lehmur (1937).

Readers are invited to reproduce the results given above, and to extend them in any natural way. Submissions should include program listings, hardware description, run time and output, and will be judged for accuracy, originality and efficiency (not necessarily in that order). A prize will be awarded to the 'best' entry received by 1 August 1984. Please address to Mr MR Mudge, *C/- APC*, 77 Glenhuntly Road, Elwood, Victoria 3184.

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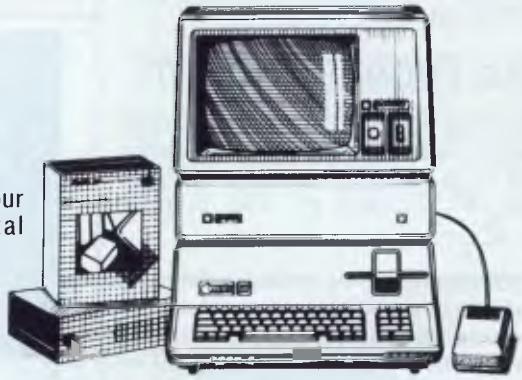

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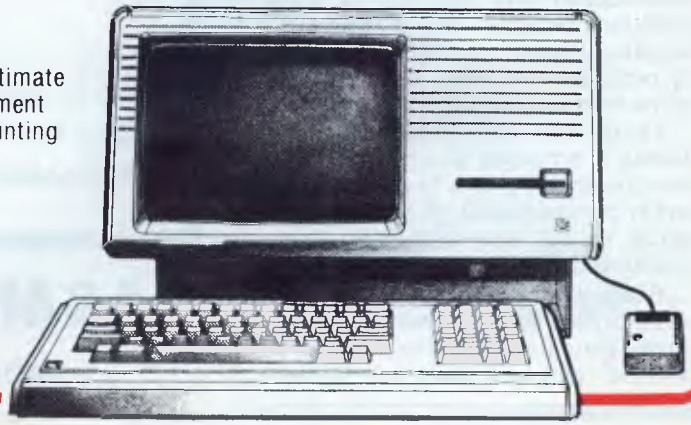

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CP/M access

Programs written for one CP/M machine should run without modification on another, or at least that's the theory. Richard Moffat explains how to call CP/M functions from within your own machine code programs.

There are several reasons why it can be a good thing to persevere with writing programs using CP/M, and not the routines hidden deep within the ROM in your machine. The first major advantage of accessing files on disk is easier — for example, how many times have you erased a file only to discover that you have deleted the wrong one? I'm sure nearly everyone has done this at some stage, and if you don't have a back-up of the file it can be very annoying. However, if you know a little about how CP/M stores files in the directory, you don't need to spend a lot of money on a utility to recover 'lost' files, as you can write one yourself in under 20 minutes.

Once you have mastered file access there is a whole suite of programs waiting to be written, only bounded in complexity by your imagination and available time.

Another significant advantage of using as many CP/M functions as possible instead of CALLs to ROM routines is that your program will become much more portable. As an example, one of my early machine code programs used no CP/M functions at all, even though its purpose was to copy files from one disk to another. To run this program on another micro using CP/M would require several days conversion because of the non-standard way in which the disk access had been written. More recently, I wrote a much more powerful utility to perform a similar function which I'm confident could run on any CP/M machine within a couple of hours. Therefore, if you want to write any software that you hope to market, write it using CP/M functions wherever possible.

Problems

My first attempts at using CP/M functions from within my own machine code programs were fraught with problems. The only information I had to work from was provided in Digital Research's *CP/M Interfacing Guide*, which is far from ideal as an introduction. Nearly all my first programs failed and I must have cursed the creator of CP/M more times than I care to mention. Part of the problem was due to my tendency to use the instruction manual only as a last resort, but I've certainly learnt from my mistakes.

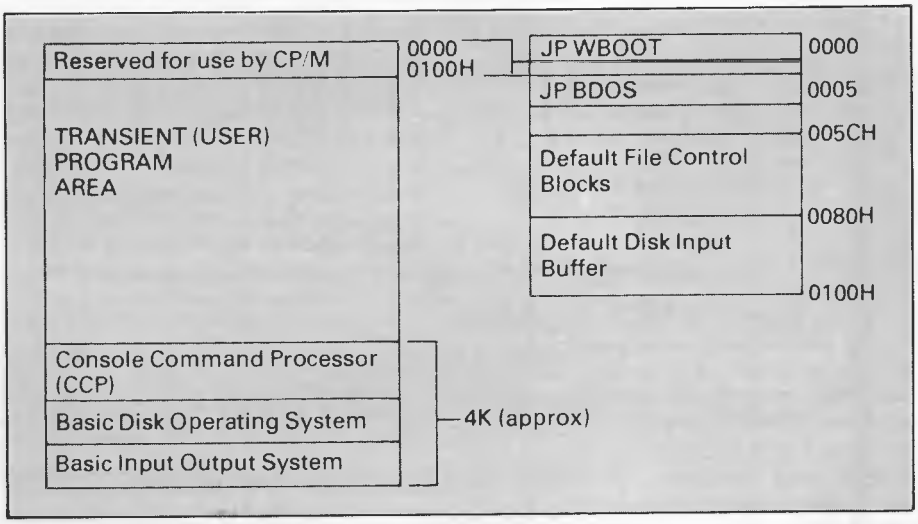

Fig 1 Typical CP/M memory map

CP/M memory map

Let's take a look at a typical CP/M system memory map (Fig 1).

The Console Command Processor (CCP) decodes and takes appropriate action on the text typed in after the prompt. The CCP checks that what has been typed in corresponds to any of the built-in commands (DIR, TYPE, ERA, REN, SAVE, and so on). If not, it looks at the disk directory to see if what has been typed corresponds to a file on the disk which has a .COM extension: if it finds such a file it proceeds to load the file into memory starting at address 0100 hex. When all the file has been loaded the CCP executes CALL 0100H to run the program. As well as processing the command, the CCP scans the rest of the input text and places it in the Default Disk Input Buffer at locations 0080 hex onwards. Location 0080H contains the length of the entered text. In addition, if

```
        ORG 0100H       ; set the assembly address
W.BUFF  EQU 09          ; code number for write strings
        LD C,W.BUFF     ; set up function code in C
        LD DE,TEXT      ; set up address of string in DE
        CALL 0005       ; call the BDOS
        JP 0000         ; perform a warm boot
TEXT:   DEFM 'HELLO $'  ; note the dollar terminator
```

Fig 2 Z80 code

the CCP finds that you have typed a possible filename or filenames after the command then it places a correctly formed file control block at location 005CH for the first filename and at location 006CH for the second — it's then up to your program to make use of these if required.

The Basic Input Output System or BIOS is the only machine-specific part of the CP/M operating system. It contains the necessary code for writing to and reading from disks, printing characters on the VDU, and so on.

The Basic Disk Operating System or BDOS is the real workhorse of the system. It's the interesting part as it's possible to call the BDOS in order for it to perform various tasks such as reading a file into memory, creating a new file and printing text to the screen.

To call the BDOS we use the vector at 0005, as locations 0005, 0006 and 0007 contain the code for JP BDOS. This vector also provides a way of finding out the highest available memory location that our program can make use of (assuming that the program ends with a JP 0000 to reload the CCP by a warm boot). The instruction LD HL,(0006) puts this highest available address into the HL register pair.

Before calling the BDOS with CALL 0005, the C register must be loaded with a code number. This number tells the BDOS which function is to be carried out, so if the C register is not correctly set up you may find that CP/M has just erased one of your programs, or performed some other unexpected operation. It may be necessary to pass a parameter to the BDOS in addition to the code number: if a single byte parameter is required then it is placed in the E register, if an address is required it is placed in the DE register pair. Some BDOS functions return a result and this is placed in the Accumulator.

Consider the Z80 code in Fig 2 to print a message.

CP/M knows it has reached the end of a string to be printed when it reaches the dollar sign.

If this simple program is assembled and run (with any slight adjustments needed for your assembler) you will notice a delay between the message 'HELLO' appearing on the screen and the return of the prompt. This is caused by the JP 0000 instruction which causes the operating system to be reloaded from the disk. To avoid this delay we can use the fact that the CCP executed the program with a CALL 0100H. Provided we leave the stack in exactly the same state as when the program was run it's possible to return to the CP/M prompt with a simple RET instruction. The modified program is shown in Fig 3.

It is important to set up your own local stack when writing CP/M programs

```
        ORG 0100H
W.BUFF  EQU 09
        LD (OLDSP),SP      ; save the stack pointer
        LD SP,STACK        ; set up our own local stack
        LD C,W.BUFF
        LD DE,TEXT
        CALL 0005
        LD SP,(OLDSP)      ; reset the stack pointer
        RET                ; back to CP/M
TEXT:   DEFM ' HELLO $'
        DEFS 16            ; room for the stack which grows
                           ; down
STACK : DEFW 0000
OLDSP : DEFW 0000
```

Fig 3 Modified program

because the default stack grows down from location 0100: that is, it grows into the default disk input buffer — this is vital if your program uses this area for disk I/O.

File control blocks play an important role in CP/M. A file control block (FCB) is an area of memory containing a program's filename, filetype and other information relating to the current record being processed, where the file is on the disk. The disk directory contains the FCB for each file present on the disk, each

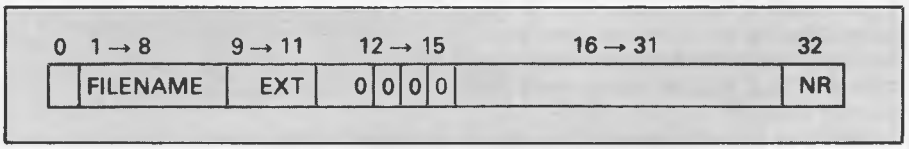

Fig 4 Frequently used FCB bytes

being 32 bytes long. The exact meaning of each byte in the FCB can be found in the CP/M documentation but the ones that are frequently used are shown in Fig 4.

Byte zero gives the status of the file. A zero indicates an active file whereas E5H indicates an unused FCB or a null entry. Under CP/M 2.2 this byte can also contain the user number of an active file. When a file is erased this byte is set to E5H so that the operating system forgets the file ever existed — the rest of the FCB remains as it was before the file was erased and this provides a way of recovering accidentally-erased files. It's only possible to recover such files if no other files have been added to the directory (thus overwriting the old FCB), and the file was not erased by using ERA'.', which writes an E5Hbyte to every byte in the directory. If you have a good disk editor on your system this can be used to search the directory tracks (usually about track 2) and then change the first byte of the correct FCB to a zero. Alternatively, it's not too difficult to write a program to find the file and then change the FCB to that of an active file in much the same way.

Another important point worth noting is that when the BDOS returns to your program, the chances are that it has altered the registers that were holding precious information prior to the CALL 0005 instruction. Therefore, instead of calling the BDOS direct, call a routine in your own program, called 'CPM' for example. This routine should save all the registers (except AF, since a result may be returned), CALL BDOS and then recover all the registers again. It may also be worthwhile to include an ORA instruction at the end of the routine to set the flags, since a zero result in the Accumulator often means that the BDOS has carried out the desired function without error.

For example:

```
CPM:  PUSH BC
      PUSH HL
      PUSH DE
      CALL 0005
      POP DE
      POP HL
      POP BC
      OR A
      RET
```

It's not usually necessary to save the IX and IY registers too since the BDOS is written in 8080 code which has neither of these registers. However, some machines including the Osborne 1 use these registers in the BIOS so it's really a case of trial and error to see if you need to save them on your system.

It is often necessary to copy the matched filename and filetype and copy it into memory where it can be made use of: to do this decode the byte address. When a match is found, the sector of the directory containing the matched FCB is read into the disk input buffer. Since

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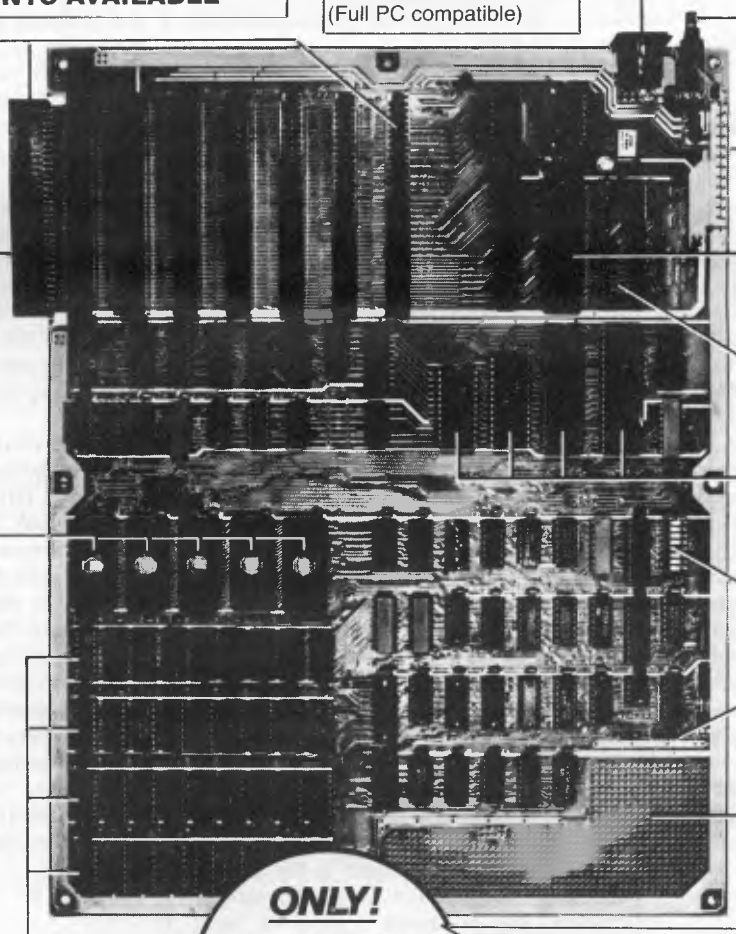

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```
GETDIR:  LD HL,DIRTBL      ;  start of my table
         LD (DIRPNT),HL    ;  set up a pointer
         LD C,17           ;  find first match
GET001:  LD DE,FCB         ;  address of FCB in DE
         CALL CPM          ;  enter BDOS (saving registers)
         INC A
         RET Z             ;  if code was FF it will now be 0
         DEC A             ;  back to original byte address.
         AND A,3           ;  get in range 0...3
         RRCA              ;  multiply by 32 by shifting
         RRCA              ;  right through carry 3 times.
         RRCA
         ADD A,81H         ;  we don't need byte 0 so add 81 hex
         LD L,A            ;  get address into HL.
         LD H,0
         LD DE,(DIRPNT)    ;  current pointer position.
         LD BC,11          ;  number of bytes to copy.
```

Fig 5 Code used for program requiring a table in memory

each FCB is 32 bytes long and a single sector contains 128 bytes, there will be four file control blocks in this buffer, only one of which is required. The first step in decoding the byte address is to mask off all but the lower two bits so that either 0, 1, 2 or 3 remains. I then multiply this result by 32 to reach the correct address within the buffer. Once this address has been reached it's a simple matter to copy the filename and filetype into memory wherever needed.

As an example, I wrote a program requiring a table in memory containing all the directory entries. The code I used to obtain this table is shown in Fig 5.

The next eight bytes of the FCB contain the primary filename padded with blanks if necessary. The filetype or extension follows in bytes 9 to 11, again padded with blanks if required. Bytes 12 to 15 are normally assumed zero. Bytes 16 to 31 are filled in by the operating system regarding where the file is actually stored on the disk. Byte 32 is the record number currently being processed — it is important that when a file is accessed for the first time, this byte is set to zero.

Disk directory searching

CP/M provides two functions which enable the disk directory to be searched. The first, BDOS function number 17, searches the directory for the first occurrence of the file whose FCB is located at the address in the DE register pair. The next, BDOS function number 18, finds the next occurrence of said FCB.

As each file on the disk has a unique name and extension you may wonder why it's necessary to have this second function at all. The reason is that it's possible to include wild cards in the FCB which will match any byte at all. These wild cards are byte 3FH — that is, a question mark. If you set up a FCB which has as the primary filename ????????, it is possible to find all the files on the disk with the given extension by using function 17 followed by repeated use of function 18. It is important that after using function 17 there are no other DBOS functions used before you use function 18. Both these functions return a result called the byte address. The byte address is a code referring to the position of the FCB within the directory.

The routine in Fig 6 should prove useful — it took several days of frustration to decode the byte address correctly, and since then I have used the routine in about 70 per cent of all my machine code programs.

The BDOS also provides functions for creating a new file, renaming a file, erasing a file, reading from a file, writing to a file, opening a file and closing a file. All these functions are described fully in the CP/M documentation but a few points are worth making here.

Firstly, you must open a file before reading or writing to it. This is not strictly correct as in some cases it isn't necessary, but it doesn't do any harm and it's a good habit to get into. Secondly, and more importantly, at the end of writing to a file you must close the file so that the disk map for that file is correctly updated.

A good analogy is a ring file with papers inside it. Before using it, whether for reading or for inserting new information, you must open the file first. Then, after you have used the file, you must close it before putting it back on the shelf.

Conclusion

Before using any of these features pass the address of the FCB on which the operation is to be performed to the BDOS. All you will need to set is the primary filename and the extension; the operating system takes care of the rest of the FCB. The exceptions to this are reading or writing to a file. In these cases you also need to set the NR byte of the FCB. This is worth remembering as there are many cases when this is what's wrong with a program — you have forgotten to set the record number. Note that you need only set this byte initially — after reading or writing a record the operating system automatically increments the NR field.

In case you are wondering how CP/M copes with files longer than 256 records (since the NR byte can have any one of 256 values), there is a byte in the FCB called the extent byte. One extent equals 256 records and in this way the system copes with very large files.

Finally, a hint about software protection. You will have noticed that when you type something in after the prompt which appears in lower case, the CCP automatically folds this back into upper case — making it impossible to use files with lower case letters or graphics codes. This is purely a function of the CCP, not of the BDOS.

END

```
         LDIR              ;  copy the filename & filetype
         LD (DIRPNT),DE    ;  update pointer
         XOR A             ;  quicker then LD A,0
         LD (DE),A         ;  ensure end of table zero
         LD C,18           ;  set up search for next match
         JR GET001         ;  go back and do it
FCB:     DEFB 00           ;  find active entries only
         DEFM '???????????'
         DEFB 0,0,0,0
         DEFS 16
DIRPNT:  DEFW DIRTBL
DIRTBL:  DEFS 64 * 11
```

Fig 6 Routine for machine code programs

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See review in September issue

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The story behind MSX

Tom Sato uncovers the success story behind ASCII's development of MSX — a badly needed computer standard.

In the centre of the MSX operation is one revolutionary company called ASCII. ASCII has set standards which a large number of manufacturers now follow. The Japanese computer industry badly needed an industrial standard. There were a huge number of micros with limited software and this deterred many would-be computer buyers.

Origins

ASCII started off as a small publishing company back in 1977, the year when the PET 2001, APPLE II and TRS-80 came onto the market. That July ASCII started publishing its computer magazine of the same name — in terms of history, and circulation, it's the Japanese equivalent of *APC*.

The following year, having realised that US software was far superior to Japan's, vice president Nishi flew to the US and signed a deal with Microsoft to set up a company called ASCII Microsoft. ASCII footed the bill to set up the new company, so ASCII Microsoft is a 100 per cent Japanese company with ASCII holding all its shares.

At that time the Japanese electronics giants, NEC and Sharp, were developing their own micro after seeing Apples and PETs being sold like hot cakes. ASCII's first deal was to supply NEC with a modified version of Microsoft Basic for the NEC PC8001. This was the turning point for ASCII and ASCII Microsoft. The success of the PC8001 brought in more business and as the number of personal computer manufacturers increased, so did ASCII's business. At the time of writing, ASCII Microsoft's Basic dominated 80 per cent of Japanese personal computers including Hitachi, Fujitsu, NEC, National Panasonic.

ASCII Microsoft's task is to adapt the language to individual machines and 'Japanise' it so most computers with Microsoft Basic can handle Japanese characters.

Earlier this year I went to ASCII in Tokyo and met Hiroshi Watanabe, one of the vice managers of ASCII.

He told me: 'The MSX machine is designed to be easy to adapt. We gave the prototype MSX computer to all interested so all they had to do was modify it, which wasn't difficult. By November last year 11 manufacturers announced their products to our amazement.'

MSX machines use old technology. But the way the Japanese have adapted the ageing Z80 and TMS 9918 chips and executed the whole operation is an eye opener.

The philosophy behind MSX is standard hardware which any manufacturer can build with identical software. The chips used in MSX are produced by many second source manufacturers. The Z80 is made by NEC, Sharp and a number of others. The same goes for the graphics chip and the sound generator, so there should be no chip shortage problems. The sheer number of MSX makers means that no one semiconductor manufacturer can cope with the demand. Also the Z80 and TMS 9918A are tried and tested and no one has to learn new technology.

In terms of cost the Z80 and TMS are now very cheap compared with some exotic VLSIs.

ASCII sold prototype MSX machines to software houses well before the launch of MSX computers, so by the second month after the launch of the machines there were about 100 software titles independently produced. Arcade video game producers were also encouraged to move into the home computer software market. Namco, which created Pacman, is now converting most of the coin-operated arcade games to the original specification for MSX computers.

MSX is made as expansible as possible; it can handle up to 16 I/O ports so you can plug in anything from a disk interface to expansion RAM. This expandibility meant that the MSX makers were quick to include various firmware and peripherals for their machines. The choice of graphics chip (TMS 9918A) means that user memory is not eaten up by using high resolution graphics; it has its own 16k video RAM. Also this chip can handle sprites as well as 16 colours in high resolution.

On the negotiation side, ASCII has been able to reap the harvest of past efforts in selling Microsoft Basic. But what is ASCII's plan for the future of the MSX system?

'Well', said Wantanabe, 'the blueprint of a second generation MSX is already drawn up. I think MSX will be around for a long time. The reason why Apple was so popular for such a long time was because of the huge amount of software and peripherals. MSX has a similar quality and MSX will expand around the same basic system for quite a while.

'The MSX-DOS for floppy disk drives is now in working order at our laboratory and manufacturers will be releasing disk drives in May. The disks are not standardised but MSX-DOS is the same for all disks. It is possible to have 3.5in and 5in floppy disks at the same time and transfer data between them. The popularity of floppy disks among home computer users has recently increased dramatically.

'As for software, we have converted Microsoft's Multiplan to MSX. Also various languages which run under MS-DOS including Fortran, Cobol, Logo and Pascal will be converted to MSX.'

Watanabe continued, 'We have about 100 games software titles now, increasing rapidly. Before the launch of MSX we sold prototypes to various software houses to enable them to get started early. Quite frequently a software house would send in a prototype of its MSX software and ask us to test it. We have all the MSX computers in our laboratory to do this. We also support smaller software houses which have limited finance. ROMs have to be made in a large quantity to be cost-effective, so we do that for them.'

'What of future MSX hardware?' I asked.

'A number of VLSI manufacturers are now working on customised chips for MSX,' said Watanabe. Thirty or so chips will be reduced to about five but with total hard/software compatibility. The MSX chips will cost less thus enabling reduction in the overall price of MSX computers. This opens a wide horizon for MSX as there is a possibility of MSX ICs being used outside computers: for example, they can be used for controlling videos and TVs.'

Conclusions

What ASCII has created is the Japan Computer Industry Inc, with almost all the electronics giants participating. It has considerable strength combined with an ability to market consumer electronics. The company has an impeccable record for quality control. It is almost inevitable that MSX will be exported, as with hi-fi and videos.

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PROGRAM CONVERSION

BBC

This month Surya turns his attention to the BBC in his continuing series on graphics and sound on each of the machines included in the APC Basic Converter Chart (see November issue). Find out how to convert BBC listings to work on your micro.

The complexity of the BBC's graphics often make its listings all but incomprehensible to owners of other machines. But there are a lot of well-written BBC listings around which the aforementioned owners would no doubt like to get up and running on their own machines. For this reason, I think it worthwhile to go into the subject in a fair amount of detail.

The BBC comes in one of two models: the 'A' and 'B'. The only difference between the two as far as graphics is concerned is that the model B offers eight screen resolutions, or 'modes', while the A offers only four.

The BBC has very powerful graphics-handling capabilities. This is useful if you own one, but makes life difficult for anyone trying to convert BBC graphics routines. Let's start with the business of modes. The model B can support eight different screen resolutions, while the model A supports modes 4, 5, 6 and 7 only. A brief summary of the modes follows:

0 — 80x32 text, 640x256 graphics, 2 colours
1 — 40x32 text, 320x256 graphics, 4 colours
2 — 20x32 text, 160x256 graphics, 16 colours
3 — 80x25 text, 2 colours, text only
4 — 40x32 text, 320x256 graphics, 2 colours
5 — 20x32 text, 160x256 graphics, 4 colours
6 — 40x25 text, 2 colours, text only
7 — 40x25 text, teletext mode (see later)

Mode x, where x is in the range 0 to 7, clears the screen and places you into the appropriate mode. This can be done as either a command or statement.

Once in a given mode, the graphics statements are as follows:

CLG —clears the graphics screen
CLS —clears the text screen
MOVE x,y —move the graphics cursor to point x,y
DRAW x,y —draw a line from the current cursor position to point x,y in the current foreground colour
COLOUR x —set the colour to be used for all subsequent printing of text, where x is an integer in range 0 to 15 to set foreground colour, 128 to 143 to set background colour. Note that the colour values are dependent upon the current mode: colour 2, for example, is yellow in a four-colour mode but green in mode 2 (the 16-colour mode). For an explanation of the colour codes, see later.
GCOL w,x —sets the colour to be used for all subsequent graphics operations, where x is the colour and w is the logical operation defined as:

0 — use the specified colour
1 — OR the specified colour with any colour already present
2 — AND the specified colour with any colour already present
3 — XOR (eXclusive OR) the specified colour with that already present
4 — invert (that is, change to the logical opposite) the colour already present

Note that x is as for COLOUR.

PLOT —more powerful version of draw: see later for further details

To set the text or graphics colour, numbered codes are used. These codes, as has been mentioned, are dependent upon the current mode. These codes can be reset (see VDU later — virtually everything you say about BBC graphics needs to be qualified in some way), but default values are:

Two-colour modes (0,3,4 and 6):
Black —0 foreground, 128 background
White —1 foreground, 129 background

Four-colour modes (1 and 5):
Black —0 foreground, 128 background
Red —1 foreground, 129 background
Yellow —2 foreground, 130 background
White —3 foreground, 131 background

Sixteen-colour mode (2):
Black —0 foreground, 128 background
Red —1 foreground, 129 background
Green —2 foreground, 130 background
Yellow —3 foreground, 131 background
Blue —4 foreground, 132 background
Magenta —5 foreground, 133 background
Cyan —6 foreground, 134 background
White —7 foreground, 135 background

Flashing colours:
Black/White —8 foreground, 136 background
Red/cyan —9 foreground, 137 background
Green/magenta —10 foreground, 138 background
Yellow/blue —11 foreground, 139 background
Blue/yellow —12 foreground, 140 background
Magenta/green —13 foreground, 141 background
Cyan/red —14 foreground, 142 background
White/black —15 foreground, 143 background

The last four colours incidentally, are not a typesetting error but merely one of the BBC's little idiosyncrasies.

To recap, first of all a mode is selected. This determines the resolution and the

number of colours available. Then the screen may be cleared (using CLG and CLS), and the text colour (COLOUR x) and graphics colour (GCOLx) set. The graphics statements available are MOVE, DRAW and PLOT.

PLOT:

Whichever mode has been selected, the screen is addressed as a virtual screen 1280 x 1024 pixels. The origin (0,0) is at the bottom left-hand corner of the screen though this — like most things on the BBC — can be repositioned if desired. As desribed earlier, DRAW x,y draws a line in the current foreground colour to the specified coordinates. MOVE x,y moves to the specified coordinates without drawing (OK — for the purists — it draws a line in the current background colour (s)). PLOT is a more sophisticated form of DRAW and uses three parameters which we'll call k, x and y since the manual does.

Parameters x and y are straightforward, these being the coordinates used. The parameter k determines the manner in which the line is plotted as follows:

0 — move (ie, draw in background colour (s)) relative to present position
1 — draw (in foreground colour) relative to present position
2 — as 1, above, but in logical inverse colour
3 — as 1, above, but in background colour. This differs from 0 in that the background colour will overwrite any foreground colour present
4 — move to position (x,y)
5 — draw line to position (x,y) in current foreground colour
6 — as 5, but in logical inverse colour
7 — as 6, but in current background colour

Note that 0-3 plot x points in the x-axis and y points in the y-axis; that is, the plot is relative. 4-7 move to the screen co-ordinate (x,y); that is, the plot is absolute.

Higher values of k may be used to achieve other effects. The ones which are currently implemented are:

8-15 — as 0-7 but with the last point in the line omitted
16-23 — as 0-7 but using a dotted line
24-31 — as 0-7 but using a dotted line and with the last point in the line omitted
64-71 — as 0-7 but plotting only the last point of the line
80-87 — as 0-7 but use the last two points visited to plot and fill a solid triangle

You can see from the above that PLOT 4 is the same as MOVE and PLOT 5 is the same as DRAW.

There are also 33 'VDU codes', a number of which are related to graphics. These appear in listings as VDUx, where the most commonly used values of x are:

5 — join text and graphics cursors to enable text and graphics to be printed at the present graphics cursor position. This is disabled using VDU 4
19 — a very common VDU code used to redefine logical colours. For example, colour 1 is normally white in two-colour modes, but the programmer may wish to change it to a different colour. Thus VDU 19 allows access to colours not normally available in a given mode. The statement takes the form VDU 19, logical colour code, new colour code, 0,0,0 OR VDU 19, logical colour code, new colour code;0;. Thus in mode 0, VDU 19,1,3;0; would redefine white to appear as yellow. VDU 20 resets all colour codes to their default values.
23 — define a user-defined character. It uses the same binary-based system as most other machines, the form being VDU 23, ASCII code of the character to be defined, followed by the eight codes separated by commas.
24 — define a graphics window, that is an area of the screen outside of which no graphics may appear. The form taken is VDU 24,lower x coordinate;lower y coordinate;upper x coordinate;upper y coordinate;. Thus VDU 24,100;200;300;400; would define a graphics window with coordinate (100,200) as the bottom left-hand corner and (300,400) as the top right-hand corner. This is reset by VDU 26.
28 — define a text window. This works as for VDU 24, only commas are used instead of semi-colons and no trailing punctuation mark is required. The text screen is 39x31 characters by default. VDU 26 resets default.

And that covers the graphics handling. Now for sound.

Sound

The BBC has two sound statements, SOUND and ENVELOPE. The SOUND statement is relatively straightforward, ENVELOPE is so specific to the BBC that it would be of little use to spend the not inconsiderable amount of time necessary to explain it. Even if you could work out roughly what sort of sound was being created, you would have no way of effectively simulating it on another machine. What ENVELOPE does is to define the shape of the sound generated by the SOUND statement, so you may not be able to recreate the sound faithfully.

The format is SOUND channel, volume, pitch, duration where:

* Channel is in the range 0-3, channel 0 producing 'white noise' and used to create special effects.
* Volume is in the range 0 to −15 with 0 silent (useful) and −15 the loudest.
* Pitch ranges from 0 to 255, covering some five-and-a-bit octaves.
* Duration is in the range −1 to 254. −1 means 'continue until stopped' (either by pressing escape or by sending another note to the same channel), positive values are in twentieths of a second.

Sending two or more notes to the same channel at the same time produces a chord. Where channel 0 is used, the type of white noise produced depends upon pitch, the BBC manual summarising the effects as follows:

0 — high-frequency periodic noise
1 — medium-frequency periodic noise
2 — low-frequency periodic noise
3 — periodic noise, frequency determined by pitch setting of channel 1
4 — high-frequency white noise
5 — medium-frequency white noise
6 — low-frequency white noise
7 — white noise, frequency determined by pitch setting of channel 1

And that's the BBC micro! You do need to remember that without the equivalent of the ENVELOPE statement, you will not be able to achieve the kind of complex sound effects used in some BBC programs. Sound effects are generally the frills rather than the meat of a program, and while good sound effects can very much improve a program, they can usually be simplified without losing the effectiveness of a program.

END

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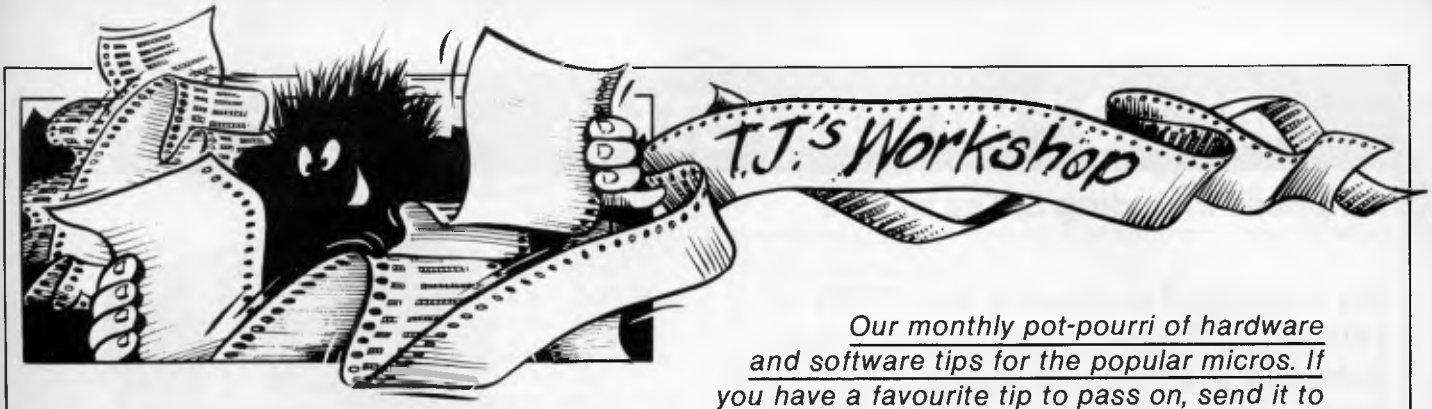


Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', 77 Glenhuntly Road, Elwood, Victoria 3184. Please keep your contributions as concise as possible. We will pay $10–$30 for any tips we publish. APC can accept 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.

64 screen dump

Here is a short listing for a routine which produces an exact printed copy of the Commodore 64 screen.

It will reproduce all characters and block graphics in upper or lower case and normal or reverse video.

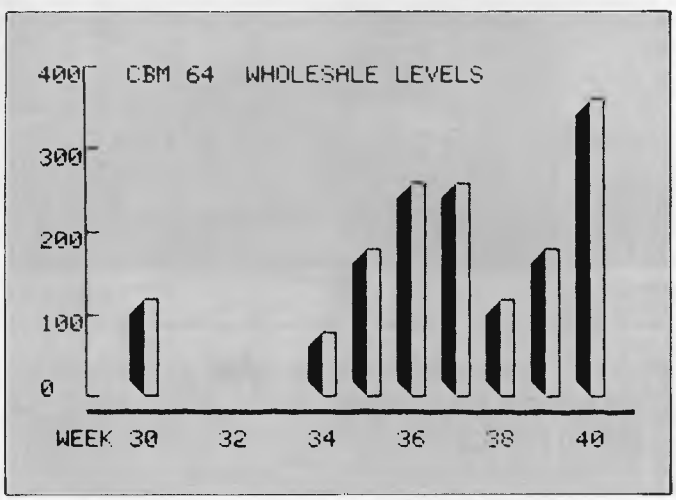
It's a fairly easy task to convert for the VIC 20. Alterations in lines 60040 (checking for upper/lower case), 60100 (screen memory locations), and 60105 (screen width) are necessary.

The program runs by examining the screen one line at a time, and building up a string of CHR$ values to be printed. It is very useful as a subroutine in a main program.

D Twinberrow

```
60000 REM*******SCREEN DUMP*******
60001 REM*****                *****
60002 REM*****BY D.K.TWINBERROW*****
60010 AT$="":AS$=""
60020 F=0:DIMAS$(80)
60030 OPEN4,4:PRINT#4
60040 CK=PEEK(53272):IFCK=21THENCASE=145
60050 IFCK=23THENCASE=17
60100 FORX=1024TO2023STEP40
60105 FORS=0TO39
60110 CH=PEEK(X+S)
60120 IFCH>=0 AND CH<=31 THEN AS$(S)=AS$(S)+CHR$(CH+64)
60130 IFCH>=32 AND CH<=63 THEN AS$(S)=AS$(S)+CHR$(CH)
60140 IFCH>=64 AND CH<=95 THEN AS$(S)=AS$(S)+CHR$(CH+32)
60150 IFCH>=96 AND CH<=127 THEN AS$(S)=AS$(S)+CHR$(CH+64)
60160 IFCH>=128 THEN CH=CH-128:AS$(S)=AS$(S)+CHR$(18):F=1:GOTO60120
60170 IFF=1 THEN AS$(S)=AS$(S)+CHR$(146):F=0
60190 AT$=AT$+AS$(S):AS$(S)=""
60200 NEXTS
60210 PRINT#4,CHR$(15)CHR$(CASE)AT$CHR$(0)
60220 AT$="":NEXTX
60230 CLOSE4:RETURN

READY.
```



Tandy tips

The following Tandy routines may be useful.

1) Places a comma after every third digit from the right in a number. Number input in X, output as A$. Uses A,B,C, internally.

```
500 A$=MID$(STR$(X),2):
  A=LEN(A$): C=A
510 AA=1:BC=A:
  IF A=0 THEN RETURN
  ELSE IF B/3 INT(B/3)
  THEN A$=LEFT$(A$,A)+
  ","+MID$(A$,A+1):
  GOTO510 ELSE 510
```

2) Given a line of text, this routine stops the words being split by the edge of the screen. Text input in A$. Line length in LL. Uses A2 internally. For ? read print.

```
600 IF LEN(A$)<LL
  THEN?A$:RETURN ELSE
  A2=LL
610 IF MID$(A$, A2,1)=" "
  THEN 620 ELSE
  A2=A2-1:IF A2=0 THEN?
  A$:RETURN ELSE 610
620 ?LEFT$(A$,A2-1):
  A$=MID$(A$,A2+1):
  GOTO600
```

3) This routine justifies a row of numbers into 0.00 form which is ideal for use in money printing routines. INPUT P where P is the sum of money in cents. Output in S. Uses A,B internally.

```
100 S$=MID$(STR$(P),2):
  B=VAL(S$):IF B<1
  THENS$="0" + S$
110 A=LEN(S$):B=A
120 IF MID$(S$,B,1)="."
  THEN 130 ELSE B=B-1:IF
  B=0 THEN B=A+1:
  GOTO 130 ELSE 120
130 S$=S$+RIGHT$
  (".00",2-(A-B)):
  RETURN
```

These routines have been running on my Tandy Color Computer since they were developed (I don't have Extended Basic or PRINT USING). They should be easy to convert to computers that don't have ELSE or multi-statement lines.

Peter Griffiths

Tandy merge

There do not seem to be many programs or hints for the TRS-80 Color Computer around at the moment, so here is a handy little program to rectify the situation. It allows the user to merge two Basic programs together. My computer has Extended Colour Basic Version 1.0 — I'm not sure whether the program will work with other versions of Basic.

```
10 'MERGE FOR THE TRS-
  80 COLOR COMPUTER
20 CLEAR 200,16364
30 FOR I=16365 TO
  16381
40 READ A:POKEI,A:NEXT I
50 DATA 158,25,175,140,
  12,158,27,48,30,32
60 DATA 3,174,140,3,
  159,25,57
```

To merge program B onto the end of program A:

1. CSAVE program B onto tape.
2. CLOAD or type in the MERGE program and RUN it.
3. CLOAD program A.
4. Make a note of the last line number in program A.

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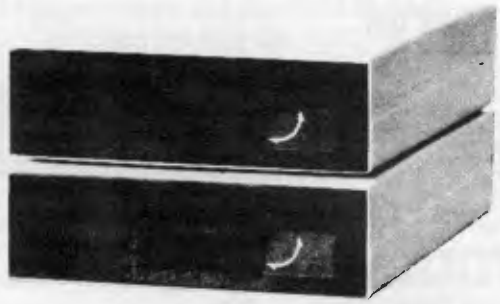

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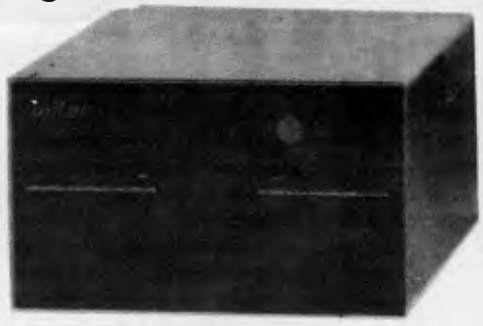

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APC 7

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5. EXEC 16365.
6. CLOAD program B.
7. Use RENUM to make the line numbers in program B higher than the last line number in A.
8. EXEC 16376

The merge is now complete and the program in memory can be CSAVED as one program (which it now is).

Here is the assembly language listing of the machine code:

```
          ORG   $3FED
FIRST     LDX   $19
          STX   QUIT,PCR
          LDX   $1B
          LEAX  -2,X
          BRA   +3
SECOND    LDX   QUIT,PCR
          STX   $19
          RTS
QUIT      RMB   2
```

D Winnett

```
10 REM** TOPLINE C64 - SHORT VERS. *
1000 ML=828
1010 READ A:IF A=256 THEN STOP
1020 POKE ML,A:ML=ML+1:GOTO 1010
1030 DATA 160,0,162,40,169,0,153,0
1070 DATA 216,200,202,208,247,160,0,185
1080 DATA 100,3,240,7,153,0,4,200
1090 DATA 76,75,3,76,49,234,7,153
1100 DATA 0,4,200,76,89,3,150,2
1110 DATA 148,136,137,147,160,137,147,160
1120 DATA 148,136,133,160,148,143,144,160
1130 DATA 140,137,142,133,160,143,134,160
1140 DATA 148,136,133,160,147,131,146,133
1150 DATA 133,142,174,174,174,160,160,160,0
1170 DATA 120,169,60,141,20,3,169,3
1180 DATA 141,21,3,88,96
1190 DATA 120,169,49,141,20,3,169,234
1200 DATA 141,21,3,88,96,256
```

Topline for Commodore 64

This program is designed to print a non-vanishing line of print at the top of the screen which can be altered from within the program by POKE commands.

The address in the hardware IRQ interrupt vector at $0314-$0315 is changed to that of the ML subroutine at $033C (828). This routine fills the topline colour memory and then the characters of the line are loaded from their locations to the screen locations.

The 40 characters are in data statements in lines 1100-1150 and in the example program the topline reads (in reverse print):

To change to characters in program mode,
POKE867+CP,SC
where CP = character position in the line and,
SC = the screen code.
To turn on the topline ..... SYS909 and,
To turn off..... SYS922

N Cornish

```
10 REM*********************************
11 REM* TOPLINE FOR COMMODORE 64    *
12 REM*                             *
13 REM* BY ML PROGRAM BY:-          *
14 REM*              NEIL CORNISH   *
15 REM*                             *
16 REM* LOTS OF HELP FROM:-         *
17 REM*              MIKE RYCHTER   *
18 REM*                             *
19 REM*          03.06.84           *
20 REM*********************************



1000 ML=828:                        REM     LOCATED IN CASSETTE BUFFER.
1010 READ A:IF A=256 THEN END:      REM     IN S/R CHANGE END TO RETURN.
1020 POKE ML,A:ML=ML+1:GOTO 1010
1030 DATA 160,0
1040 DATA 162,40:                   REM     40 CHRS IN MESSAGE.
1060 DATA 169,0:                    REM     COLOUR. 0=BLACK.
1050 DATA 153,0
1070 DATA 216,200,202,208,247,160,0,185:  REM   COLOUR MEMORY FILLED & CHRS
1080 DATA 100,3,240,7,153,0,4,200:  REM     TRANSFERRED TO SCREEN LOC'NS.
1090 DATA 76,75,3,76,49,234,7,153:  REM     ENDS WITH JMP TO NORMAL
1100 DATA 0,4,200,76,89,3,150,2:    REM     INTERRUPT ROUTINE AT $EA31.
1110 DATA 148,136,137,147,160,137,147,160:REM   LINES 1110 - 1150 CONTAIN THE
1120 DATA 148,136,133,160,148,143,144,160:REM   40 CHARACTERS FOR THE LINE
1130 DATA 140,137,142,133,160,143,134,160:REM   PADDED WITH SPACES
1140 DATA 148,136,133,160,147,131,146,133:REM   FOLLOWED BY 0 (BRK)
1150 DATA 133,142,174,174,174,160,160,160
1160 DATA 0:                        REM     MUST FOLLOW CHRS.
1170 DATA 120,169,60,141,20,3,169,3:  REM   THIS IS START (SYS909) AT
1180 DATA 141,21,3,88,96:           REM     $030C. IT SETS $033C (828)
1190 DATA 120,169,49,141,20,3,169,234:  REM IN CINV (IRQ VECTOR) SO THAT
1200 DATA 141,21,3,88,96,256:       REM     THIS S/R PERFORMED EACH 1/60
1210 :                              REM     SECOND.
1220 :                              REM     TO CHANGE A CHR IN THE LINE,
1230 :                              REM     POKE867+CP,SC
1240 :                              REM     WHERE CP= CHR POS'N IN LINE
1250 :                              REM     AND   SC= SCREEN CODE.
1260 :                              REM     SWITCH OFF WITH SYS922

READY.
```

BBC garbage collection

A peculiarity of the BBC Basic interpreter is that it does not perform any 'garbage collection', or, support the FRE(X$) function found in many Basics. This means that programs which perform extensive manipulation of strings can gradually consume the free variable space, resulting ultimately in an ominous 'No room' catastrophic error message.

This proved to be the problem with a mailing list program where alphabetical order sorts are carried out on various fields of the data. The data is organised using a separate string array for each field (title, surname, house number, road, town) with an array element per record, and the problem arises because elements in each array are exchanged in the course of the sort.

The solution is to avoid moving the string array elements when sorting the arrays. This is done by exchanging the pointers to the string array elements instead. A simple way is needed to find the location of the string pointers in memory, and use is made of a CALL statement which builds a parameter block at 0600H before executing a machine code subroutine.

The example shows the relevant portions of the program:

Lines 60-69 assemble a machine code subroutine (PBMOV) which transfers the parameter block placed at 0600H by the CALL statement to a safe location, because 0600H is also used by other parts of Basic. 0C00H was chosen as it is reserved for customised character fonts and is rarely used.

Line 64 sets the number of bytes of the parameter block to be transferred. This should be at least 3* (number of arrays)+2.

Lines 1400-1470 comprise a Basic subroutine which the sort program calls (using GOSUB) in order to exchange two elements in all arrays. The two elements are specified by T and rec.

Line 1400 calls the machine code subroutine and specifies the string arrays we wish to locate.

Lines 1420, 1460 set up a FOR-NEXT loop which will handle one array on each pass.

Line 1430 reads the pointer information in the parameter block and finds the location (N) of the 4-byte pointer block for array element (0).

Line 1440 calculates the locations (Y and Z) of the pointer blocks for the two array elements to be exchanged.

Line 1450 then exchanges these pointer

blocks.

The technique used is general and may be useful in other applications with little or no modification.

Martin Cope

```
LIST
   50 REM
   51 REM PBMOV - PARAMETER BLOCK MOVE ROUTINE
   52 REM
   60 DIM A% 20
   61 FOR C=0 TO 2 STEP 2
   62 P%=A%
   63 [OPT C
   64 .PBMOV LDY 20
   65 .LOOP DEY:BEQ EXIT
   66 LDA &600,Y:STA &C00,Y
   67 JMP LOOP
   68 .EXIT RTS
   69 ]NEXT
   70 REM
   71 REM
 1300 REM
 1310 REM ARRAY ELEMENT INTERCHANGE SUBROUTINE
 1320 REM
 1400 CALL PBMOV,sur$(0),title$(0),ho$(0),road$(0),town$(0)
 1410 M=&C00
 1420 FOR X=1 TO 13 STEP 3
 1430 N=(M?X)+256*(M?(X+1))
 1440 Y=N+4*T:Z=N+4*rec
 1450 W=!Y:!Y=!Z:!Z=W
 1460 NEXT
 1470 RETURN
 1500 REM
 1510 REM
```

IF statements and bubble sorts

After reading about replacing IF statements with boolean operations, I thought it might be possible to apply this to a bubble sort to speed it up. Unfortunately this method of exchange was slower on my computer (NEC 8201a) than the ordinary IF exchange as normally used in sorts of this kind.

This may not apply to other versions of Basic. When converting the program, note that the operation of the algorithm depends on a true condition producing a −1 and false a 0.

K Garroch

```
10 DIM A(28)
20 FOR T%=0 TO 25
30 A(T%)=25-T%
40 PRINT A(T%);" ";
50 NEXT
60 PRINT TIME$

70 FL%=0
80 FOR T%=0 TO 25
90 S=A(T%)
100 T=A(T%+1)

110 A(T%-(S<T))=T
120 A(T%-(S>T))=S
130 FL%=FL%-(S>T)
140 NEXT
150 IF FL%<>0 THEN 70
160 PRINT TIME$
170 FOR T%=1 TO 26
180 PRINT A(T%);" ";
190 NEXT
```

Spectrum operating system quirk

I have found an interesting quirk in the Spectrum operating system. It occurs whenever the 'scroll?' command is encountered when printing to the screen. Typing CAPS LOCK (SHIFT and 2) produces the last command interpreted (for example, when listing a program, LIST is produced). Try typing in the following as a direct command:

FOR A=1 TO 1000:PRINT "FRED":NEXT A

When the scroll? prompt appears type caps lock — the whole of this line will reappear. Also, after pressing another key, all the keywords are listed.

C Evans

Save machine code on the VIC and 64

An easy way to SAVE machine code programs on the VIC 20 or Commodore 64 without the use of a long machine code program is to type in a couple of direct commands.

For a program starting at address S and ending at address E the following commands should be typed:

First: PRINT(S/256-INT (S/256))*256, INT (S/256)

This produces two numbers we will call LS and HS respectively.

Next: PRINT (E/256-INT (E/256)) *256, INT (E/256)

Two more numbers we will call LE and HE will appear.

Finally: just enter the line POKE 43, LS:POKE44, HS:POKE45,LE: POKE46,HE:SAVE" program name", I,I inserting the values for LS,HS,LE and HE.

The program can then be verified with the verify command and the VIC or 64 returned to normal by SYS64824 for the VIC or SYS64738 for the 64.

M Davies

VIC's operation speeded up

Location 37879 can be used to speed up the operation of the VIC.

This is useful for adding difficulty to games and zest to graphics. It does not, however, appear to work with the super expander graphics. Speed is achieved here by using Multicolour mode.

The higher the value POKEd into 37879, the faster the operation.

eg POKE 37879,255 — fast
POKE 37879,1 — slow

D Williams

VIC goes into reverse

An interesting effect that can improve an explosion, or the demise of a player, in a game is the reversing of the screen contents a few times. The following routine can be used to do this on the VIC 20.

The program is stored in a part of the memory that is not affected by any operation performed by the VIC and hence no memory is lost when the routine is used. It can be accessed from Basic

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CATCHA SNATCHA

Barney Bootlace, is demoted from ace detective of the aristocracy to the level of mere store detective at one of the craziest run-down stores in town.

It's a hectic life for the hardened crime fighter when he has to look after lost children, taking them to the lost children's office in the top left hand corner of the shop. He must also rush the lost umbrellas and handbags to the lost property office ready for the careless owners to fetch. The lost property office is in the top right hand corner of the shop. At least some variety enters into the action when the occasional bungling shop-lifter attempts to remove a box off the counter and get away with it. Barney has to grab the box and return it to the manager's office to prove it was shoplifting, but watch those shoplifters run as you try to grab that box. They hide the box under their coats and you have to keep your eye on them in case they get mixed up with the other shoppers.

There is one time our hero has reason to panic — when the occasional customer drops a parcel bomb in the rows between the counters.

VIC 20

BEWITCHED

You have allowed the evil magician Mordread to cast you down into the haunted maze of dungeons beneath his dark and forboding castle.

He has transformed you into a magical key to roam for eternity through the haunted labyrinths below ground, whilst he enslaves all those who live above.

There are four sets of different coloured doors, all of which must be opened before you can gain freedom, and all the time you are at the mercy of hordes of ghosts and ghouls intent on hampering your progress. At the entrance to the maze there are four coloured keys, the colours corresponding to those of the doors. You must pass through one of these keys to become the same colour, and only then can you open the corresponding doors.

You must escape from this dank, evil place so that you can repel the forces of darkness and bring light and liberty to the land once again.

VIC 20

FAST LOADING

ARCADIA

The spaceship Arcadia has been specially equipped with dual Plasma Disrupter guns and an Ion Thrust Drive in order to combat the deadly menace of the many alien races of the Atarian Empire. Your mission as commander of the Arcadia is quite simple — to destroy as many of the enemy as possible. Intelligence reports indicate that the Atarian fleets will attack in formation and are often quite suicidal in their methods.

If you manage to destroy the entire fleet within this time another fleet will attack you.

ARCADIA works on the basic unexpanded VIC-20, requiring no memory expansion or peripherals except the standard Commodore cassette recorder.

VIC 20
Commodore 64

WACKY WAITERS

You enter this rather ramshackle place to find that the vacancy is for a waiter. Pure desperation for work makes you apply for the job, and the mean-looking boss decides you'll do but warns he'll keep an eye on you.

It doesn't take long for the first guest to scream for service, so off you run to find out what they require. Into the first lift you leap as it passes, taking you up into the building. You have been called to the third floor so on that floor you leap out. You have to wait for the next lift to pass and leap in. You timed it wrong and your tip is dropping, but you'll soon learn. The lift finally passes. In you dive. Now you have the knack, you race into the lift and so on to the next.

You are only paid by tips and the quicker you learn this waiter lark the better for you.

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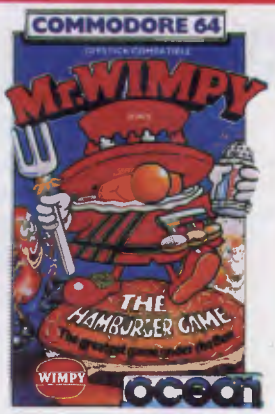
COSMIC CONVOY

Planets in the system Coman are dying. Millions of people need supplies urgently. A relief convoy is assembled in orbit around Com-Alpha. Your task is to guard that convoy to the next planetfall. You command a squadron of H-Vips, each with a fully sorted Gon-4 stab laser. You know that the convoy must cross the Trans-Com freight lanes where the meanest space pirates could pounce. Survive long enough to escort the supplies to Com-Beta and become an Admiral — but the next planet in the system still needs supplies.

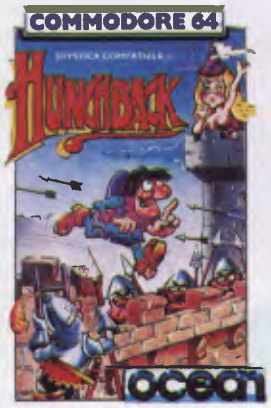
☐ COMMODORE 64



MR WIMPY

Mr Wimpy's task is to make his delicious Burgers and you must guide him around the screen to achieve this. First assemble the ingredients, avoiding the moving manholes and Waldo the burger-thief. Now make the Wimpy Burgers, avoiding the kitchen rebels. If you are trapped by the rebels you can pepper them into oblivion but only three times, unless you pick up the bonus gems, the ice cream or the cup of coffee, which gives you more chances to shoot.

☐ COMMODORE 64



HUNCHBACK

QUASIMODO must rescue the imprisoned Esmerelda from the castle stronghold. Jump along the Ramparts, swing over the Fiery pit, dodge the Arrows and Fireballs and remember to keep ahead of the chasing Knight. 15 Screens of fun and excitement and each one more difficult than the last.

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T.J.'s Workshop

using SYS 730 and from a machine code program via JSR $02DA.

```
1 FOR A=730 TO 738:READ B:POKE A,B:NEXT A
2 DATA 173, 15, 144, 73, 8,141,15, 144, 96
```

```
LDA $900F
EOR #08
STA $900F
RTS
```

M Davies

Commodore 64 moving message

In the Apple II europlus' Hello program it has, down the bottom of the screen a moving message. This program will make a message of your choice move across the screen.

As this is a typeset copy of the program there are a few points you should note before typing this program.

'S' means CLR/HOME
'R' means CTRL — RVS ON
'Q' means CRSR DOWN

```
10 A$=" THIS IS THE MESSAGE " :REM PUT YOUR MESSAGE HERE
20 FOR A = 1 TO 75 : NEXT : REM CONTROLS SPEED OF MESSAGE
30 PRINT"SRQQQQQQQQQQQQQQQQQQQQ";
40 LEFT$(A$,39);
50 A$=MID$(A$,2)+LEFT$ 9a$,1):GOTO 20
```

J Williams

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!

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. In the words of *The Hitch-hiker's Guide to the Galaxy:* Don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which the computer's output is displayed.' This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *APC.*

For those completely new to computing, let's start with the question: What is a microcomputer? We can think of a micro as: a general-purpose device in contrast to a typewriter, which can only be used for typing; a calculator, for performing calculations; a filing cabinet, for filing information, to name just a few of its functions. A micro can do all these things and more.

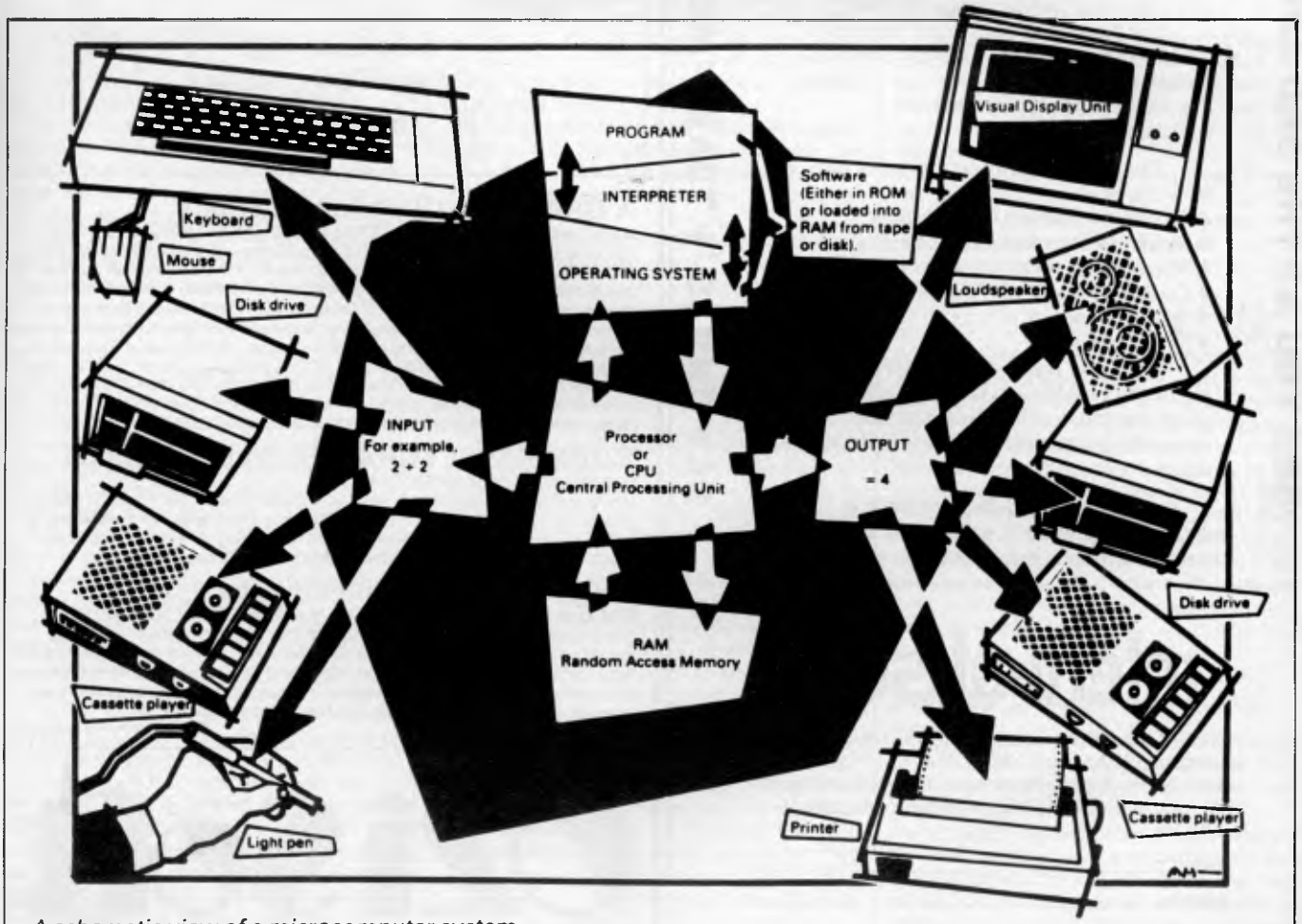
If it's to be of any use, a general-purpose device needs some way of knowing what to do. We do this by giving the computer a set of logical instructions called a *program.* The general term for computer programs is *software.* Every other part of a microcomputer system is known as *hardware:* 'If you can touch it, it's hardware.'

Programming

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a *code* known as a *computer language.* There are literally hundreds of different languages around, the most popular of these being *Basic.* Basic is an acronym of *B*eginners' *A*ll-purpose *S*ymbolic *I*nstruction *C*ode. Although originally intended as a simple introductory language, Basic is now a powerful and widely used language in its own right.

Other languages you're likely to come across in *APC* are *Forth, Pascal, Logo, C* and *Comal* to name but a few. These are known as *high level* languages because they approach the sophistication of a human language. You'll also see references in *APC* to the *low level* languages, *assembly language* and *machine code.* We'll look at these in a moment.

The heart of a micro, the workhorse, is the *processor* or *C*entral *P*rocessing *U*nit *(CPU).* The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor available, *Z80, 6502, 6800* and *8088* being just a handful (literally) of the types in common use. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.



A schematic view of a microcomputer system

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64 apple VIC 20

BIG LITTLEBITS

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As it's electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by *binary* (base two) notation, the two binary digits (known as *'bits'*) being 0 and 1. It's possible to program computers in binary notation, otherwise known as machine code (or machine language) programming.

Machine code is called a low level language because it operates at a level close to that 'understood' by the processor. Languages like Basic are known as high level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.

Between high level languages and machine code is a low level language known as assembly language or, colloquially, *assembler.* This is a mnemonic code using symbols which the processor can quickly convert to machine code.

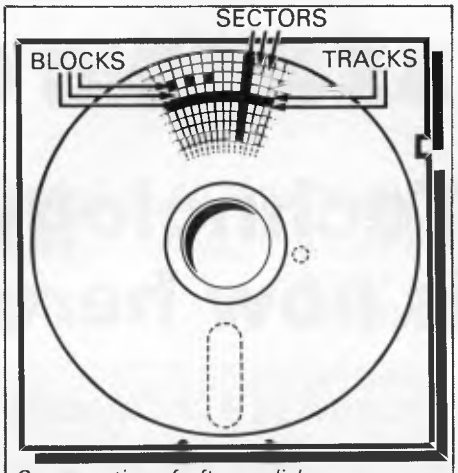
Since everything has to be converted into binary form before the processor can make sense of it, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the *A*merican *S*tandard *C*ode for *I*nformation *I*nterchange, *ASCII.* This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

A program written in a high level language must be converted into binary before the processor can carry out its instructions. We could of course do this manually, but since this is exactly the sort of tedious job computers were designed to do for us, it makes much more sense to write a program to do it.

There are two types of program to do this translation for us.

The first of these is a *compiler* which translates our whole program permanently into machine code. When we *compile* a program, the original high level language version is called the *source code* while the compiled copy is called the *object code.* Compiled programs are fast to run but hard to edit. If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code. For this reason there is a second translation program: an *interpreter.* An interpreter waits until we actually *run* (use) the program, then translates one line at a time into machine code — leaving the program in its original high level language. This makes it slower to run than a compiled program, but easier to edit.

There are two unusual Basic words you're likely to come across: *POKE* and *PEEK.* When you program in a high level language, you are normally unable to choose in which part of the machine's memory the processor will store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'poke' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above poke with 'PEEK (10000)', the computer would respond by displaying the value 56. POKEing and PEEKing is normally done to increase program speed, but may also allow us to do things which could not be done through Basic.



Cross-section of a floppy disk

Memory

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of *memory.* There are two types of memory: *Read Only Memory (ROM)* and the badly named *Random Access Memory (RAM).* ROM is so-called because the processor can 'read' (get things out of) its contents, but is unable to 'write to' (put things in) it.

ROM is used to store *firmware*, the name given to software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and *data* (information). The second important difference is that RAM needs a constant power supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

There is a type of RAM, known as *CMOS RAM*, which requires only a tiny amount of power to retain its contents. This is found in portable computers like the Tandy 100. It is usually powered by small ni-cad batteries so that programs and data are retained even when the main power is switched off. At present, CMOS RAM is extremely expensive and is not likely to be used in desktop machines for a little while yet. (CMOS stands for *C*omplementary *M*etal *O*xide *S*emiconductor).

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8 bit binary number. 8 bits make one *byte* and 1024 bytes make one *Kilobyte* or *1k.* 32k, for example, means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 . . , 1024 being the nearest binary multiple to 1000.

While we're on the subject of bits, you'll often see computers and their processors described in terms of their *bit power: 8-bit, 16-bit, 32: 16-bit* and so on. This is a means of describing how large a binary number the processor can handle in one chunk. A binary number, incidentally, is known — confusingly — as a *word.* An 8-bit processor, for example, can handle 8-bit words, that is, up to 11111111 (255 in decimal). Anything larger than this has to be broken down into manageable chunks before it can be processed.

A 16-bit machine can handle bigger chunks of data at a time. This means it can handle (*'address'*) larger amounts of memory at one time. This is why most 8-bit machines have a maximum of 64k RAM while 16-bit micros usually have 128k upwards.

As 16-bit processors can handle larger words than an 8-bit machine, they ought to be twice as fast. In practice, however, there is a little more to it than that. While it may take a 16-bit machine half as long to work out that 2+2=4, the actual processing is only part of the story.

The result of the calculation has to be placed into the appropriate memory location, passed to the screen or whatever is required. The transfers to and from the processor are often made in 8-bit form; this is why you'll hear people arguing that certain processors are not 'true' 16-bit. If the problem has to be handed to the processor in 8-bit form, turned into 16-bit, calculated and then the result turned back into 8-bit for transfer elsewhere, there may be little or no saving in time over an 8-bit system.

The other factor affecting speed is that the actual processing may form only a small part of the overall operation. A word processor, for example, spends most of its time passing files to and from disk and waiting for the user to type the next character. The processing itself consumes very little time. And if you look at the Benchmarks summary *(APC*, February 1984, pp 59-60), you'll see some 8-bit machines beating their 16-bit rivals — even in processor-bound operations like the *APC* Benchmarks.

Returning to the subject of RAM for a moment, a word of warning: Don't rush out with your new-found understanding to buy the machine offering you the most RAM for your money. Quite aside from the fact that the amount of RAM is by no means the only consideration when buying a micro (no matter how much manufacturers may stress it), different machines use differing amounts of RAM for things like graphics. Always check how much RAM is actually available to the user for program storage. Machines which proudly proclaim '64k' may well leave you with less than half of this in which to store Basic programs and data.

Back-up storage

There are numerous forms of *permament* or *back up storage*, but by far the most common are *floppy disk*, *floppy tape* and *cassette.*

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a *disk drive.* Disk drives comprise a high-speed motor to rotate the disk and a

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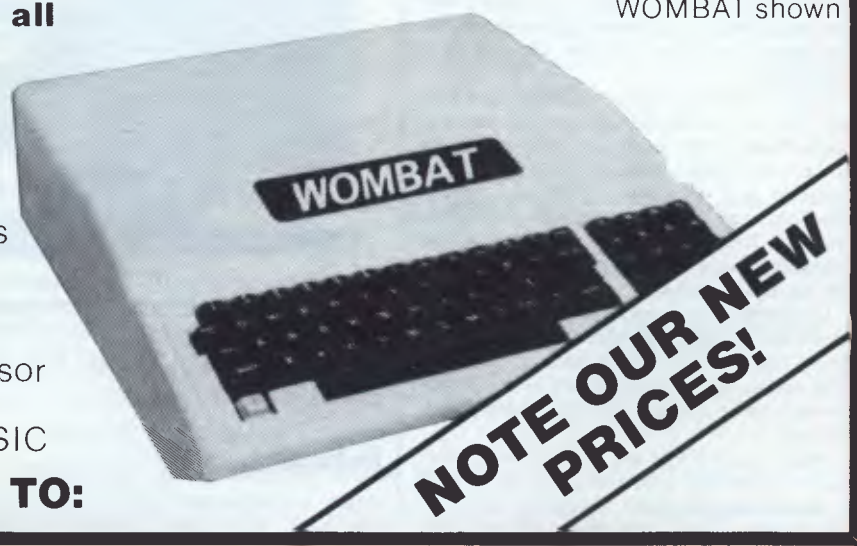
Standard case WOMBAT shown



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read/write head to record and 'play back' programs and data.

The disk is divided into concentric rings called *tracks* (similar to the tracks on an LP) which are in turn divided into small *blocks* by spoke-like divisions called *sectors*.

There are two methods for dividing the disk into sectors. One method is called *hard sectoring*, where holes punched in the disk mark the sectors, and the other is *soft sectoring* where the sectors are marked magnetically. The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers have apparently begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible.

Since the computer needs some way of organising the disk, we have a program called a *Disk Operating System (DOS)*, usually known simply as the *Operating System (OS)*. The operating system does all the 'housekeeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available, each with its own advantages and disadvantages. The three most popular OSs are *CP/M* (*C*ontrol *P*rogram for *M*icros), *MS-DOS* (*M*icro*S*oft *D*isk *O*perating *S*ystem) and *PC-DOS* (*P*ersonal *C*omputer *D*isk *O*perating *S*ystem). MS-DOS and PC-DOS, incidentally, are all but identical.

Disks can support what are known as *random access files*. That is, you can randomly choose a point in a file and the drive head will move directly to that point. You can then edit the file, and only the blocks affected will be rewritten. The rest of the file remains unchanged.

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and adequate for games, for example.

Cassettes can support only *serial access files*. That is, whenever a file is to be edited, the whole file must be written back to the tape. This makes certain applications — word processing being a prime example — extremely tedious.

Floppy tape drives are a compromise between speed and cost. They use a small continuous loop tape which, like a disk, is divided into blocks. Floppy tape drives rely on serial access files, but by rotating the tape at high speed and using the block markers, they can simulate random access files.

Another type of disk you'll see referred to is the *hard disk*. This is an extremely efficient method of storing large amounts of data. Hard disk capacity generally starts at around 10 *Mbytes* (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Input/output

Since computers need some way of communicating with the outside world, we need *input* and *output* devices. Input and output devices include all manner of things from hard disk units to light pens, but the minimum requirement for most applications is a typewriter-style *keyboard* for input and a TV-like *Visual Display Unit* for output. The Visual Display Unit is variously referred to as a *VDU*, *Cathode Ray Tube (CRT)* and monitor.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, and so on, may all be built into a single unit or they may be separate, connected by cables.

Take this paragraph slowly and it will make sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — *parallel* or *serial*. Parallel *input/output (I/O)* requires a number of parallel wires. Each wire carries one bit, so with eight wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). Serial I/O, in contrast, uses a single wire to transmit a series of bits one at a time (that's why it's called serial), with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different *interfaces*. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the *RS232* (or *V24*) while the Centronics standard is popular for parallel interfaces.

Networks

When two computers want to communicate with each other over a distance, there are again two ways of doing it (nothing is ever clear-cut in the world of micros — you'll get used to it). Both methods use the public phone network. The first is known as an *acoustic coupler*. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. The acoustic coupler is convenient in that you can unplug it from one computer and plug it into another one in a matter of seconds. They are generally slow, however, and prone to interference.

The alternative method is to use a *modem*. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from Telecom.

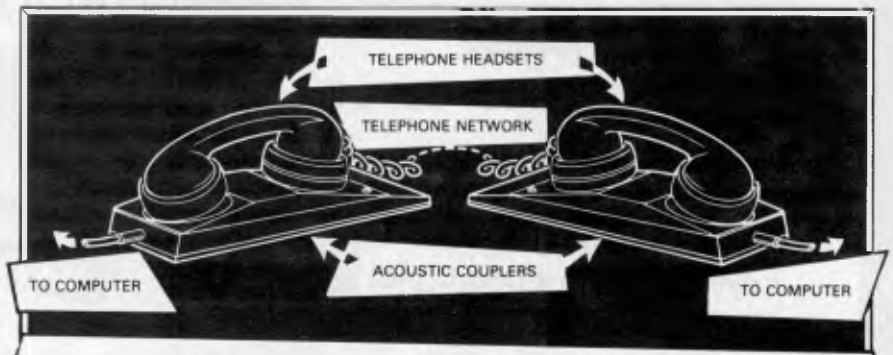
A term you'll hear used in connection with acoustic couplers and modems is *baud rate*. The baud rate is a measure of the speed at which a device can transmit and receive data. You can safely think of the baud rate as being bits-per-second, though the accurate definition is a little more complex. Therefore, a 300-baud modem can transmit/receive data at the rate of 300 bits (about 50 characters) per second.

A 1200/75 modem means that it receives at 1200 baud but transmits at 75. Most modems are 1200/75 and acoustic couplers 300/300. By way of comparison, saving programs to cassette is normally done at between 300 and 1500 baud.

Finally, communications between computers is either *full* or *half duplex*. Full duplex is when the machine receiving the data echoes it back to the machine transmitting it and says 'This is what I think you said — is that right?'. If it's wrong, the section will be transmitted again. Half duplex is where no checking is made. If you're ever unsure of which to use, start with full duplex. If everything you type appears on your display twice, then you should switch to half duplex.

Database

A database allows you to store, process and report on structured information. Most of the cheaper packages are based on a traditional card index where each card about an individual, order or item of stock is stored in a single record and a group of like records is stored in a file (corresponding to the index card box). Sophisticated packages can relate several files together, so that you can process groups of dissimilar but related records.



Computer-to-computer communications using acoustic couplers.

Spreadsheet

Spreadsheet software is useful to anyone who regularly uses a calculator. The VDU acts like a 'window' on a large sheet of numbers — neatly laid out in rows and columns, occasionally interspersed with text headings. The user is able to shift the window to the point of interest and so enter text. The rest of the calculation is displayed immediately with automatic recalculations throughout.

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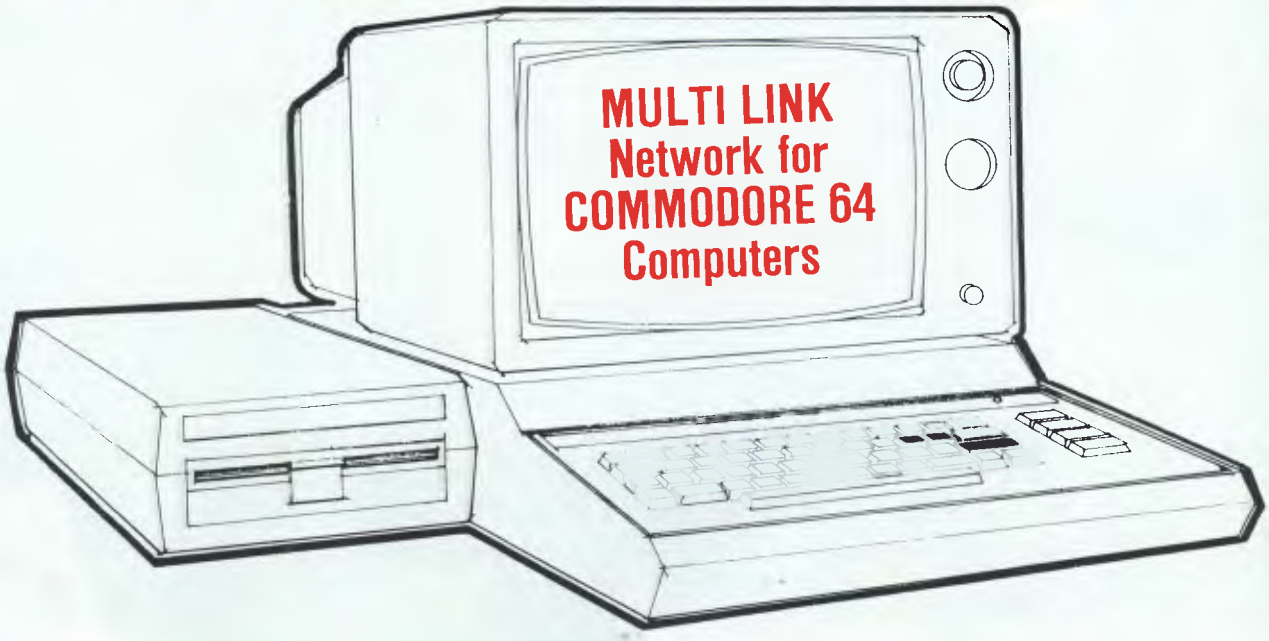

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ATARI

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Wordstar Professional	795.00	695.00
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Hardware excludes sales tax		
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Microspooler	Call	Call
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BLUDNERS

In the April edition the wrong number was published for Philitronic Components and Services. It should read (03) 654 1327, not (03) 639 1402.

The correct address for Typewriter World is 672 George Street, Sydney, NSW 2000.

Last month we forgot to publish the winner of the March Prize Puzzle. The winner is Mr NR Sheehan of Riddells Creek. Your prize will be with you shortly.

Now for the good ones. In TJ's Workshop (April issue), L Zolin passed on his tip of 'Trouble-free saving'. That was all very well, but we forgot to publish the listing so here goes . . .

```
60000 pn$="0[REV]:FILENAME[REV]"
60001 na$=":[REV]FILENAME[REV]"
60002 pt=val(left$(pn$,1)):ifpt=0thenpt=1:goto60004
60003 ifpt=1thenpt=0
60004 pq$=right$(str$(pt),1)+na$
60005 open15,8,15,"i0":print#15,"s0:"+pn$:input#15,a,b$,c:printb$":"pn$;","c
60006 ifa>19thenprint"scratch error":goto60009
60007 savepn$,8:input#15,a,b$,c,d:ifa>19thenprint "save error":goto60009
60008 verifypn$,8:input#15,a,b$,c,d:ifa>19thenprint "verify error"
60009 print"[CLR]dos status ="a;" ";b$;" "c;d:close15:print"[DEL]"
60010 poke631,13:poke198,1:print"60000 pn$="chr$(34)pq$chr$(34)"[CLR]":end
```

For those of you trying to run 'HIRES EDITOR' (MicroBee program in May *APC*), don't bother. Lines 00100 to 00350 were missing, so we're making amends by publishing the missing listing and including a tip to speed up the painfully slow printing routine.

```
00100 cls:underline:print"HIRES screen editor"\"and printer rout
ine for LPVII (Seikosha family)"\"LKS 840329":normal

00110 print\"Special function keys :"\"ESC=cursor right  TAB=cur
sor up  BS=cursor left  LF=cursor down"\"CTRL+L toggles between
the graphic and character modes."

00120 print"Top r/h corner shows graphic bytes free and"\"draw (
1) / erase (-1) flag toggled by DEL in graphic mode."\"In chara
cter mode DEL resets the byte under cursor to graphic."


00130 print\"To start printing, press BREAK and then CTRL+P"\"
Printer must be on line ! CTRL+P will return to editor"\"Number
in r/h top corner shows number of graphic line printing"


00140 curs 960:print "Press any key to continue";:if key="" then
 140

00150 cls:hires:poke220,64:U=128

00160 rem Screen display

00170 plot 0,0 to 479,0 to 479,255 to 0,255 to 0,0

00180 P1=3.14159:X=240:Y=128:plot X,255 to X,0:plot 0,Y to 479,Y
:S0=60/63:R1=128:for Y0=0 to P1 step P1/1E2:H=int(R1%cos(Y0)%90)
:V=int(R1%sin(Y0)):set X+H,Y+V:set X-H,Y-V:next Y0

00190 curs 16,15:print "C I R C L E scaled for printer":curs 15,
2:print "HIRES screen editor LKS 840329":for A=1 to 16:curs 3,A:
print CI3 A];:curs 53,A:print CI3 A];:next A

00200 rem Screen editor

00210 F=-1:X=240:Y=128

00220 poke 140,1:on error goto 540

00230 rem Character mode

00240 Z=(255-Y)/16%64+X/8

00250 if Z<0 then let Z=0 else if Z>1022 then let Z=1022

00260 gosub 520:print chr$(0);

00270 K=asc(key):if K=U then 270

00280 if K=3 then 560

00290 if K=12 then 370

00300 if K=9 then let Z=Z-64

00310 if K=27 then let Z=Z+1

00320 if K=8 then let Z=Z-1

00330 if K=10 then let Z=Z+64

00340 if K<32 then 250 else if K=127 then let K=U:Z=Z-1

00350 print CA1 K];:Z=Z+1:goto 250
```

The printing routine can be speeded up by replacing graphic blanks, which have to be sent to the printer as five bytes, by character blanks, which need only one byte. The following line will achieve this:

```
00605 FOR A=S TO S+1023:IF PEEK(A)=U THEN POKE A,32:NEXT A ELSE NEXT A
```

To minimise Graphic-on-character errors in the Graphic mode, the following line will do the reverse:

```
00375 S=61440:U=128:FOR A=S TO S+1023:IF PEEK(A)=32 THEN POKE A, U:NEXT A ELSE NEXT A
```

LAZING AROUND

by J J Clessa

Quickie

If I spend one quarter of my money and give away three quarters of the remainder, I have 30c left. How much did I have to start with?

Prize puzzle

The telephone numbers of two friends of mine are most unusual. Each number is a six-digit perfect square, the square root of which is equal to the sum of the two three-digit numbers formed if the original number is split into two halves.

To illustrate, if the number is 1 2 3 4 5 6, then $1\ 2\ 3\ 4\ 5\ 6 = (123 + 456)^2$.

Can you tell me what the two telephone numbers are?

Answers, on postcards only please, to: Prize Puzzle June 1984, Lazing Around, *APC*, 77 Glenhuntly Road, Elwood 3184 to reach this office not later than 15 July '84.

April prize puzzle

As frequently happens, it turns out that a solution exists of which we were unaware, so there are two solutions. They are:

1 Peter ..... $512 or 388.80
2 Paul & Albert ..... $320 or 64.80
3 Sally & Mary ..... $200 or 10.80
4 Michael ..... $125 or 1.80

The winning entry came from NR Sheehan of Riddells Creek. Well done, Mr Sheehan, your prize will be with you shortly.

NETWORK NEWS

Q: When is a bulletin board not a bulletin board?
A: When it's a Citadel — Peter Tootill and Steve Withers explain.

As the name suggests, most computerised bulletin boards are modelled on the pen and paper bulletin boards found in your local supermarket. Citadel adopts a different metaphor — "that of a building consisting of a series of independent rooms, each of which hosts a discussion devoted to a particular topic" (David Mitchell, one of the developers of Citadel).

Citadel has a number of interesting features including provision for networking to other Citadel systems and both private and closed-group messages. Privacy is achieved by "hiding" the name of the room, making the room "invisible" to users who don't know its name.

Several people are experimenting with Citadel in Australia, but we don't know of any that are open to callers. If you have a Bell modem (and don't care about the phone bill), try these US numbers:

0011 1 206 839 4759 (SPACE Citadel)
0011 1 206 329 0436 (Ckcms Citadel)
0011 1 206 527 7638 (Eskimo North Minibin)

Network Jargon

The idea of parity (in the context of communications) is to increase the probability of a message being transmitted without errors caused by noise on the line. To be more precise, parity checking allows the detection (but not correction) of any single bit error in a character.

Last month we used the transmission of the word 'KEY' to discuss start and stop bits, so we'll stick with that example. You may recall that using the ASCII code, the letters are represented as follows:

Letters	Decimal code	Binary code
K	75	1001011
E	69	1000101
Y	89	1011001

What would happen if a 'blip' of line noise coincided with the last bit of the letter 'K', causing the receiving computer to see it as an 0 instead of a 1? Quite simply, it would read the character as a 'J' (decimal 74) instead of a 'K'. This type of error can be detected by using a parity bit.

Let's start by looking at even parity. The idea is that there should be an even number of 1s in the character. In the case of the letter 'K' there are an even number of 1s, so the parity bit should be an 0. On the other hand, 'E' has three 1s, so we must add another 1 as the parity bit. Odd parity works the other way round, of course. The generation and checking of parity bits is usually performed by the serial I/O chip along with the start and stop bits.

The trouble with parity bits is that they only warn you when an odd number of bits have been affected, and they don't tell you which bit(s) were corrupted. What makes things worse is that there is no obvious course of action when a parity

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25	$1.50	$3.00	$5.00	$7.50	$10.00
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35	$2.10	$4.20	$7.00	$10.50	$14.00
40	$2.40	$4.80	$8.00	$12.00	$16.00
45	$2.70	$5.40	$9.00	$13.50	$18.00
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3	$0.15	$0.30	$0.51	$0.75	$1.02
4	$0.20	$0.40	$0.68	$1.00	$1.36
5	$0.25	$0.50	$0.85	$1.25	$1.70
10	$0.50	$1.00	$1.70	$2.50	$3.40
15	$0.75	$1.50	$2.55	$3.75	$5.10
20	$1.00	$2.00	$3.40	$5.00	$6.80
25	$1.25	$2.50	$4.25	$6.25	$8.50
30	$1.50	$3.00	$5.10	$7.50	$10.20
35	$1.75	$3.50	$5.95	$8.75	$11.90
40	$2.00	$4.00	$6.80	$10.00	$13.60
45	$2.25	$4.50	$7.65	$11.25	$15.30
50	$2.50	$5.00	$8.50	$12.50	$17.00
55	$2.75	$5.50	$9.35	$13.75	$18.70
60	$3.00	$6.00	$10.20	$15.00	$20.40
65	$3.25	$6.50	$11.05	$16.25	$22.10
70	$3.50	$7.00	$11.90	$17.50	$23.80
75	$3.75	$7.50	$12.75	$18.75	$25.50
80	$4.00	$8.00	$13.60	$20.00	$27.20
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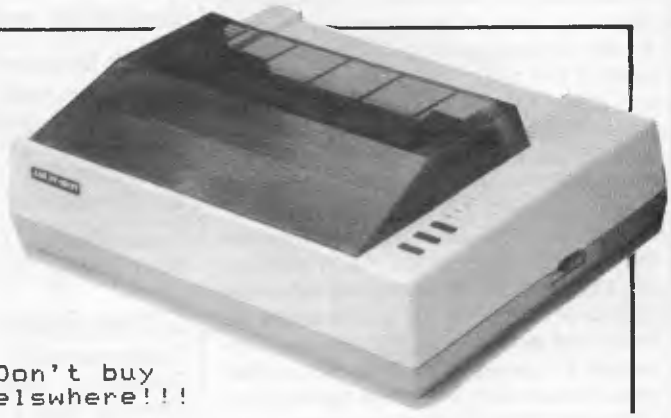

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NETWORK NEWS

error is detected. Some terminals display the letters 'pe' and others a 'splodge'. While some computers ignore the erroneous characters completely, others send back a message saying that a parity error was detected. For this reason most of the systems mentioned in this column don't use parity in an active way — they expect to see a parity bit, but they don't worry if it is an 0 or a 1. This means you can successfully talk to them using seven data bits and any sort of parity — odd, even, mark (always 1) or space (always 0) — or eight data bits and no parity.

If a system provides file transfer facilities, it's most likely that it will use the Christensen protocol. This relies on the use of eight data bits and no parity, so that's the setting you should use. The reason for using eight data bits is that this allows binary files to be transmitted efficiently. Other protocols convert bytes into two seven-bit characters, but this means transmitting twice as many characters and may seriously damage your phone bill.

If you don't know what kind of parity a system uses, our recommendation of eight data bits and no parity still stands, with seven bits and even parity as the next best guess. If neither of these work it's really a matter of trial and error, although we have never found a system that uses seven data bits and no parity.

STD ready reckoner

The chart shown should help you keep track of the cost of calling bulletin boards outside your local call area. It's based on the average costs per minute quoted by Telecom on June 2 1984. We wanted to make the chart more accurate, but despite several phone calls to Telecom and a visit to one of their Business Offices, the average cost was the only information they could (or would) provide. Until they provide more details of their charging algorithm, and we update the chart, bear in mind that calls are metered in 15c units.

System Listings

You will notice a few changes to the overseas listings this month. There are some new numbers and a slightly different layout, but the biggest change is that we no longer list systems which are known to have restricted hours. On the other hand, just because a system is on our list doesn't necessarily mean it is a 24 hour, seven days a week service.

A European magazine lists a bulletin board on Sydney's 997 exchange — as we aren't sure of its accuracy we're not listing the number until we've confirmed that it exists. If any readers know of such a system, please send us whatever details you have.

Australian systems

Micro Design Lab RCPM

Telephone: (02) 663 0150. Hours: 5pm–7am weekdays. 24 hours weekends.

MI Computer Club BBS

Telephone: (02) 662 1686. Program downloading. Hours: 24 hours daily.

Sydney Public Access RCPM

Telephone: (02) 808 3536. System Operators: Barrie Hull and David Simpson. Hours: 24 hours daily.

Software Tools RCPM

Telephone: (07) 378 9530. Hours: 24 hours daily.

MICOM CBBS

Telephone: (03) 762 5088. System Operator: Peter Jetson. Hours: 24 hours daily.

Gippsland RCPM

Telephone (051) 34 1563. System Operator: Bob Sherlock. Hours: 24 hours daily.

Sorcerer Computer Users Association CBBS

Telephone: (03) 836 4616. System Operator: Bruce Alexander. Program downloading for SCUA members. Hours: 24 hours daily.

Perth RMPM

Telephone: (09) 367 6068. Hours: 6pm–9pm WST.

Adelaide Micro User Group BBS

Telephone: (08) 271 2043. Hours: 10am–10pm, weekends and public holidays only.

Darwin RCPM

Telephone: (089) 277 111. Hours: 24 hours daily.

New Zealand systems

NZ Micro Club RBBS

Telephone: 0011 64 9 762 309. System Operator: Chris Cotton, Hours: 24 hours daily. Software up/downloading.

This information is correct and current to the best of our knowledge. Please send corrections and updates to: Steve Withers, C/- *Australian Personal Computer*, 77 Glenhuntly Road, Elwood, Vic 3184.

Overseas systems

North America

SYSTEM	*NUMBER*	*NOTES*
Forum 80	0011 1 816 861 7040	
CBBS	0011 1 312 545 8066	
F88S	0011 1 312 677 8514	
A88S	0011 1 703 255 2192	
ABBS Ottowa	0011 1 613 725 2243	
MA88S Fort Walton Beach	0011 1 904 862 1072	
Bull-80 Alabama	0011 1 205 492 0373	
SPACE Citadel	0011 1 206 839 4759	
Ckcms Citadel	0011 1 206 329 0436	
Eskimo North Minibin	0011 1 206 527 7638	
Conn-80	0011 1 212 441 3755	TRS-80 Color Computer

Europe

ELFA A8C-MONITOR, Sweden	0011 468 730 0706	Half duplex
A8C-Banken, Sweden	0011 463 511 0771	
A8C-MONITOR, Sweden	0011 468 801 523	Password required
C8BSD Gothenburg	0011 463 129 2160	75/1200 baud
C8BS Sweden*	0011 463 169 0754	
XD-8BS Helsinki	0011 358 072 2272	
Commodore BBS, Finland	0011 358 116 223	
Tedas, Munich	0011 49 89 596 422	
Decates, Germany	0011 49 66 154 51433	

UK

C8BS South West	0011 44 626 890 014
Forum-80 Hull	0011 44 482 859 169
Liverpool Mailbox	0011 44 51 428 8924
BASUG	0011 44 742 667 983
Computer Answers	0011 44 1 631 3076
C8BS Surrey	0011 44 4862 25174
Blandford Board	0011 44 258 54494

Africa

Connection 80, CapeTown	0011 27 21 457 750
TRShop, CapeTown	0011 27 21 5367
Clan Computers, Durban	0011 27 31 66356
Peters Computers, Johannesburg	0011 27 11 834 5134
Peters Computers, Johannesburg	0011 27 11 834 5135
War Games, Johannesburg	0011 27 11 642 3722

* After receiving the tone and connecting your modem, either type <C/R> or <COM C/R>. The system then asks for a password which is 'cbbs' in *lower-case* letters. If you only get a '>' from the system, it needs resetting, so type <I> C/R.

BENCHMARKS

A list of Benchmarks used when evaluating micros is given below. An explanation can be found in the February '84 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

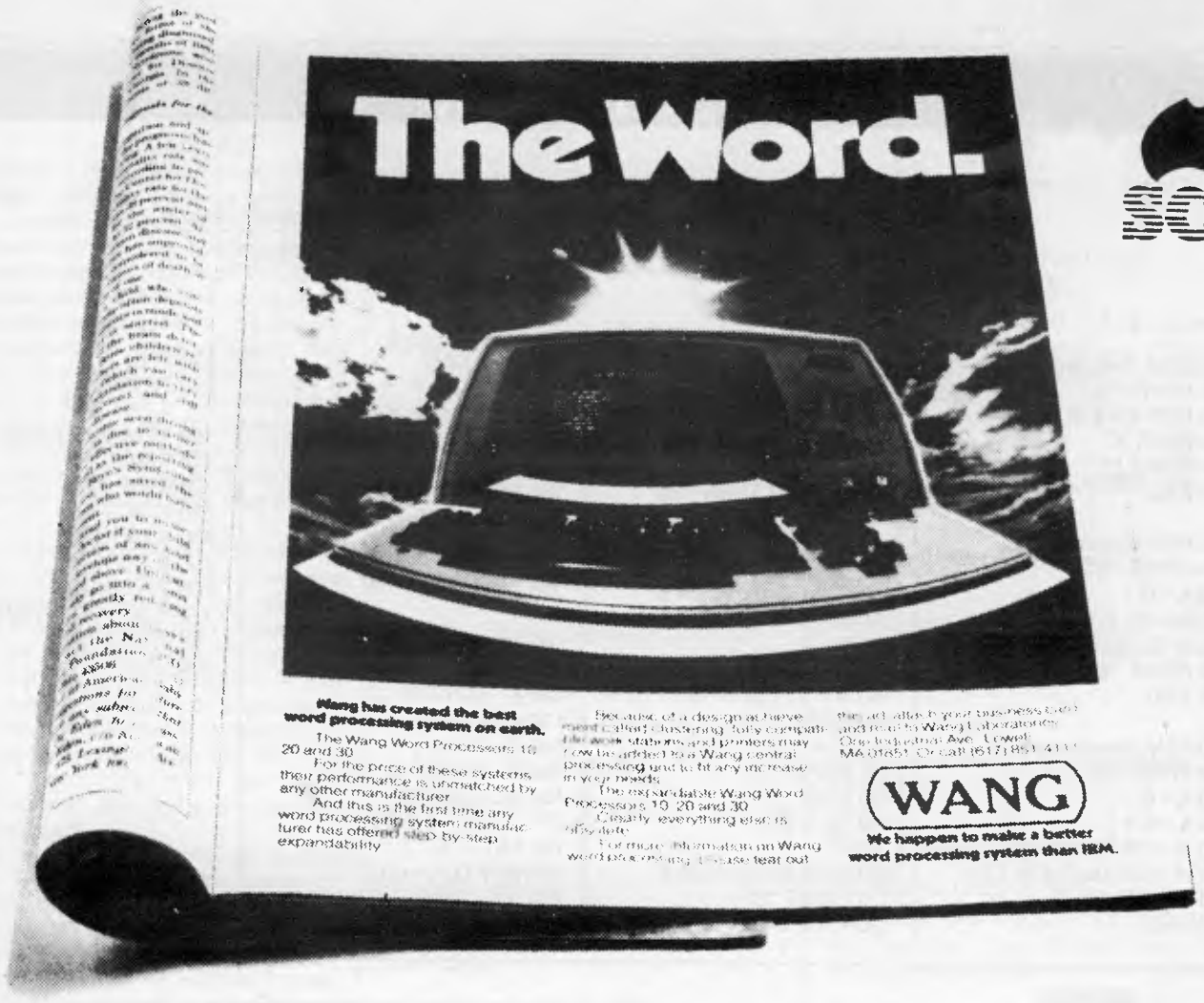
```
100 REM Benchmark 7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 If K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K^2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

DIARY DATA

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.

Melbourne	3rd Australian Personal Computer Show Contact: Australian Exhibition Services.Tel: (03) 267 4500	July 18-21, 1984
Melbourne	Ausgraph '84 Contact: Australasian Computer Graphics Association Tel: (03) 341 6944	September 18-21, 1984
Dallas, USA	PC World Expo Contact: Conference Management Group Tel: (617) 879 0700	October 3-5, 1984
Melbourne	EPOS '84 Contact: Retail Management Development Program Tel: (03) 536 2386	October 15-18, 1984
Brisbane	Computer Expo '84 Contact: Robert Woodland Exhibitions Tel: (07) 372 3380	November 8-11, 1984



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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 number.
All programs are paid for at the rate of $20 per page of published listing. Send contributions to:
APC programs, 77 Glenhuntly Road, Elwood, Vic 3184.

This month's programs offer a great selection of games and utilities.

'Function Keys' provides Atari owners with ten programmable function keys — without hardware mods! For the Commodore 64, a utility to obtain split screen graphics by the use of raster interrupts. 'BBC Sected', a powerful disk recovery program for the BBC micro — a tool which no disk-based BBC owner should be without.

'Balloon" is a game for the Commodore 64 where you guide a balloon through a maze which gets harder and harder. For the VZ 200, your lethal trail is your weapon (and your opponent's) in 'Blockout'. And finally, 'Monster Hunt', a game for the VIC 20, is full of fire-breathing dragons and googles to keep you digging your way to safety.

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

Balloon

by A Roe and D Ponting

In this game for the Commodore 64 you must guide a balloon around a maze, trying to reach the top left-hand corner of the screen. There are 2 separate mazes. When the second maze is completed, an earthquake effect is introduced to make the game even harder.

You could replace one of the given mazes with one of your own and challenge a friend to complete it.

```
 1 REM  ********************************
 2 REM  *                              *
 3 REM  *   BALLOON                    *
 4 REM  *                              *
 5 REM  * COMPUTER   : COMMODORE 64    *
 6 REM  * LANGUAGE   : BASIC 2         *
10 REM  * PROG.TYPE  : MAZE GAME       *
11 REM  *  DATE       : 6-11-83         *
14 REM  *                              *
15 REM  ********************************
17 GOSUB2000
20 POKE53280,6:POKE53281,6:PRINT"■";:HS=0:BAL=3:QQ=1
30 SC=1000
40 RESTORE:ONQQGOSUB10000,11000
50 SW(1)=14:SW(2)=13:SW(3)=15:SW(4)=13:DX=1:DY=2:N=2
```

PROGRAMS

```
1062 PRINT"■■■■■     ■"
1063 PRINT"■■■■■■■1000■"
1064 PRINT"■■■■■■■     ■"
1070 GOTO7000
2000 REM TITLE
2010 POKE53280,13:POKE53281,13
2020 PRINT"■■";
2030 PRINT"         B A L L O O N   F U N
2040 PRINT"■■■  GUIDE YOUR BALLOON THROUGH THE MAZES■
     USING:-"
2050 PRINT"                    F 5
2052 PRINT"                     |
2055 PRINT"                     |
2060 PRINT"           CBM ------+------ SHIFT
2062 PRINT"                     |
2065 PRINT"                     |
2070 PRINT"                    F 7
2080 PRINT"■YOU CAN ALSO MOVE DIAGONALLY.FOR EXAMPLE
     PRESS F5 AND CBM ";
2085 PRINT"AT THE SAME TIME"
2090 PRINT"■     ■ OR USE A JOYSTICK IN PORT 2 ■
2100 PRINT"■      BONUS BALLOON FOR 5000 PTS"
2110 PRINT"■ CHOOSE KEYBOARD OR JOYSTICK CONTROL"
2120 INPUT"   (K - J)       ■■■■■";K$
2130 IFK$<>"J" AND K$<>"K"THENPRINT"■■":GOTO2120
2140 IFK$="J"THENK=1
2150 IFK$="K"THENK=2
2200 RETURN
2500 GOTO2500
4000 REM GAME OVER
4010 PRINT"■■":POKESP+21,0
4015 POKE53280,2:POKE53281,2
4020 PRINT"■■■■■■■■■■"TAB(11)"G A M E   O V E R"
4025 PRINT"■■■"TAB(11)"YOUR SCORE WAS"HI
4030 PRINT"■■■"TAB(5)"■ PRESS ANY KEY TO PLAY AGAIN "
4035 FORI=0TO50:GETA$:NEXT
4040 GETA$:IFA$=""THEN4040
4050 RUN
5999 :
6000 REM *** JOYSTICK ***
6005 REM ***   CONTROL PORT 2  ***
6010 ONKGOTO6015,6040
6015 JV=PEEK(56320)
6020 IF(JVAND1)=0THENSY=SY+2*(SY>1)
6025 IF(JVAND2)=0THENSY=SY-2*(SY<255)
6030 IF(JVAND4)=0THENSX=SX+2*(SX>1)
6035 IF(JVAND8)=0THENSX=SX-2*(SX<350)
6037 GOTO6062
6040 K1=PEEK(197):K2=PEEK(653)
6042 IF(K1=6)THENSY=SY+2*(SY>1)
6044 IF(K1=3)THENSY=SY-2*(SY<255)
6046 IF(K2=2)THENSX=SX+2*(SX>1)
6048 IF(K2=1)THENSX=SX-2*(SX<350)
6062 ONFL GOSUB9000
6070 POKESP,SX+256*(SX>255):POKESP+16,(PEEK(SP+16)
     AND254)OR-(SX>255):POKESP+1,SY
6073 IFSW=5THENSW=0:POKE2040,SW(N):N=N+1:IFN=5THENN=1
6074 SW=SW+1:SC=SC-1:GOSUB10230
6075 IFPEEK(SP+31)<>0THEN8000
6080 GOTO6010
6999 :
7000 REM DEFINE SPRITES
7010 SP=53248
7020 FORT=0TO191:READA:POKE832+T,A:NEXTT
7030 POKE2040,13
7040 POKESP+21,1:POKESP+39,7
7045 SX=310:SY=218
7050 POKESP,SX+256*(SX>255):POKESP+16,(PEEK(SP+16)
     AND254)OR-(SX>255):POKESP+1,SY
7060 PP=PEEK(SP+31)
7499 :
7500 REM SET UP SID
7510 SO=54272
7520 FORT=0TO28:POKESO+T,0:NEXT
7530 POKESO+5,9:POKESO+6,240:POKESO+24,15:POKESO,200
7599 GOTO6000
7600 :
7610 :
8000 REM HIT
8002 IFSX<68 AND SY<70THEN9500
8005 POKESO+4,33
8010 FORT=10TO35:POKESO+1,T:POKE53280,T:NEXTT:POKE53280,6
8015 POKESO+4,32
```

PROGRAMS

```
 8020 SX=310:SY=220:BAL=BAL-1:HI=HI+(250-SY):SC=1000:
      GOSUB10220
 8025 IFBAL<1THEN4000
 8027 POKESP,SX+256*(SX>255):POKESP+16,(PEEK(SP+16)
      AND254)OR-(SX>255):POKESP+1,SY
 8030 PP=PEEK(SP+31)
 8050 GOTO6080
 8999 :
 9000 REM EARTHQUAKE
 9010 POKE53270,(PEEK(53270)AND248)+X:X=X+DX:IFX=7 OR X=0
      THEN DX=-DX
 9100 RETURN
 9499 :
 9500 REM BONUS !  START NEW GAME
 9510 IFSX>40 AND SY>56THEN6080
 9512 SX=310:SY=220:HI=HI+(1000-SC):SC=1000
 9513 IFBAL<1THEN4000
 9515 PP=PEEK(SP+31)
 9520 HI=HI+1000:00=00+1
 9530 IFHI>5000 AND IH=0THEN BAL=BAL+1:IH=1
 9540 IFQQ>2THENQQ=1:FL=1
 9550 GOSUB10220
 9555 POKESO+4,17:FORNN=1TO10
 9560 FORT=20TO40STEP2:POKESO+1,T:NEXTT
 9570 FORT=40TO20STEP-2:POKESO+1,T:NEXTT
 9580 NEXTNN:POKESO+4,16
 9614 POKESP,SX+256*(SX>255):POKESP+16,(PEEK(SP+16)
      AND254)OR-(SX>255):POKESP+1,SY
 9615 PP=PEEK(SP+31)
 9620 GOTO40
 9999 :
10000 PRINT"■■**********************************************"
10002 PRINT"**           ***************          ****";
10004 PRINT"**                  ********         *****";
10006 PRINT"**                    ***           *******";
10008 PRINT"********              *                 **";
10010 PRINT"******                                  **";
10012 PRINT"******       **                        ****";
10014 PRINT"*****       *****         ******       ****";
10016 PRINT"**         ********     *********      ***";
10018 PRINT"***      ************************       **";
10020 PRINT"**      ***********************         **";
10022 PRINT"****      ********************          **";
10025 PRINT"*****      ********************         **";
10027 PRINT"******    ************     ****         **";
10030 PRINT"*******    ******             **        **";
10035 PRINT"**                                      **";
10040 PRINT"**                         **           **";
10045 PRINT"**                        ****          **";
10050 PRINT"**     ***********************************";
10060 PRINT"**                                      **";
10070 PRINT"**                                       *";
10080 PRINT"****                                     *";
10090 PRINT"*********************                    *";
10095 PRINT"**********************************************";
10199 :
10200 REM SCORE UP-DATE
10210 PRINT"■ TIME           BALLOONS     SCORE"
10220 PRINT"■"TAB(23)BAL"■ "TAB(32)HI"■ "
10225 POKESP+21,1
10230 PRINT"■"TAB(6)SC"■ "
10290 RETURN
10999 :
11000 PRINT"■■**********************************************"
11002 PRINT"*          *        *****         ********";
11004 PRINT"*                  *****           ******";
11006 PRINT"*                  ****             *****";
11008 PRINT"*********   ***    **     *****     ******";
11010 PRINT"****************          *******    *****";
11012 PRINT"****************         *********   *****";
11014 PRINT"*******     *******     **********    ****";
11016 PRINT"******       **********    ****      ***";
11018 PRINT"*****         ********        *       ***";
11020 PRINT"****     **    *****                 ******";
11022 PRINT"***      ***    ****       **          ****";
11025 PRINT"***     *****    **      ******     *******";
11027 PRINT"**     ******          *********      ****";
11030 PRINT"**      ******         *********     ******";
11035 PRINT"****      ******     ************       **";
11040 PRINT"**     ************************     ******";
11045 PRINT"***      ********************     *******";
11050 PRINT"**      **********      ********    ******";
```

PROGRAMS

```
11060 PRINT"*      *******          ********    ****";
11070 PRINT"***                                   *";
11080 PRINT"*****             ***                 *";
11090 PRINT"******          ********              *";
11095 PRINT"*****************************************";
11100 GOSUB10200:RETURN
19999 :
20000 REM *** SPRITE BALLOON 1 ***
20002 DATA0,254,0,3,255,128,7,255,192,15,255,224
20003 DATA15,255,224,15,255,224,7,255,192,3,255,128
20004 DATA0,254,0,0,56,0,0,56,0,0,16,0
20005 DATA0,16,0,0,16,0,0,16,0,0,16,0
20006 DATA0,124,0,0,124,0,0,124,0,0,0,0
20007 DATA0,0,0,0
20020 REM *** SPRITE BALLOON 2 ***
20022 DATA0,254,0,3,255,128,7,255,192,15,255,224
20023 DATA15,255,224,15,255,224,7,255,192,3,255,128
20024 DATA0,254,0,0,56,0,0,56,0,0,16,0
20025 DATA 0, 60, 0, 0, 16, 0, 0, 32, 0, 0, 64, 0
20026 DATA 12, 128, 0, 63, 0, 0, 31, 128, 0, 15, 192, 0
20027 DATA 7, 128, 0, 0
20100 REM *** SPRITE BALLOON 3 ***
20102 DATA0,254,0,3,255,128,7,255,192,15,255,224
20103 DATA15,255,224,15,255,224,7,255,192,3,255,128
20104 DATA0,254,0,0,56,0,0,56,0,0,16,0
20105 DATA 0, 60, 0, 0, 8, 0, 0, 4, 0, 0, 2, 0
20106 DATA 0, 1, 96, 0, 0, 240, 0, 3, 248, 0, 3, 240
20107 DATA 0, 1, 224, 0
```

Atari Function keys

by Paul Lay

'Function keys' provides programmable function keys on Atari micros. 16k is required on cassette-based systems and 32k for disk machines.

On the Atari, CTRL, SHIFT and any other key pressed simultaneously is normally ignored. This program modifies the keyboard interrupt routine to trap CTRL-SHIFT-key combinations and the deferred vertical blank interrupt routine, to allow these combinations to be used. The net result is that CTRL + SHIFT + a numeric key (0-9) can now be treated as a programmable function key.

To run the program, select KEYBOARD for input, then choose the key you wish to define and enter the string to be assigned to the key. Note that any control characters will be displayed, so the 'cursor down' character, for example, will appear rather than the cursor moving down a line. When the function key is used, however, the control characters will have their usual effect. Note that the RETURN key, when pressed, will be displayed as an 'E' over an 'L' but will be interpreted as a RETURN.

Each key can be assigned up to 113 characters. The emulator occupies locations 1536 to 1704 inclusive of RAM page 6. The code for the function keys is placed 38 pages below RAMTOP; this allows a GRAPHICS 8 screen to be used.

```
10 REM ****************************
20 REM *                          *
30 REM *  PROGRAMMABLE FUNCTION   *
40 REM *                          *
50 REM *  KEY EMULATOR / EDITOR   *
60 REM *                          *
70 REM *    (C) 1984 Paul Lay     *
80 REM *                          *
90 REM ****************************
100 REM
110 REM Machine Code For Emulator
120 REM
130 DATA 32,64,21,72,169,0,141,12
```

```
140 DATA 0,169,6,141,13,0,173,106
150 DATA 0,56,233,38,141,205,0,169
160 DATA 0,141,204,0,160,125,162,6
170 DATA 169,7,32,92,228,160,51,162
180 DATA 6,120,140,8,2,142,9,2
190 DATA 88,104,96,138,72,173,204,0
200 DATA 208,63,173,9,210,162,9,221
210 DATA 149,6,240,8,202,16,248,104
220 DATA 170,76,190,255,169,0,141,138
230 DATA 6,141,139,6,138,72,162,7
240 DATA 14,139,6,10,144,3,238,139
250 DATA 6,202,208,244,141,138,6,173
260 DATA 139,6,24,109,205,0,141,139
270 DATA 6,104,170,189,159,6,141,204
280 DATA 0,104,170,104,64,173,252,2
290 DATA 201,255,208,14,174,204,0,240
300 DATA 9,189,0,122,141,252,2,206
310 DATA 204,0,76,98,228,223,222,218
320 DATA 216,221,219,243,245,240,242
330 DATA 0,0,0,0,0,0,0,0,0,0
340 FOR A=1536 TO 1704:READ B
350 POKE A,B:NEXT A:A=USR(1540)
360 REM
370 REM Emulator now executing
380 REM so run editor
390 REM
400 DIM CODE$(1280),SIZE(10),FN$(15),IN$
(15)
410 FOR F=0 TO 9:SIZE(F)=0:NEXT F
420 GRAPHICS 0:OPEN #1,12,0,"E"
430 TRAP 430:? CHR$(125):POKE 16,64:POKE
 53774,64:CLOSE #3
440 POKE 752,1:POSITION 10,2
450 ? "FUNCION KEY EDITOR"
460 POSITION 10,3
470 ? "__________________"
480 POSITION 15,4:? "MAIN MENU"
490 POSITION 15,5:? "_________"
500 POSITION 9,7
510 ? "Enter Functions From"
520 POSITION 15,10:? "KEYBOARD"
530 POSITION 15,13:? "CASSETTE"
540 POSITION 15,16:? "DISKETTE"
550 POSITION 7,20
560 ? " SELECT  to choose option"
570 POSITION 10,22
580 ? " START  when ready"
590 A=0:B=1
600 COLOR 160:Z=A:GOSUB 1850
610 COLOR 32:Z=B:GOSUB 1850:B=A
620 C=PEEK(53279):IF C=6 THEN 660
630 IF C<>5 THEN 620
640 A=A+1:IF A>2 THEN A=0
```

PROGRAMS

```
650 FOR F=152 TO 0 STEP -8:SOUND 0,F,10,
14:NEXT F:GOTO 600
660 FOR F=254 TO 0 STEP -2:SOUND 0,F,8,1
4:NEXT F:SOUND 0,0,0,0
670 ? CHR$(125):POSITION 12,2
680 ? "______________":POSITION 12,1
690 M=256*PEEK(205):POKE 752,0
700 ON A+1 GOTO 710,1510,1770
710 ? "KEYBOARD ENTRY":POKE 764,255
720 ? :? :? "Enter KEY Number )";
730 INPUT #1,N:N=INT(N)
740 IF N<0 OR N>9 THEN 670
750 ? :? "Use  OPTION  To FINISH"
760 ? :? "Use  START  To DELETE"
770 ? :? " KEY ";CHR$(176+N);CHR$(160)
780 ? :POKE 766,1:OPEN #2,4,0,"K"
790 C=0
800 POKE 764,255
810 CH=PEEK(764):CN=PEEK(53279)
820 IF CN=6 THEN 950
830 IF CN=3 THEN 980
840 IF CH=255 THEN 810
850 C=C+1:IF C<=113 THEN 880
860 POKE 766,0:? CHR$(253);
870 POKE 766,1:C=113:GOTO 800
880 CODE$(128*N+C,128*N+C)=CHR$(CH)
890 IF CH=12 THEN ? CHR$(27);:FOR F=50 T
O 0 STEP -1:SOUND 0,F,10,14:NEXT F:GOTO
800
900 IF CH=39 THEN ? CHR$(210);:GOTO 800
910 IF CH=60 THEN ? CHR$(236);:GOTO 800
920 IF CH=124 THEN ? CHR$(213);:GOTO 800
930 IF CH=188 THEN ? CHR$(195);:GOTO 800
940 GET #2,B:? CHR$(B);:GOTO 800
950 POKE 766,0:? CHR$(126);
960 POKE 766,1:C=C-(C>0)
970 FOR F=200 TO 250:SOUND 0,F,6,14:NEXT
 F:SOUND 0,0,0,0:GOTO 800
980 FOR F=0 TO 250 STEP 2:SOUND 0,F,8,14
:NEXT F:SOUND 0,0,0,0
990 SIZE(N)=C:POKE 766,0
1000 POSITION 9,17:? "Do You Want To Edi
t"
1010 POSITION 8,19:? "Any More Keys (Y/N
 )";
1020 GET #2,B
1030 IF  NOT (B=89 OR B=121 OR B=78 OR B
=110) THEN ? CHR$(253);:GOTO 1020
1040 CLOSE #2
1050 IF B=89 OR B=121 THEN 670
1060 TRAP 1140:? CHR$(125):POKE 764,255
1070 ? :? " OPTIONS ":? :?
1080 ? "1...Return To  BASIC ":? :?
```

PROGRAMS

```
1090 ? "2...Save To Cassette & Return":?
 :?
1100 ? "3...Save To Diskette & Return":?
 :?
1110 ? "Please Select (1,2 or 3) >";
1120 INPUT #1,B:B=INT(B)
1130 IF B>=1 AND B<=3 THEN 1150
1140 ? CHR$(253):GOTO 1060
1150 ON B GOTO 1160,1320,1690
1160 ? CHR$(125)
1170 ? "Returning To  BASIC ":?
1180 FOR A=1 TO 9
1190 POKE 1694+A,SIZE(A)
1200 IF SIZE(A)=0 THEN 1240
1210 FOR B=1 TO SIZE(A)
1220 POKE M+128*(A-1)+B,ASC(CODE$(A*128+
SIZE(A)+1-B))
1230 NEXT B
1240 NEXT A
1250 POKE 1704,SIZE(0)
1260 IF SIZE(0)=0 THEN 1300
1270 FOR B=1 TO SIZE(0)
1280 POKE M+1152+B,ASC(CODE$(SIZE(0)+1-B
))
1290 NEXT B
1300 POKE 16,192:POKE 53774,192
1310 GRAPHICS 0:NEW
1320 ? CHR$(125)
1330 ? "Save To  CASSETTE ":?
1340 ? "Insert SAVE Cassette Then":?
1350 ? "Press RETURN";
1360 POKE 764,255
1370 IF PEEK(764)<>12 THEN 1370
1380 ? :? :OPEN #3,8,0,"C"
1390 FOR F=0 TO 9
1400 B=SIZE(F)
1410 ? #3,B
1420 NEXT F
1430 FOR F=0 TO 9
1440 IF SIZE(F)=0 THEN 1490
1450 FOR G=1 TO SIZE(F)
1460 B=ASC(CODE$(F*128+G,F*128+G))
1470 ? #3,B
1480 NEXT G
1490 NEXT F:CLOSE #3
1500 GOTO 1170
1510 ? "CASSETTE ENTRY"
1520 ? :? :? "Insert LOAD Cassette Then"
1530 ? :? "Press RETURN";
1540 POKE 764,255
1550 IF PEEK(764)<>12 THEN 1550
1560 ? :? :OPEN #3,4,0,"C"
1570 FOR F=0 TO 9
```

PROGRAMS

```
1580 INPUT #3,B
1590 SIZE(F)=B
1600 NEXT F
1610 FOR F=0 TO 9
1620 IF SIZE(F)=0 THEN 1670
1630 FOR G=1 TO SIZE(F)
1640 INPUT #3,B
1650 CODE$(F*128+G,F*128+G)=CHR$(B)
1660 NEXT G
1670 NEXT F:CLOSE #3
1680 GOTO 1060
1690 ? CHR$(125)
1700 ? "Save To  DISKETTE ":?
1710 GOSUB 1890
1720 ? "Insert SAVE Diskette Then":?
1730 ? "Press RETURN";
1740 POKE 764,255
1750 IF PEEK(764)<>12 THEN 1750
1760 ? :? :OPEN #3,8,0,FN$:? "Saving Fil
e > ";FN$:? :GOTO 1390
1770 ? "DISKETTE ENTRY"
1780 ? :? :GOSUB 1890
1790 ? "Insert LOAD Diskette Then"
1800 ? :? "Press RETURN";
1810 POKE 764,255
1820 IF PEEK(764)<>12 THEN 1820
1830 ? :? :OPEN #3,4,0,FN$:? "Loading Fi
le > ";FN$:?
1840 GOTO 1570
1850 PLOT 13,9+Z%3:DRAWTO 24,9+Z%3
1860 DRAWTO 24,11+Z%3
1870 DRAWTO 13,11+Z%3:DRAWTO 13,9+Z%3
1880 RETURN
1890 ? "Enter Filename ";:POKE 764,255
1900 INPUT IN$:? :IF LEN(IN$)=0 THEN 189
0
1910 IF LEN(IN$)<3 THEN 1930
1920 IF IN$(1,2)="D:" OR (IN$(1,1)="D" A
ND IN$(3,3)=":" AND (ASC(IN$(2,2))>48 AN
D ASC(IN$(2,2))<53)) THEN 1950
1930 FN$(1,2)="D:"
1940 FN$(3)=IN$:GOTO 1960
1950 FN$=IN$
1960 RETURN
```

BBC Sected

by R Nurse and S James

'Sected' is an abbreviation for sector editor. It provides similar features to 'Disk Doctor' for a disk-based BBC Model B and can be used with both 40- and 80-track drives.

Sected allows the user to examine and/or modify a disk, sector-by-sector, in either hexadecimal or ASCII modes. Its prime use is to recover corrupted disks by modifying the corrupted sectors. I

found it every bit as useful and powerful as many commercial packages.

When the program is run, you will be prompted for the drive to be used; for single-drive systems, this will normally be drive 0. You are then asked for the start track and sector — that is, the first sector you want to examine. To look at the disk directory, for example, you would enter 0 for both track and sector.

The screen format (see screendump) comprises 16 lines of 16 columns: a total of 256 bytes, or one sector. The drive number, track and sector are shown at the top of the screen — together with a 'Loaded' message if the sector loads without error, or a 'Load-error' if the sector is physically damaged.

To modify the sector, use the cursor keys to move to the desired location. By entering a two-digit hexadecimal value the existing value can be overwritten. For those more familiar with ASCII, press SHIFT-FO and enter a character. The ASCII value of the character is then written to the cursor position, and the cursor moves one position to the right.

If you have modified a sector, and wish to save the changes, press the TAB key to save the edited sector to disk before loading a new sector. To move to a new sector, press SHIFT and the right or left cursor key. To move to a new track, press CTRL and the right or left cursor key.

To 'fill' an area of the disk with a character, move the cursor to the start of the area to be filled and press SHIFT + F1. You will then be prompted to move the cursor to the end of the area to be filled and press SHIFT + F1 again. Next, enter a hex value if you are in hex mode, or press a key if you are in ASCII mode, and then TAB to save the sector to disk. RETURN then loads the sector again if you want to continue working on it.

To dump a sector to a printer, press SHIFT + F2. This option assumes an 80-column (or wider) printer and assumes automatic line-feeds. If your printer does not perform automatic line-feeds on carriage returns, add in a new line as follows:

65 X FX 6,0

Finally, to exit the program press ESCAPE. You will be asked if you wish to save the current sector (y/n) and then returned to Basic.

```
10 REM ************************************************
20 REM *                                              *
30 REM *            SECTED - Disc Sector Editor       *
40 REM *             (C) R.Nurse & S.James 1984       *
50 REM *                                              *
60 REM ************************************************
70 *FX226,200
80 MODE3
90 VDU23;8202;0;0;0;
100 VDU23,224,0,16,32,64,255,64,32,16
110 VDU23,225,0,8,4,2,255,2,4,8
120 *FX4,1
130 stmem%=&900:endmem%=stmem%+&FF
140 PROCmc
150 ONERRORGOTO170
160
170 CLS
180 PRINTTAB(30)"DISC SECTOR EDITOR"
190 PRINTTAB(30)"-------------------"
200 PRINT'TAB(25)"(C) R.Nurse & S.James 1984"
210 !&71=stmem%:?&73=0:?&74=0:?&75=3:REM Set up OSWORD block
220 ntrack%=40:REM No.tracks
230 INPUT''"   Drive No.:"dr$
240 dr%=EVAL dr$:IFdr%<0 GOTO170
250 ?&70=dr%
260 PRINT" Track(0-"ntrack%-1"):";:INPUT""tr$
270 track%=EVALtr$
280 IFtrack%<0 ORtrack%>(ntrack%-1) GOTO170
290 INPUTTAB(1)"Sector(0-9):"se$
300 sect%=EVALse$
310 IFsect%<0 ORsect%>9 GOTO170
320 PROCload(track%,sect%)
330 *FX15,1
340 xx%=5:yy%=2:ascii%=0:no%=0
350 CLS:Mode$="Hex  ":PROCscprint
360 PRINTTAB(0,18)"Commands:"
370 PRINT"TAB  - Save this sector onto disc";SPC(5);"RETURN";
SPC(4);"-Reload this sector from disc"
380 PRINT"SHIFT f0  -Change mode (Ascii-Hex)";SPC(4);"SHIFT f1
-Fill part of current sector"
390 PRINT"CTRL  ";CHR$224;",";CHR$225;" -Back,forwards a track";
SPC(6);"SHIFT";CHR$224;",";CHR$225;" -Back,forwards a sector"
400 PRINT"SHIFT f2  -Print sector on printer"
410 ONERROR GOTO1660
420 REPEAT:PROCmove:UNTIL0
430 END
440
450 REM Check any keys pressed,move cursor
460 DEFPROCmove
470 key%=INKEY(0):IFkey%=-1ENDPROC
480 xm%=0:ym%=0
490 IFkey%=9 PROCsave(track%,sect%):ENDPROC
500 IFkey%=13 PROCload(track%,sect%):PROCscprint:ENDPROC
510 IFkey%=200 PROCswapmode:ENDPROC
520 IFkey%=201 PROCfillsect:ENDPROC
530 IFkey%=202 PROCprinter:ENDPROC
540 IFINKEY(-1) ANDkey%=136 PROCsect(-1):ENDPROC
550 IFINKEY(-1) ANDkey%=137 PROCsect(1):ENDPROC
560 IFINKEY(-2) ANDkey%=136 PROCtrack(-1):ENDPROC
570 IFINKEY(-2) ANDkey%=137 PROCtrack(1):ENDPROC
580 IFkey%=136 xm%=-3
590 IFkey%=137 xm%=3
600 IFkey%=139 ym%=-1
610 IFkey%=138 ym%=1
620 IFkey%<127 ANDascii% PROCvalput(key%):xm%=3:GOTO640
630 IFkey%>47 ANDkey%<58 ORkey%>64 ANDkey%<71 ANDascii%=0
PROChexin:ENDPROC
640 IFxm%=0 IFym%=0 ENDPROC
650 IFxx%+xm%<3 xm%=45:ym%=-1
660 IFxx%+xm%>50 xm%=-45:ym%=1
670 IFyy%+ym%<2 ym%=15
680 IFyy%+ym%>17 ym%=-15
690 PRINTTAB(xx%,yy%)" "
700 xx%=xx%+xm%:yy%=yy%+ym%
710 PRINTTAB(xx%,yy%)">"
720 ENDPROC
730
740 REM Input Hex Number
750 DEFFNinput
760 XX%=POS:YY%=VPOS
770 I$="":REPEAT
780 II%=GET:IFII%=127 A$=LEFT$(A$,LENA$-1)
790 IFII%=13GOTO830
800 IFII%=38GOTO820
810 IFII%<48ORII%>70 VDU7:GOTO780
820 I$=I$+CHR$II%:PRINTTAB(XX%,YY%)I$" "
830 UNTILII%=13 ORLENI$=2
840 IFI$="" GOTO760
850 =I$
860
870 REM Put value (V%) into sector at present position of cursor
880 DEFPROCvalput(V%)
890 row%=FNrow(yy%):col%=FNcol(xx%)
900 val$=STR$~V%:IFLENval$<2 val$="0"+val$
910 IFV%<32 OR V%>126 AS$="." ELSEAS$=CHR$V%
920 PRINTTAB(xx%+1,yy%)val$TAB(55+col%,yy%)AS$
930 ?(stmem%+row%*16+col%)=V%
940 ENDPROC
950
960 REM Save present sector onto disk
970 DEFPROCsave(track%,sect%)
980 ?&76=&48
990 A%=&7F:X%=&70:Y%=0:CALL&FFF1
1000 ENDPROC
1010
1020 REM Swap between Hex & Ascii Modes
1030 DEFPROCswapmode
1040 IFMode$="Hex  " Mode$="Ascii" ELSE Mode$="Hex  "
1050 PRINTTAB(30,0)Mode$
1060 ascii%=1-ascii%
1070 ENDPROC
1080
1170 REM Put Hex number into sector
1180 DEFPROChexin
1190 v%=?(stmem%+FNrow(yy%)*16+FNcol(xx%))
1200 hex$=STR$~(v% MOD16)+CHR$key%
1210 PROCvalput(EVAL("&"+hex$))
1220 ENDPROC
1230
1240 REM Move to new sector
1250 DEFPROCsect(D%)
1260 IFno%PRINTTAB(0,23)STRING$(50," "):no%=0:REM Cancel fill
1270 sect%=sect%+D%
1280 PRINTTAB(40,0)STRING$(10," ")
1290 IFsect%>9 sect%=0:PROCtrack(1):ENDPROC
1300 IFsect%<0 sect%=9:PROCtrack(-1):ENDPROC
1310 PROCload(track%,sect%)
1320 PROCscprint
1330 *FX15,1
1340 ENDPROC
1350
1360 REM Move to new track
1370 DEFPROCtrack(D%)
1380 PRINTTAB(40,0)STRING$(10," ")
1390 IFno% PRINTTAB(0,23)STRING$(50," "):no%=0
1400 track%=track%+D%
1410 IFtrack%>ntrack%-1 track%=0
1420 IFtrack%<0 track%=ntrack%-1
1430 PROCload(track%,sect%):PROCscprint
1440 *FX15,1
1450 ENDPROC
1460
1470 REM Load track,sector
1480 DEFPROCload(TT%,SS%)
1490 ?&76=&53:?&77=TT%:?&78=SS%:?&79=&21
1500 A%=&7F:X%=&70:Y%=0:CALL&FFF1
1510 ENDPROC
1520
1530 REM Display present sector
```

```
1540 DEFPROCscprint
1550 VDU30
1560 IF?&7A<>0 Err$="Load Error":VDU7 ELSE Err$="Loaded      "
1570 PRINTTAB(5,0)"Track:";?&77" "TAB(15,0)"Sector:";?&78"
"TAB(25,0)"Mode:"Mode$
1580 IF?&7A COLOURO:COLOUR129
1590 PRINTTAB(40,0)Err$;CHR$20;TAB(55,0)"0123456789ABCDEF"
1600 PRINTSTRING$(80,"=");
1610 CALLdump%
1620 PRINTTAB(xx%,yy%)">"
1630 ENDPROC
1640
1650 REM Error Detected
1660 *FX4
1670 IFERR<>17MODE7:CLS:REPORT:PRINTERL:END
1680 PRINTTAB(0,23)STRING$(45," ")
1690 COLOUR129:COLOURO:PRINTTAB(0,23)"Save Sector?":VDU20
1700 A$=GET$:IFA$="Y"PROCsave(track%,sect%)
1710 END
1720
1730 REM Machine Code for printing sector contents to screen
1740 DEFPROCmc
1750 DIM dump% 200
1760 FORT%=0TO2STEP2:P%=dump%
1770 [OPTT%:LDY#0
1780 .loop JSR num:JSR row:JSR chars:CPY#0:BNE loop:RTS
1790 .row LDX#0:JSR spc:.rl LDA stmem%,Y:JSR hex:JSR spc:INY:
INX:CPX#16:BNE rl:JSR spc:RTS
1800 .num JSR spc:TYA:JSR hex:JSR spc:LDA#58:JSR &FFEE:RTS
1810 .chars TYA:SEC:SBC#16:TAY
1820 LDX#0:.cl LDA stmem%,Y:CMP#32:BCC nprint:CMP#127:BCS
nprint:.cont JSR &FFEE:INY:INX:CPX#16:BNE cl:JSR &FFE7:RTS
1830 .nprint LDA#46:JMP cont
1840 .hex PHA:LSRA:LSRA:LSRA:LSRA:JSR hexnyb:PLA:AND#15:JSR
hexnyb:RTS
1850 .hexnyb CMP#10:BCC hexny1:CLC:ADC#7
1860 .hexny1 CLC:ADC#48:JSR &FFEE:RTS
1870 .spc LDA#32:JSR &FFEE:RTS
1880 ]:NEXT
1890 ENDPROC
1900
1910 REM Fill part of present sector
1920 DEFPROCfillsect
1930 pos%=FNrow(yy%)*16+FNcol(xx%)
1940 COLOUR129:COLOURO:PRINTTAB(0,23);:IFno%=0 PRINTTAB(0,23)"Move
cursor to ot her point,then press SHIFT f1":no%=no%+1:
p1%=pos%+stmem%:VDU20:ENDPROC
1950 p2%=pos%+stmem%
1960 VDU20:PRINTSTRING$(50," ")
1970 IFMode$="Ascii" CH$="Character" ELSECH$="Value"
1980 COLOUR129:COLOURO:PRINTTAB(0,23)CH$" to fill with:";
1990 IFMode$<>"Ascii" val%=EVAL("&"+FNinput) ELSEREPEATC%=GET:
UNTILC%<127:val%=C%
2000 VDU20:PRINTTAB(0,23)STRING$(30," ")
2010 IFp1%=p2% ?p1%=val%:GOTO2040
2020 FORT%=p1% TOp2% STEP S8N(p2%-p1%)
2030 ?T%=val%:NEXT
2040 no%=0:PROCscprint
2050 PRINTTAB(0,23)STRING$(20," ")
2060 ENDPROC
```

```
2080 REM Print sector on printer
2090 DEFPROCprinter
2100 *FX3,10
2110 IF?&7A Err$="Load Error" ELSE Err$="Loaded"
2120 PRINT'TAB(5)"Track:";?&77" ";TAB(15)"Sector:";?&78" ";TAB(25)
"Mode:"Mode$; TAB(40)Err$;TAB(55)"0123456789ABCDEF"
2130 PRINTSTRING$(80,"=");
2140 CALLdump%
2150 VDU3:*FX3,0
2160 ENDPROC
2170
2180 DEFFNcol(XX%) =(XX%-3)DIV3
2190 DEFFNrow(YY%) =YY%-2
2200
2210 REM ** END OF LISTING **
```

```
   Track:27  Sector:5  Mode:Hex      Loaded        0123456789ABCDEF
==========================================================================
00 :00 00 AA 85 DB 00 00 84 1D F1 BA 33 38 29 22 44  ..........38)"D
10 : 49 53 43 20 53 45 43 54 4F 52 20 45 44 49 54 4F  ISC SECTOR EDITO
20 : 52 22 0D 00 BE 1D F1 0A 33 38 29 22 2D 2D 2D 2D  R"......38)"----
30 : 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 2D 22 00  ------------",
40 : 00 C8 26 F1 27 0A 32 35 29 22 20 43 29 20 52 2E  ..&.'.25)"(C) R.
50 : 4E 75 72 73 65 20 26 20 53 2E 4A 61 6D 65 73 20  Nurse & S.James
60 : 31 39 38 34 22 0D 00 D2 30 21 26 37 31 30 73 74  1984"...!&71=st
70 : 6D 65 6D 25 3A 3F 26 37 33 3D 30 3A 3F 26 37 34  mem%:?&73=0:?&74
80 : 3D 30 3A 3F 26 37 35 3D 33 3A F4 20 53 65 74 20  =0:?&75=3:. Set
90 : 75 70 20 4F 53 57 4F 52 44 20 62 6C 6F 63 6B 00  up OSWORD block.
A0 : 00 DC 1A 6E 74 72 61 63 6B 25 3D 34 3A 3A F4 20  ...ntrack%=4:.
B0 : 4E 6F 2E 74 72 61 63 6B 73 0D 00 E6 19 E0 27 27  No.tracks.....''
C0 : 22 20 20 20 44 72 69 76 65 20 4E 6F 2E 3A 22 64  "   Drive No.:"d
D0 : 72 24 0D 00 F0 19 64 72 25 3D A8 64 72 24 3A E7  r$....dr%=.dr$:.
E0 : 64 72 25 3C 30 20 E5 80 74 6A 48 0D 00 FA 0C 3F  dr%<0 ..tj@....?
F0 : 26 37 30 3D 64 72 25 80 81 84 26 F1 22 20 54 72  &70=dr%...&." Tr
```

```
Commands:
TAB - Save this sector onto disc     RETURN   -Reload this sector from disc
SHIFT f0  -Change mode (Ascii-Hex)   SHIFT f1  -Fill part of current sector
CTRL ←,→ -Back,forwards a track      SHIFT ←,→ -Back,forwards a sector
SHIFT f2  -Print sector on printer
```

Example of screen display during use

Slalom

by A Pearce

The player is given a time limit in which to glide down a slope dotted with trees, attempting to go through gates which frequently appear on the screen. In addition to these obstacles the course itself moves from side to side. On crashing into the trees or the fencing or even the side of the gate, the player loses a great deal of the remaining time allowed.

The main loop of the game is a simple routine which shows the MicroBee's excellent implementation of programmable characters in scrolling the trees (which are printed at the bottom of the screen) and the other objects up the screen.

If the user would prefer not to have a click of the speaker every time a tree goes past, remove the OUT commands in line 340 but leaving the other statements intact. If you own an older model 'Bee it might be wise to run the program without these commands anyway as it may well make the game faster.

The game is written totally in HIRES PCG graphics so that more experienced programmers can vary the DATA at lines 590 to 680 to create their own variations of the game as it suits them

```
100 REM ************************************
110 REM **  SLALOM!   By Andrew Pearce 1984  **
120 REM ************************************
130 REM Do intro ...
140 POKE 220,1111:CLS:LORES:PLOT 0,0TO127,0TO63,20TO0,0:PLOT
    62,19TO64,19:PLOT 59,18TO67,18:PLOT 55,17TO71,17:PLOT 52,16
    TO74,16:PLOT 49,15TO77,15
150 PLOT 63,20TO63,0:PLOT 63,20TO27,0:PLOT 63,20TO99,0:PLOT
    63,20TO43,0:PLOT 63,20TO83,0:CURS1,3:PRINT[A64 45]:CURS1,5
    :PRINT[A64 45]
```

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MPA/APC634

```
16Ø RESTORE7ØØ:FORA=1TO7:U=1:READA1$,A2$:IFA1$=" "THENNEXTA
    ELSEFORB=62TO32+ASTEP-1:U=U+1:CURSB,4:PRINTA2$;" ":CURSU,4
    :PRINT" "A1$:FORC=1to10:NEXTC:NEXTB:NEXTA
17Ø FORA=1TO125Ø:NEXTA
18Ø INVERSE:NORMAL:RESTORE:P=63488+65*16:FORA=PTOP+16*1Ø-1:
    READB:POKEA,B:NEXTA:CLS:PRINT[A25 45];" Instructions ";
    [A25 45]
19Ø PRINT"Hi all you ski fans! In this game you must glide down
    a heavily":PRINT"wooded ski slope while going through as
    many gates as you can."
2ØØ PRINT"There is,however, a time limit which is kept and colliding
    with a tree shortens this considerably.Also try to stay on the
    course";
21Ø PRINT"- if you crash into the fencing you lose more time":
    PRINT[A64 45]:CURS32,1Ø:PRINT"<    Left direction":CURS32,11
    :PRINT">    Right direction"
22Ø PCG:CURS1,1Ø:PRINT"ABCDE";:NORMAL:PRINT"       You":PCG:
    PRINT"FGGGGGGGGH";:NORMAL:PRINT"  Gate":PCG:PRINT"IJ";:NORMAL:
    PRINT"          Tree"
23Ø CURS1,15:PRINT[A2Ø 45];" Press any key to start ";[A19 45]
24Ø IFKEY$=""THEN24Ø
25Ø CLS:S1=Ø:Z=Ø:J=Ø:PCG:L=32:T=12:M=2ØØØ
26Ø FORA=1TO15:CURS12,A:PRINTCHR$(13Ø):CURS52,a:PRINTCHR$(13Ø)
    :NEXTA
27Ø IFP>ØTHEN3ØØELSELETP=INT(RND*1Ø):IFP<4THENLETP=INT(RND*1Ø)
    :D=INT(RND*1Ø):IFD>5THENLETD=-1ELSELETD=1
28Ø IFP=ØTHEND=Ø
29Ø IF M<=ØTHEN51Ø
3ØØ U=U+1:IFU>1ØTHENCURSINT(RND*21)+T+2,16:PRINT"FGGGGGGGGGGGGH"
    :U=Ø
31Ø IFU>ØTHENCURSINT(RND*34)+T+2,16:PRINT"IJ"
32Ø CURSL-2,1:PRINT"ABCDE"
33Ø IFR=ØTHENGOSUB58Ø
34Ø OUT2,Ø:OUT2,255:M=M-1:S1=S1+1
35Ø IFP>ØANDD=1THENLETT=T-1ELSEIFP>ØANDD=-1THENLETT=T+1
36Ø IFT<3THENLETT=T+1:P=Ø
37Ø IFT>2ØTHENLETT=T-1:P=Ø
38Ø CURST,15:PRINTCHR$(13Ø):CURST+4Ø,15:PRINTCHR$(13Ø)
39Ø IFPEEK(6144Ø+L-5)=2ORPEEK(6144Ø+L-6)=2ORPEEK(6144Ø+L-4)=2
    THENLETE=1:GOTO48Ø
4ØØ IFPEEK(6144Ø+L+4)=2ORPEEK(6144Ø+L+5)=2ORPEEK(6144Ø+L+3)=2
    THENLETE=2:GOTO48Ø
41Ø IFPEEK(6159Ø4+L)=199THENLETJ=J+1:W1=FLT(INT(RND*2Ø))*5Ø:
    CURSL-2,2:NORMAL:PRINTINT(W1):FORA=1TO5Ø:NEXTA:CURSL-2,3:
    PLAY8;9;4:PRINT"     ":PCG:S1=S1+W1
42Ø IFPEEK(6159Ø4+L-1)<>32ANDPEEK(6159Ø4+L-1)<>199ORPEEK(6159Ø4+L-2)
    <>32ANDPEEK(6159Ø4+L-2)<>199ORPEEK(6159Ø4+L)<>32ANDPEEK(6159Ø4+L)
    <>199THEN47Ø
43Ø POKE258,Ø:Q1$=KEY$
44Ø IFQ1$=","THENLETL=L-1
45Ø IFQ1$="."THENLETL=L+1
46Ø GOTO 27Ø
47Ø PLAY1:Z=Z+1:FORA=1TO7:FORB=1TO25:NEXTB:OUT2,Ø:OUT2,255:NEXTA
    M=M-1ØØ:GOTO 27Ø
48Ø IFE=1THENLETL=L+3
49Ø IFE=2THENLETL=L-3
5ØØ PLAY1Ø:FORA=1TO7:FORB=1TO25:NEXTB:OUT2,Ø:OUT2,255:NEXTA:GOTO 27Ø
51Ø R=Ø:PLAY5;6;5;6;4;5;6;5;4;5;6;4;5;1Ø:NORMAL:CLS:PRINT[A27 45];
    " Game Over "; A25 45 :IFS1>H1THENLETH1=S1
52Ø PRINT:PRINT:PRINTTAB(12);"No. of gates completed -"J:PRINTTAB(18)
    ;"No. of trees hit -"Z:PRINTTAB(29);"Score -"S1:PRINT[A64 45]
    :PRINTTAB(27);"Hi Score -"H1
53Ø CURS2Ø,15:PRINT"Would you like another go?"
54Ø Q1$=KEY$:IFQ1$=""THEN54Ø
```

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```
55Ø IFQ1$="Y"ORQ1$="y"THEN25Ø
56Ø IFQ1$="N"ORQ1$="n"THENCLS:END
57Ø GOTO 54Ø
58Ø PLAY 1Ø,2;12;13;1Ø;1Ø;17;15;13;1Ø:R=1:RETURN
59Ø DATA Ø,Ø,Ø,192,48,12,3,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø
6ØØ DATA 252,48,48,48,48,5Ø,5Ø,5Ø,5Ø,6Ø,51,51,48,48,48,48
61Ø DATA Ø,Ø,Ø,6Ø,195,Ø,Ø,Ø,6Ø,255,255,255,255,6Ø,Ø,Ø
62Ø DATA 63,12,12,12,12,2Ø4,2Ø4,2Ø4,2Ø4,6Ø,2Ø4,2Ø4,12,12,12,12
63Ø DATA Ø,Ø,Ø,3,12,48,192,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø
64Ø DATA 192,192,192,192,192,24Ø,252,192,252,24Ø,192,192,192,192,
        192,192
65Ø DATA Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,255,255,Ø,Ø,Ø,Ø,Ø,Ø,Ø
66Ø DATA 3,3,3,3,3,15,63,3,63,15,3,3,3,3,3,3
67Ø DATA Ø,1,2,4,9,2,4,9,18,4,9,18,36,8,Ø,1
68Ø DATA 128,192,16Ø,144,2ØØ,16Ø,144,2ØØ,164,2Ø8,2ØØ,164,14Ø,136
        128,192
69Ø DATA "a","1","1","o","S","m"," "," ","**","**","**","**","**","**"
700 REM ******* This Program Takes up 3422 Bytes *******
```

Blockout

by B Pritchard

Blockout is a game for the unexpanded VZ 200 which will work with joysticks or from the keyboard. The object of the game is to trap your opponent by boxing him/her/it, in with the lethal trail that you (and your opponent) leave as you move around the screen.

The main points of the program are:

- Lines 10 to 30 are a short machine language which will set the whole screen white when called.
- Lines 185 to 190 initialise the variables.
- Line 195 sets up the screen.
- Line 200 checks to see if the computer has to move (otherwise it gets the players move from the keyboard or the left joystick).
- Lines 205 to 240 process the left player's movements.
- Line 245 collects the right player's move from the keyboard or the right joystick.
- Lines 250 to 285 process the right player's move.
- Lines 300 to 325 check if either player has hit a line or run off the edge of the screen.
- Lines 400 to 440 calculate and display each player's score.
- Lines 500 to 595 control the computer's movements.
- Lines 1000 onwards are the instructions and keyboard controls.

```
 0 REM ********************
 1 REM **    BLOCKOUT    **
 2 REM **       BY       **
 3 REM ** B.PRITCHARD    **
 4 REM **    29/4/84     **
 5 REM ********************
 10 FORI=-28687TO-28674
 15 READA:POKEI,A
 20 NEXT
 25 DATA33,0,112,17,1,112,1,255,7,54,85,237,176
    ,201
 30 POKE30862,241:POKE30863,143
 35 CLS:PRINTTAB(7)"*** BLOCKOUT ***":PRINT
 40 INPUT"INSTRUCTIONS";A$
 45 IFLEFT$(A$,1)="Y"THEN1000
 50 INPUT"ONE OR TWO PLAYERS";PL
 55 IFPL<>1ANDPL<>2THEN50
 60 IFPL=2THEN75
 65 RI$="YOU":LE$="I"
 70 GOTO185
 75 INPUT"LEFT PLAYERS NAME";LE$
```

```
 80 INPUT"RIGHT PLAYERS NAME";RI$
185 X1=1:Y1=0:X2=-1:Y2=0
190 AX=0:AY=32:BX=127:BY=32
195 MODE(1):X=USR(0)
200 IFPL=1THEN500ELSEA=PEEK(27000):AA=(INP(43)
    AND31)
205 IFA=239THENX1=-1:Y1=0
210 IFA=253THENX1=1:Y1=0
215 IFA=247THENX1=0:Y1=-1
220 IFA=223THENX1=0:Y1=1
225 IFAA=27THENX1=-1:Y1=0
230 IFAA=23THENX1=1:Y1=0
235 IFAA=30THENX1=0:Y1=-1
240 IFAA=29THENY1=0:y1=1
245 B=PEEK(26700):BB=(INP(46)AND31)
250 IFB=223THENX1=-1:Y1=0
255 IFB=247THENX1=1:Y1=0
260 IFB=253THENX1=0:Y1=-1
265 IFB=239THENX1=0:Y1=1
270 IFBB=27THENX1=-1:Y1=0
275 IFBB=23THENX1=1:Y1=0
280 IFBB=30THENX1=0:Y1=-1
285 IFBB=29THENX1=0:Y1=1
300 AX=AX+X1:AY=AY+Y1
305 IFAX<0ORAX>127ORAY<0ORAY>63THEN400
310 IFPOINT(AX,AY)<>2THEN400
315 BX=BX+X2:BY=BY+Y2
320 IFBX<0ORBX>127ORBY<0ORBY>63THEN405
325 IFPOINT(BX,BY)<>2THEN405
330 COLOR3:SET(AX,AY)
335 COLOR4:SET(BX,BY)
340 GOTO200
400 BS=BS+1:W$=RI$:GOTO410
405 AS=AS+1:W$=LE$
410 CLS:PRINTW$;" WON":PRINT
415 PRINT"LEFT SCORE","RIGHT SCORE"
420 PRINT:PRINTTAB(3)AS,TAB(3)BS
425 PRINT@451,"PRESS ANY KEY TO CONTINUE"
426 PRINTTAB(10)"(N=NEW GAME)"
430 A$=INKEY$:IFA$=""THEN430
435 IFINKEY$=A$ORINKEY$=""THEN435
440 IFINKEY$="N"THENRUNELSEPOKE27000,0:POKE26700,0
    :GOTO185
500 IFRND(40)<>1THEN510
505 IFRND(2)=1THENX1=RND(3)-2:Y1=0ELSEX1=0
506 IFX1=0THENY1=RND(3)-2
510 IFAX+X1<0ORAX+X1>127ORAY+Y1<0ORAY+Y1>63THEN
    525
515 IFPOINT(AX+X1,AY+Y1)=2THEN245
525 IFAX-1<0ORAY<0ORAY>63THENA1=1ELSEIFPOINT
    (AX-1,AY)<>2,A1=1
530 IFAX+1>127ORAY<0ORAY>63THENA2=1ELSEIFPOINT
    (AX+1,AY)<>2,A2=1
535 IFAY-1<0ORAX<0ORAX>127THENA3=1ELSEIFPOINT
```

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Split screen graphics

by A Dilley

Many Commodore 64 owners may have heard or read about raster interrupts, and how useful they can be. The following listing from Andrew Dilley demonstrates the use of raster interrupts to obtain split screen graphics.

The value contained in the raster register is the number of the horizontal lines being drawn on the TV screen. The screen is divided up into horizontal lines with line numbers 50-250 on the screen window and the others on the border.

Suppose a program is written that tells the 64 to switch to bit map mode at one point and then back to normal at another. Only those lines drawn after the switch will be produced in the new mode; the rest will be unchanged.

To save the computer having to monitor the position of the raster all of the time, interrupts are used. Normally these occur every 1/60th of a second and are used to update the TI jiffy clock, flash, cursor, and so on.

However, two things allow the interrupts to be utilised. First, the address of the interrupt routine is held at memory location 788 and 789. By changing the values held here, it is possible to redirect the computer whenever an interrupt occurs.

Secondly, there is a register in the Vic chip (53274) which allows the conditions under which the interrupt occurs to be selected. These can be light-pen interrupts, sprite collision interrupts and — yes, you guessed it — raster interrupts.

Once the computer has been told to provide raster interrupts, it needs to be told when. This is done by giving it a raster compare value. When the raster value matches the compare value, an interrupt is triggered. The compare value is stored in the same location in memory from which the actual raster position is read.

The demonstration program shows the split screen effect with bit mapped graphics. By changing the one memory location, the sixth item of data on line 640 from 20 to 40, the routine will give the split screen effect in extended colour mode.

The high-resolution screen is placed at 8192 and part of the 64's character set is copied into memory starting at 14336.

```
95 PRINT "{CLR}"
100 GOSUB 500  :REM  LOAD MACHINE-CODE
110 GOSUB 300  :REM  CHARACTER SET
120 GOSUB 400  :REM  CLEAR HI-RES
130 POKE 53272,(PEEK(53272)AND240)OR14: REM  THIS GETS OUR
    CHAR. SET
140 POKE 252,199:POKE 253,15
150 SYS 12*4096
160 PRINT"{HOME}{DOWN}…"
170 PRINT" {RVS}{RED}SPLIT-SCREEN GRAPHICS"
190 FOR I=1024 TO 1023+40*19:POKE I,16+6:NEXT
192 REM  THIS SETS THE COLOUR OF THE HI-RES SCREEN
200 FOR X=0 TO 319
210 Y=INT(75+70*SIN(X/10))
220 B=320*(INT(Y/8))+8*(INT(X/8))+(Y AND 7)
230 POKE 8192+B,PEEK(8192+B) OR 2↑(7-(XAND 7))
240 NEXT
250 PRINT"{DOWN} UNDER THIS 'SCREEN' YOU CAN SEE THE":PRINT"
    CHARACTER SET."
260 FOR T=1 TO 1000:NEXT
270 FOR I=200 TO 250:POKE 252,I:NEXT
280 FOR T=1 TO 1000:NEXT
290 FOR I=250 TO 200 STEP-1:POKE 252,I:NEXT
295 GOTO 260
300 PRINT "-COPYING CHARACTERS FROM ROM TO RAM"
310 POKE 56334,PEEK(56334)AND254
320 POKE 1,PEEK(1)AND251
330 FOR I=0 TO 64*8
340 : POKE I+14336,PEEK(I+13*4096)
350 NEXT
360 POKE 1,PEEK(1)OR4
370 POKE 56334,PEEK(56334)OR1
380 RETURN
400 PRINT "-CLEARING HI-RES SCREEN"
410 FOR I=8192 TO 8192+6144
411 REM  DON'T CLEAR ENTIRE HI-RES SCREEN, SO AS TO LEAVE
    ROOM FOR CHAR. SET
420 : POKE I,0
430 NEXT
440 RETURN
500 PRINT "-LOADING MACHINE-CODE"
510 S=12*4096
```

```
    (AX,AY-1)<>2,A3=1
540 IFAY+1>63ORAX<ØORAX>127THENA4=1ELSEIFPOINT
    (AX,AY+1)<>2,A4=1
545 IFA1=1ANDA2=1ANDA3=1ANDA4=1THENA1=Ø:A2=Ø
    A3=Ø:A4=Ø:GOTO245
546 A1=Ø:A2=Ø:A3=Ø:A4=Ø
550 R=RND(4)
555 IFR=1ANDAX-1<-1ANDAY<-1ANDAY>64THENIFPOINT
    (AX-1,AY)=2,580
560 IFR=2ANDAX+1>128ANDAY<-1ANDAY>64THENIFPOINT
    (AX+1,AY)=2,585
565 IFR=3ANDAY-1<-1ANDAX<-1ANDAX>128THENIFPOINT
    (AX,AY-1)=2,590
570 IFR=4ANDAY+1>64ANDAX<-1ANDAX>128THENIFPOINT
    (AX,AY+1)=2,595

575 GOTO550
580 X1=-1:Y1=Ø:GOTO245
585 X1=1:Y1=Ø:GOTO245
590 X1=Ø:Y1=-1:GOTO245
595 X1=Ø:Y1=1:GOTO245
1000 PRINT@64," AS YOU MOVE AROUND THE SCREEN"

1005 PRINT"YOU WILL LEAVE A TRAIL."
1010 PRINT" YOU CANNOT RUN INTO YOUR TRAIL"
1015 PRINT",OR YOUR OPPONENTS TRAIL,OR RUN"


1020 PRINT"OFF THE EDGE OF THE SCREEN."
1025 PRINT"(DOUBLING BACK INTO YOURSELF IS"
1030 PRINT"THE SAME AS RUNNING INTO YOUR","TRAIL"
1035 PRINT" WHEN PLAYING ONE PLAYER ONLY"
1040 PRINT"(AGAINST THE COMPUTER),USE THE"
1045 PRINT"RIGHT SET OF CONTROLS"
1050 PRINT@480,"PRESS ANY KEY TO CONTINUE";
1055 A$=INKEY$:IFA$=""THEN1055
1060 IFINKEY$=A$ORINKEY$=""THEN1060
1065 CLS:PRINTTAB(6)"KEYBOARD CONTROLS"
1070 PRINT:PRINT"RIGHT PLAYER:"


1075 PRINTTAB(14)"(M)=LEFT"
1080 PRINTTAB(14)"(,)=RIGHT"
1085 PRINTTAB(14)"(.)=UP"
1090 PRINTTAB(14)"(SPACE)=DOWN"
1095 PRINT:PRINT"LEFT PLAYER:"
1100 PRINTTAB(14)"(Z)=LEFT"
1105 PRINTTAB(14)"(X)=RIGHT"
1110 PRINTTAB(14)"(C)=UP"

1115 PRINTTAB(14)"(V)=DOWN"
1120 PRINT@480,"PRESS ANY KEY TO CONTINUE";
1125 A$=INKEY$:IFA$=""THEN1125
1130 IFINKEY$=A$ORINKEY$=""THEN1130
1135 GOTO35
```

```
520 I=0
530 READ H$
540 IF H$="*" THEN RETURN
550 H=ASC(H$)-48:L=ASC(RIGHT$(H$,1))-48
560 H=H+7*(H>9):L=L+7*(L>9)
570 POKE S+I,16*H+L
580 I=I+1:GOTO530
600 DATA 78,A9,19,A0,C0,8D,14,03,8C,15,03
620 DATA AD,1A,D0,09,01,8D,1A,D0,A9,00,85,FB,58,60
630 DATA AD,19,D0,29,01,D0,03,4C,31,EA,8D,19,D0
640 DATA 78,AD,11,D0,49,20,29,7F,8D,11,D0,A6,FB,E0,02,D0,02,
    A2,00
650 DHIH B5,FC,8D,12,D0,E8,86,FB,58,68,A8,68,AA,68,40,*
```

Monster Hunt

by D Baulch

The 'Hunt' is a game for the VIC 20 with a 3k expansion and joystick. It is made in two parts: a loader program and the main program which is saved separately.

The idea of the game is to dig your way underground and shoot the monsters. The googles can dig through the dirt but the dragons can't. However, the dragons can breathe fire, so watch out!

To run the Monster Hunt, enter the loader program and save it. Then type in the main program and save that too. Rewind the tape and load and run the loader program. The loader program loads the main program from there.

Listing 1: Loader program

```
0 REM*****************
1 REM*                *
2 REM* MONSTER HUNT *
3 REM* BY  S HYDE & *
4 REM*    D BAULCH   *
5 REM*                *
6 REM*****************
10 POKE52,28:POKE56,28:POKE51,0:POKE55,0
20 FORI=7168TO7679:POKEI,PEEK(I+25600):NEXT
30 FORC=7168TO7303:READA:POKEC,A:NEXT
40 POKE36869,255
110 DATA56,84,56,16,58,63,250,140
115 DATA28,42,28,8,92,252,95,49
117 DATA51,204,51,204,51,204,51,204
120 DATA62,127,73,73,127,62,36,54
130 DATA124,254,146,146,254,124,36,108
150 DATA28,54,118,156,62,115,114,34
160 DATA56,108,110,57,124,206,76,68
180 DATA0,0,128,192,96,49,31,7
190 DATA1,7,15,07,125,223,254,252
200 DATA240,124,216,254,108,240,152,0
210 DATA0,0,1,3,6,140,248,224
220 DATA128,224,240,216,190,251,127,63
230 DATA15,62,11,255,54,15,25,0
240 DATA0,0,0,96,144,9,6,0
250 DATA0,0,0,96,148,14,4,0
260 DATA140,250,63,58,16,56,84,56
270 DATA0,73,42,0,99,0,42,73
300 POKE36879,8:PRINT"□"
310 FORXX=7790TO8163:POKEXX,2:NEXTXX
320 FORXX=38510TO38641:POKEXX,3:NEXTXX
```

```
330 FORXX=38642TO38773:POKEXX,4:NEXTXX
340 FORXX=38774TO38883:POKEXX,2:NEXTXX
350 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓┌──────────────┐"
360 PRINT"▓▓▓▓▓!MONSTER HUNT!"
370 PRINT"▓▓▓▓▓└──────────────┘"
380 ZZ=7768:FORXX=1TO2:POKEZZ,0:GOSUB1000:POKEZZ,32:ZZ=ZZ+1:NEXT
410 FORXX=1TO6:POKEZZ,0:GOSUB1000:POKEZZ,32:ZZ=ZZ+22:NEXT
420 FORXX=1TO17:POKEZZ,0:GOSUB1000:POKEZZ,32:ZZ=ZZ+1:NEXT
430 FORXX=1TO6:POKEZZ,0:GOSUB1000:POKEZZ,32:ZZ=ZZ-22:NEXT
440 POKEZZ,0:GOSUB1000:POKEZZ+1,0
450 FORXX=1TO3:POKEZZ,0:GOSUB1000:POKEZZ,32:ZZ=ZZ+1:NEXT
460 GOTO2000
1000 POKE36878,15:POKE36874,200
1010 FORM=1TO10:NEXTM:POKE36874,0:FORM=1TO100:NEXTM:RETURN
2000 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓KILL▓THE▓MONSTERS"
2010 PRINT:PRINT"▓▓▓▓▓LURKING▓▓IN"
2020 PRINT:PRINT"▓▓▓▓▓▓THE▓▓CAVERNS"
2030 PRINT:PRINT"▓ C ▓▓▓GOOGLES▓200▓PTS"
2040 PRINT:PRINT"▓ F ▓▓▓DRAGONS▓200▓PTS"
2050 PRINT"▓▓▓PRESS PLAY AND WAIT.▓";
2060 POKE631,131:POKE198,1
```

Listing 2: Main program

```
0 POKE36879,8:FORE=900TO903:POKEE,0:NEXT:S=0:HI=0:M=3:POKE37879,255
1 V1=36874:V2=36875:V3=36876:V4=36877:V5=36878:POKEV5,15:S=PEEK(900)*256+PEEK(90
1)
2 POKE36869,255:DIMCH(2,2),DF(2,2),MO%(7,4):HI=PEEK(902)*256+PEEK(903)
3 POKEV4+1,9
4 HI=1000:A$="VIC"
5 SC=7680:POKE52,28:POKE51,0:POKE56,28:POKE55,0
6 :POKEV3,0
100 FORE=0TO2:FORT=0TO2
101 READCH(E,T):NEXT:NEXT:FORME=0TO2:FORU=0TO2:READDF(ME,U)
103 NEXTU,ME
104 DATA9,1,9,9,9,9,9,0,9,0,-22,0,-1,0,1,0,22,0
105 DD=3:X=10:Y=14:P=SC+X+Y*22
107 FORE=0TO5:FORT=0TO4:READMO%(E,T):NEXT:NEXT:DATA5,7,8,10,5,6,7,12,10,5,5,7,4,
13,5
108 DATA6,7,17,13,5,3,2,6,19,3,4,2,14,19,3
115 PRINT"▓";
117 FORE=7834TO8163:POKEE,2:NEXT:FORE=38554TO38663:POKEE,3:NEXT
118 FORE=38664TO38664+5*22:POKEE,4:NEXT:FORE=38774TO38883:POKEE,2:NEXT:GOSUB8500
121 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓";:FORE=1TOM:PRINT"▓▓";:NEXT:FORE=M+1TOM+10:PRI
NT" ";:NEXT:GOTO125
122 GOSUB8500
125 GOSUB9000
130 IFFRTHENGOSUB9500
137 IF(X1ANDY1)OR(X1=0ANDY1=0)THEN180
139 POKEP,32
140 X=X+X1:Y=Y+Y1:IFX>21THENX=X-X1
141 IFX<0THENX=X-X1
142 IFY<6THENY=Y-Y1
143 IFY>21THENY=Y-Y1
145 P=SC+X+Y*22:G=PEEK(P)
160 IFG=2THENS=S+INT((Y-2)/5)*5
170 CK=CH(X1+1,Y1+1):IFCK<>9THENCH=CK
175 POKEP,CH:POKEP+30720,1
178 PRINT"▓▓SCORE","▓"A$:PRINT"▓"S,HI
180 FORE=0TO5
190 CA=MO%(E,0):CO=MO%(E,1):XM=MO%(E,2):YM=MO%(E,3):NC=MO%(E,4)
195 IFPEEK(SC+XM+YM*22)=16THENPOKESC+XM+YM*22,32:XM=0:YM=0
197 IFXM=0ANDYM=0THEN320
```

```
200 IFRND(1)<.8THEN300
205 R=INT(RND(1)*4)
210 IFR=0THENDX=0:DY=-1
215 IFR=1THENDX=0:DY=1
220 IFR=2THENDX=1:DY=0:CA=NC
225 IFR=3THENDX=-1:DY=0:CA=NC+1
300 IF(CA=5ORCA=6)ANDRND(1)<.1THENGOSUB6000
301 POKESC+XM+YM*22,32
302 XM=XM+DX:YM=YM+DY:IFYM<6ORYM>21THENYM=YM-DY
303 IFXM<0ORXM>21THENXM=XM-DX
305 MO=SC+XM+YM*22:IFPEEK(MO)=2AND(CA=5ORCA=6)THENXM=XM-DX:YM=YM-DY
310 MO=SC+XM+YM*22:POKEMO,CA:POKEMO+30720,CO
315 IFMO=PTHEN5500
320 MO%(E,0)=CA:MO%(E,2)=XM:MO%(E,3)=YM
330 NEXT:GOTO125
5500 MK=0:REM BLOW UP
5505 FORE=1TO10:POKEP,CH:POKEV3,200:FORI=1TO100:NEXT:POKEP,15:POKEV3,0
5507 FORI=1TO100:NEXT:NEXT:POKEP,16:FORI=1TO500
5510 NEXT:M=M-1:IFM=<0THENGOTO20000
5511 RESTORE:X=10:Y=14:FORT=1TO18:READA:NEXT
5512 FORE=0TO5:POKESC+MO%(E,2)+MO%(E,3)*22,32:NEXT
5515 FORE=0TO5:FORT=0TO4:READMO%(E,T):NEXTT,E:POKEP,32:P=SC+X+Y*22:POKEP,1:GOTO1
21
6000 REM DRAGON FIRE
6001 MO=SC+XM+YM*22
6005 IFCA=6THENHJ=1:FS=7:FG=1
6010 IFCA=5THENHJ=-1:FS=10:FG=1
6015 FORUP=MO+HJTOMO+HJ*3STEPHJ:G=PEEK(UP)
6016 IFG=2THEN6020
6017 IFG=0ORG=1THENPOKEV4,0:GOSUB6020:GOTO5500
6018 POKEUP,FS:FS=FS+FG:POKEUP+30720,2:POKEV4,220
6019 FORLK=1TO25:NEXTLK,UP
6020 POKEV4,0:FORUG=MO+HJTOUPSTEPHJ:POKEUG,32:NEXT:RETURN
8500 FORE=7812TO7833:POKEE+30720,1:NEXT
8510 FORE=0TO10:POKE7812+E,0:POKEV1,200:POKEV1,0:FORK=0TO250:NEXT:POKEE+7812,32:
NEXT
8520 FORE=7680+6*22+10TO7680+13*22+10STEP22:POKEE,0:POKEE+30720,1:POKEV1,200
8530 POKEV1,0:FORU=1TO250:NEXT:POKEE,32:NEXT:POKEE,0:POKEE+30720,1
8540 FORE=0TO19:READA:POKEA,32:NEXT:RETURN
9000 DP=37154:POKE37139,0:PA=37137:PB=37152
9010 POKEDP,127:S3=-((PEEK(PB)AND128)=0):POKEDP,255
9020 PQ=PEEK(PA):S1=-((PQAND8)=0):S2=((PQAND16)=0):S0=((PQAND4)=0)
9030 FR=-((PQAND32)=0):X1=S2+S3:Y1=S0+S1:RETURN
9500 IFCH=1THENHJ=-1
9501 IFCH=0THENHJ=1
9505 FORT=XTOX+HJ*6STEPHJ:IFT>21ORT<0THEN9520
9506 KJ=SC+Y*22+T
9507 POKEV3,240:GH=PEEK(KJ):IFGH=2THEN9520
9508 IFGH=3ORGH=4ORGH=5ORGH=6THENGK=1:JK=T:GOTO9520
9510 POKEV3,220:POKEKJ,13:POKEKJ+30720,1:POKEP,CH:NEXT:POKEV3,0
9520 FORQ=XTOT-HJSTEPHJ:POKEQ+SC+Y*22,32:NEXTQ:POKEP,CH
9525 IFGK<>0THENGK=0:POKESC+Y*22+JK,16:MK=MK+1:S=S+200:IFMK=6THENRESTORE:GOTO954
0
9530 POKEV3,0:RETURN
9540 FORE=1TO19:READA:NEXT:POKE900,INT(S/256):POKE901,S-INT(S/256)*256:POKE902,I
NT(HI/256)
9550 POKE903,HI-INT(HI/256)*256:CLR:GOTO1
20000 PRINT"SQQQQQQQQQ]]]]]]RGAME  OVER■IIII":IFS>=HITHENPRINT"R                 II":K
=0:G=0
20005 IFS>=HITHENPRINT"IIRENTER YOUR NAMER"
20010 A$="":HI=S
20015 FORJ=1TO20
20020 FORI=38604TO38613:POKEI,XAND7:X=X+1:IF(XAND7)=0THENX=1
20021 GETY$:IFY$<>""ANDK<11THENA$=A$+Y$:K=K+1:G=1:POKE646,GAND7:PRINT"R"Y$;"■";
20023 IF(GAND7)=0THENG=1
20025 FORF=1TO25:NEXTF,I,J
20030 MK=0:RESTORE:POKE900,0:POKE901,0:S=0:M=3:GOTO5
63000 DATA7886,7908,7930,7890,7912,7934,7997,7999,7969,7970,7971,7982,7983,7984
63010 DATA8103,8104,8105,8111,8112,8113
```

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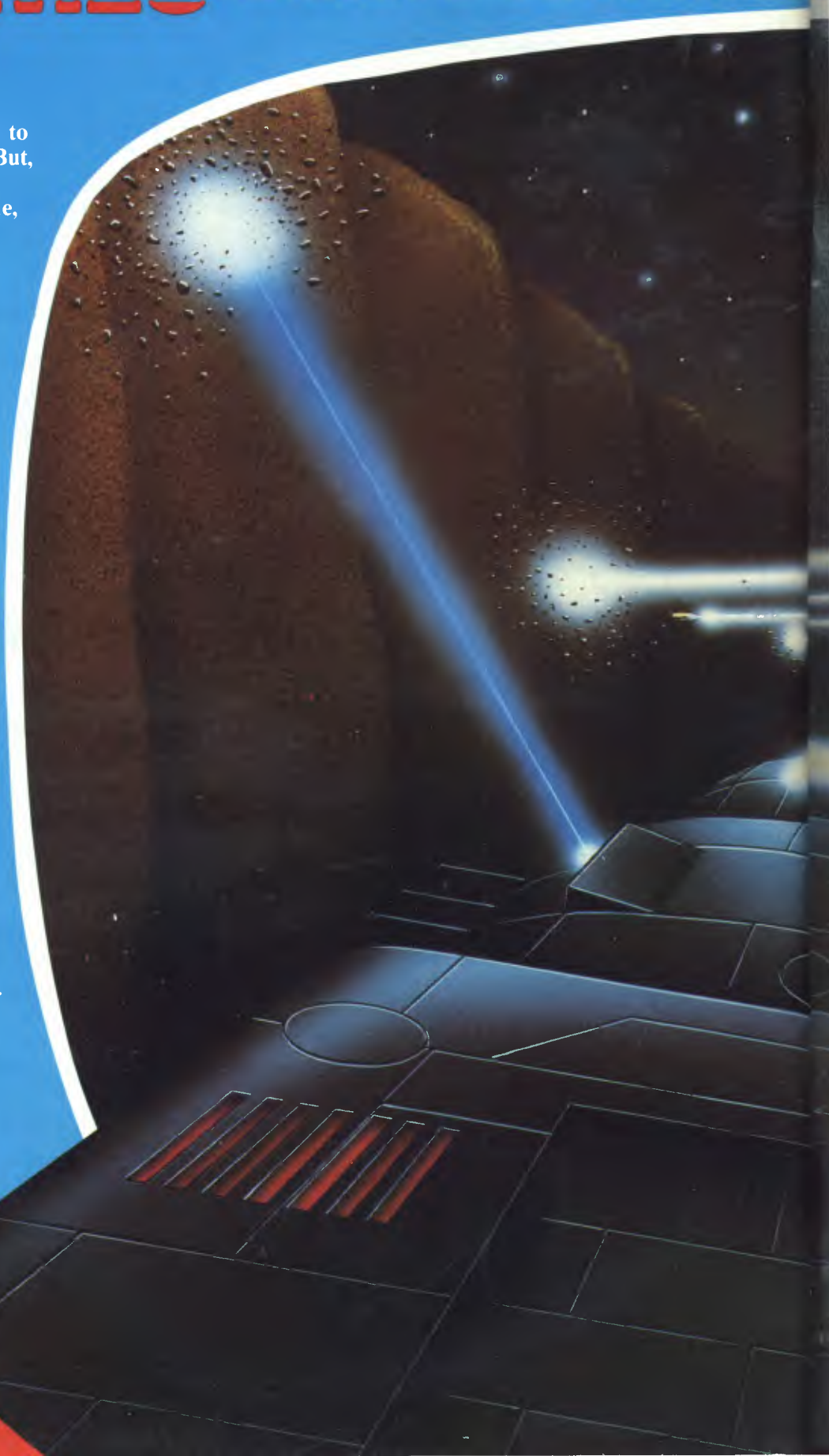

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