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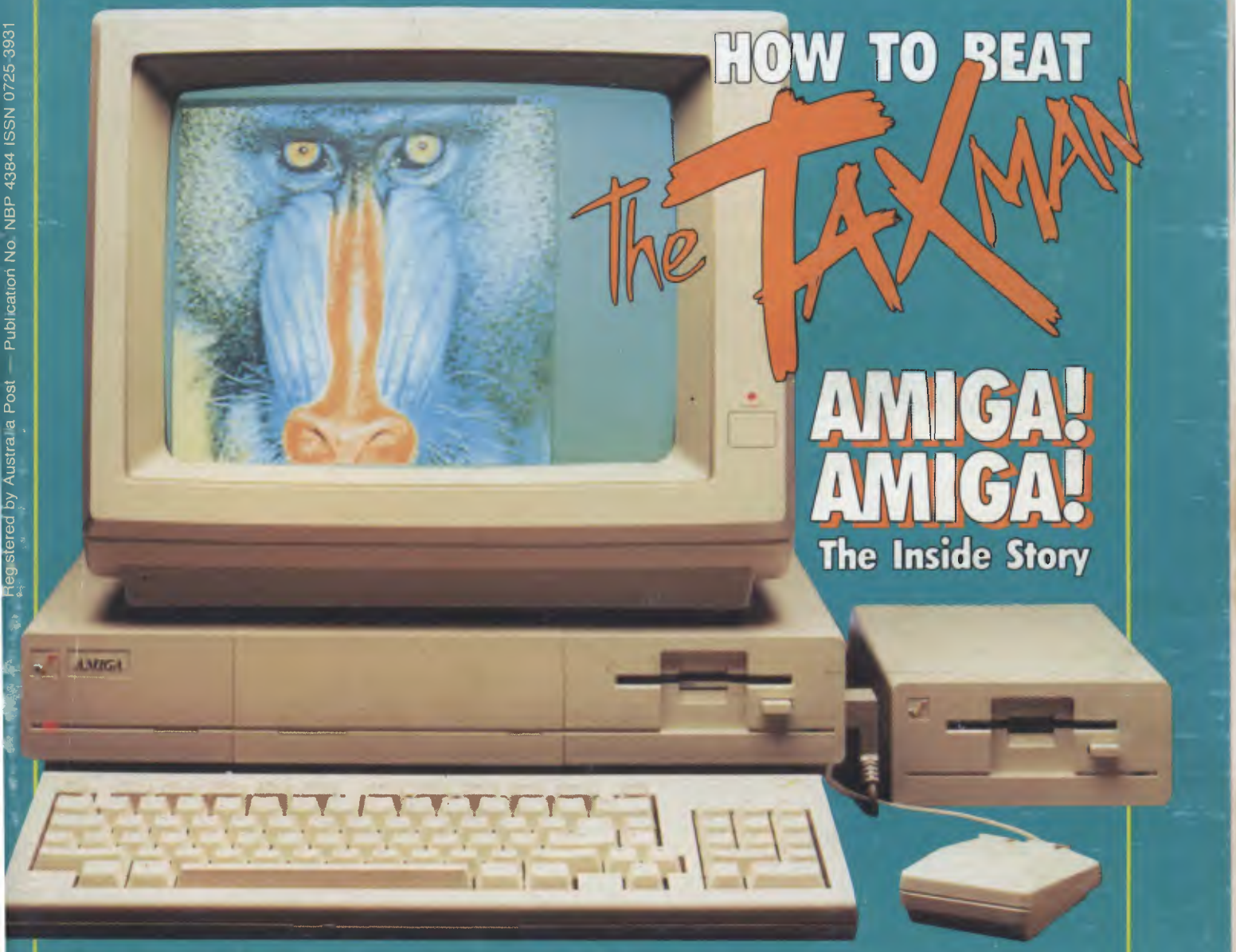

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EDITORIAL

Roll on Bubble Memory

As many readers will know, I regularly travel the country, giving seminars on topics such as PC-DOS/MS-DOS, Supporting Personal Computers and the like. Essential to those seminars is the ability to demonstrate DOS commands and various software packages. To do this, I travel with an IBM PC and use a Barco projection TV to display what happens on the screen. The displays can be very effective, allowing large audiences to see the effects of complex batch files and other commands.

In order to effectively demonstrate DOS operation — and indeed many software packages like dBase III Plus — a hard disk is essential. So some time back I upgraded my PC by adding a hard disk, and simultaneously obtained a specially constructed aluminium case with foam padding, in which to transport the newly fragile Icarus (all our machines are named).

All went fine, except for a mysterious period of erratic operation during a seminar in Melbourne. I never did find out what went wrong; by the time I'd finished writing a diagnostic suite to thoroughly test the drive it had come good again.

And so everything continued for some time, until my recent visit to Perth. I sent Icarus over by courier in advance of my own arrival, but for the trip back I took it with me as baggage.

As you wait for your bags at the airport, the assorted thumps and bangs on the other side of the carousel leave you with little doubt about the pounding taken by baggage. This time, Icarus did not escape unscathed. Turning the power on produced a horrible grinding noise from the stepper motor of the hard disk, and a distinct unwillingness to boot up.

So here I sit, with boxes full of PC software to review and work on, and a very dead PC.

The trouble is, I need a hard disk when I travel. The Compaq Plus is a possibility, but recently the airlines have started cracking down on passengers carrying portable PCs as hand baggage — they may well fit (just) under an airline seat, but they are too heavy.

However, sending a portable as baggage gives it a very slim chance of survival.

I'm now investigating alternatives: on my next trip I'll be taking a Hardcard disk drive in my luggage, mounting it into the PC on arrival and removing it again when finished. That might be the answer.

Meanwhile, I'm praying for a sharp drop in the price of bubble memories. □

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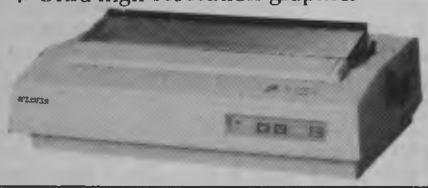

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GUNG-HO COMMODORE!

Commodore hasn't exactly received the best press about its financial position in the past year, but is now going all out to show these troubles are in the past and the company is back on its feet again, with a new management structure and paid-off debts to prove it. Natalie Filatoff spoke to Tony Serra, Commodore Australia's new managing director.

The Amiga is here! It arrived *early* — early in April — and out of the accompanying euphoria came a flurry of positive press releases from Commodore, to dispel last year's gloom and doom rumours of impending bankruptcy.

While the new managing director of Commodore Australia, Tony Serra, doesn't deny the company was in difficulty, he quotes an operating profit for Commodore International for the last half of 1985 of more than $1 million, as evidence of the company's strength.

"We're so strong," he said, "we were able to close down two major manufacturing operations and write off those losses in a single quarter, as well as repay $US52 million in bank loans in the same quarter."

Australian sales in January and February, 1986, were apparently up 66 per cent over the same period last year, and, says Serra, "There is every indication that March will be even better." Commodore International is also reported to have experienced a 50 per cent increase in sales compared to the same period in 1985.

So the Commodore's craft isn't really sinking after all (just listing a little). According to Serra, the upturn in the company's situation is the result of some long-overdue scrubbing of decks, emptying of the bilge and jettisoning of an accumulation of driftwood — "dead wood", he called it. And it seems there's been a run on the ship's armoury ...

"In the last six to eight months," says Serra, "a lot of bullets have been bitten. Hidden stocks and inventories of parts have been found and reconciled, and the company has broken down the one-man-band syndrome of Jack Tramiel, which didn't work."

Tom Rattigen, "a young, ex-Pepsico, *a la* John Sculley-type person" is at the helm, and has divided the marketing globe into three areas under the control of three key people: there's the United States and Canada (the new domain of Nigel Shepherd, formerly MD of Commodore Australia), Europe and the UK, and Australia and Asia.

"Now we're getting out there and being professional," says Serra.

Commodore sees itself as a company apart from the general computer whirlpool. "We've looked at the industry and decided we don't want to be just another computer company. We're a sales and marketing company which happens to sell computers. But," adds Serra, "that doesn't take away from the fact that we have some very technically minded people."

He says the computer industry as a whole hasn't been marketing to people. "It's been taking itself too seriously. Actually getting off Cloud Nine and being aggressive gives volume sales."

Volume sales, according to Serra, are to be had from the home market, which, he says, is far from dead, though it has changed. He believes it's been dragged further upmarket by a merging with the lower end of the business segment.

It's this merging which Serra maintains has left Commodore in a perfect position: with a leg-up, so to speak, into the business arena. He says the company's range of machines is poised to at least maintain its 70 per cent of the Australian home market, while scoring sizable successes in business.

The Commodore range now consists of the C16, the ever-popular C64, the C128D (which will soon entirely replace the earlier 128), the PC 10, the PC 20 and the Amiga.

The company is emphasising that the Amiga is not expected to pull Commodore clear of troubled waters all on its own. In fact, it's predicted the Amiga will only account for 11 per cent of sales in the coming year. "We're not naive enough to believe one new product could be the be-all and end-all," asserted Serra. The 128D is expected to bring a tidy 28 per cent of forecast sales, the PC 10 and 20 will battle it out for 28 per cent between them, and the old and new C64s will also carry a 28 per cent load, with miscellaneous peripherals bringing in the balance.

In the marketplace Tony Serra is afraid of no one, though he acknowledges that companies such as Sanyo, National, Toshiba and AWA — companies in the home entertainment game — are his main competitors. On behalf of the Amiga, he has declared Microbee Systems' Gamma to be a "nice" competitor.

"Microbee Systems doesn't have high-volume sales as its goal. It's a nice machine, but our main target is Apple. We're after the Mac, and wherever we see a head in that area we'll kick. The others aren't a threat. They have to be careful not to become aggressors. Aggressive competition will always be won by the company that manufactures its own machines ..."

Like Microbee Systems, Commodore will soon be announcing IBM PC emulation capabilities for its latest machine. The Amiga's lifeline to the world of business software should be available in June this year, though Serra insists the Amiga's open architecture will assure it of a place in any section of the marketplace, from home use to specialised application in music and graphics fields, and sophisticated business use (see Tim Hartnell's review of the Amiga — and its market positioning — on page 50).

This may be so, but at the moment everyone is asking who, other than the high-tech freaks, will buy a machine which has very little software available for it. At the time of writing, there were believed to be 70 packages available for the Amiga internationally — around 50 in Australia. While IBM compatibility will broaden the field considerably, those programs won't be taking advantage of the Amiga's fabulous capabilities. Apparently, 17 Australian software houses are writing programs for the Amiga, along with another 90 or so overseas companies — we can only wait and see how soon it takes for good drivers of this new computing vehicle to be produced.

One thing, says Serra, is clear: "Companies which are experiencing tough times don't go releasing products the way we are."

SAY GOODBYE TO SHORTHAND

Early in April, IBM researchers at Yorktown Heights, New York, demonstrated a speech recognition system, operating on a specially equipped IBM PC AT, which is claimed to be the most advanced yet achieved.

The system is claimed to correctly transcribe sentences from a 5000-word vocabulary with more than 95 per cent accuracy. It achieves this using an innovative statistical approach, originated at IBM's Thomas J Watson Research Centre, which works with a limited number of basic building blocks — used to compose words and phonetic symbols — rather than attempting to model thousands of individual words or imitating the way people recognise speech.

As sounds are uttered, the system chooses 'candidate' words using a statistical model drawn from an analysis of 25 million words of office correspondence. As the person continues to speak, new candidate words are chosen and the initial ones reevaluated in the light of the new data. Within a few seconds this process determines the most probable word and displays it.

This contextual analysis enables the system to distinguish between words which sound alike, such as 'know' and 'no', 'two', 'to' and 'too', and so on. Punctuation has to be added verbally by saying 'comma', 'exclamation point' or whatever.

The AT 'learns' the characteristics of each user's voice after he or she reads a short document into the system. Then, as the user speaks into either a free-standing or headset microphone — pausing briefly between words — phrases and sentences appear on the workstation screen. The resulting document may be edited again by voice, or by normal keyboard methods.

In this experimental desktop system two powerful high-speed subsystems are integrated into the AT, each consisting of three computer cards. These subsystems enable the power of a mainframe and three auxiliary processors to be condensed into a standard PC AT; when IBM demonstrated its first large-vocabulary real-time speech 'recogniser' in 1984 it had to use a roomful of computing machinery.

Dr Frederick Jelinek, leader of the IBM speech team, said the next step would be to test a number of the AT-based recognisers in offices, to gauge their adaptability to different speakers and to varying background noise.

"Equally important, of course, will be people's reaction to using the system," Jelinek said. "We need to understand how people in normal office settings will actually use it."

Each of the two subsystems consists of a digital signal processor chip and associated circuitry, mounted on three cards and controlled by the AT's processor. The first subsystem transforms speakers' words into a string of 'labels', thus encoding the speech. The second subsystem matches this with the words in the system's vocabulary, using a custom-designed memory management unit to search through a two-million-character memory in which the system's acoustic models and each speaker's pronunciation statistics are stored.

Future work will concentrate on expanding the system's vocabulary, improving its resistance to noise, and eliminating the need to pause between words. □

NEWS FROM IBM

Shortly after IBM in the United States announced a new portable computer, enhanced models of existing machines and various new software products, IBM in Australia released news of expanded capabilities for the IBM JX, the 'low end' of the PC range which is particularly aimed at the education market.

The new capabilities available for the JX include a hard disk expansion unit, a 256 Kbyte cluster memory card and nearly 40 new software packages.

The hard disk unit consists of a 10 Mbyte, 135 mm hard disk drive and three expansion board slots, which can be used with optional cards such as 256 Kbyte and 384 Kbyte RAM cards, allowing the user to increase memory to up to 512 Kbytes.

The 256 Kbyte cluster memory card installs on the optional cluster card, enabling users in a classroom network to install up to 384 Kbytes of memory into the main JX system unit.

New software includes six programs developed by Canada's University of Waterloo, the integrated package Enable, advanced word processors, personal productivity tools and over 20 educational programs designed to introduce students to various mathematical, scientific and language topics. All the software is available on 9 cm diskettes.

The portable computer announced by IBM is called the PC Convertible, and features an 80-column by 25-line detachable display that allows the system to be easily converted to a desktop model; two 720 Kbyte, 9 cm diskettes; battery power; 256 Kbytes of RAM; and it weighs less than 6 kg. Its price in the United States will be just under $US2000.

IBM also released a faster model of the PC AT, three new PC XTs with significant increases in storage capacity, new software to improve communications between PCs and host computers, two new series of accounting software, and price changes on 'selected' PCs, hardware options and software.

IBM Australia announced its intention to support the new 720 Kbyte 9 cm diskettes on the JX, but pointed out that the JX as available today will not support them without modifications. IBM intends to offer the ability for the current JX to be upgraded to support the 720 Kbyte storage capacity. Also, according to IBM Australia, the application programs which work on the current JX will continue to function successfully on the JX supporting the 720 Kbyte format. □

NATIONWIDE HISTORICAL INDEX

All over Australia there are collections of historical material — newspaper cuttings, memoirs, documents, photographs — many of them assembled by volunteers and kept in local museums and libraries. Also all around the country are people trying to find just that kind of information in order to trace the history of their family or a specific locale, who have no way of knowing this material exists, let alone how to access it. The material may also often be in a precarious state of preservation.

Australian Information Retrieval Services, a small company from the south-east Queensland town of Gympie, is trying to change this. It has released a 'kit', called the Local History Collection, giving step-by-step instructions on how to manage, arrange, catalogue and comprehensively index historical material. The user is told how to extract indexing information from the items and enter it on special forms, which are then returned to AIRS, entered into a computer, sorted into alphabetical order, and reproduced in a bound index.

All the material is kept on a floppy disk by AIRS and may be updated at any time. The initial purchase price includes 5000 entries, but there is no limit to the number which may be added.

If the owners of the historical material have access to a computer themselves, they can purchase the software and operate their own system independently of AIRS, but the company's ultimate aim is for all the indexes thus created to become part of a nationwide index of historical collections.

The idea and the program came about when the Gympie Historical Society and the Friends of the Gympie/Widgee Public Library wanted to make historical information about Gympie's gold rush days more available to the public. Lee Tonkin of AIRS designed the system, and has since adapted it for operation by librarians or even untrained volunteers.

As a small high-tech firm based in the country, AIRS is an example of the possible way of the future: the trend for high-technology industries, particularly software companies, to be based away from major cities in smaller towns (*or on islands?* — Ed.).

In its efforts to keep the price of the historical indexing kit at a level even small groups can afford, AIRS has decided to market it itself. It has made a video which interested organisations can purchase, re-enacting a local history society's problems and showing how the kit works. If you'd like more information or a copy of the video, contact AIRS at PO Box 567, Gympie 4570; (071) 83 4727. □

CORRECTIONS FOR LEDGERMASTER

Both author Lindsay Ford and *Your Computer* have received several angry phone calls and letters about errors in the Ledgermaster II listing published in YC March. In order to soothe readers' fevered brows and pacify Felicity, who's been fending off all those phone calls, here are the corrected lines:

Line 40 should read:

00040 IF o = 3 AND ...

The end of line 69 was illegible; it should read i = 1.

The expression X1 appears in line 113. This should be X<1.

The expression A0$(C= ... appears in line 309. This should be A0$(C)= ...

The line number for line 356 somehow became tagged onto the end of line 355 rather than at the start of the line immediately below.

Line 362 was omitted entirely! It should read:

00362 FOR X=Y TO 20: B1$(X) = " ": B3(X) = 0: NEXT X: RETURN

We apologise again to anyone who has been inconvenienced by these errors. □

DUN AND BRADSTREET DATABASE

Among the newest private databases which will soon be accessible through an IBM PC is an online system from Dun and Bradstreet, the credit and financial information company. It will enable subscribers to search through company lists for names of top executives and their positions — including heads of data processing and office management system sites. □

FILM ANSWERS RSI QUESTIONS

RSI (repetitive strain injury) has been dubbed the 'Australian Plague' and 'Kangaroo Paw', and some medical authorities reckon it has reached epidemic proportions. Twenty cents out of every dollar paid out in workers' compensation today is for RSI.

This obviously places an increasing burden on both employees and employers, not to mention insurance companies, and one of these, Switzerland Insurance, has sponsored a film on the subject to try to answer questions about RSI and educate all areas of industry about how to avoid the disease.

Narrated by newsreader David Johnson, the film examines common factors in the cause of RSI and outlines measures that can be introduced into the workplace to prevent the problem occurring. These measures include those taken by actual companies such as Chargecard, which has replaced all desks and chairs at computer terminals and introduced ideas such as computer cartoons which appear on the screen when the computer is switched on and instruct the user how to adjust the seating position to avoid strain.

Other preventive measures include group exercises, ergonomic furniture and reallocation of tasks — a mixture of practical and economical solutions.

The film is available for training sessions in the workplace; contact Lead Management, 263 Goulburn Street, Darlinghurst 2010, (02) 212 4199; or 96 Mills Street, Albert Park 3206, (03) 699 8496. □

NEW!! TOOLS FOR C PROGRAMMERS FROM HI-TECH SOFTWARE

HI—TECH C COMPILER

The HI—TECH C Compiler is an all-Australian high-performance C compiler for the Z80 and 8086/8088 processors.Now in use at thousands of sites in Australia and overseas, it combines an excellent user interface and diagnostic messages with smaller, faster generated code than any other compiler. It runs on CP/M-80, PC-DOS, MS-DOS, CP/M-86 and Concurrent CP/M. It allows for the generation of ROM based code and comes with a macro assembler, linker and librarian. The 8086 compiler supports large and small memory models and the 8087 maths co-processor. A cross compiler running under MS-DOS and producing code for the Z80 is also available.

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8086 Compiler for MS-DOS or CP/M-86	$300.00
Z80 Compiler for CP/M-80	$250.00
Z80 Cross compiler for MS-DOS	$300.00

SNAKE

SNAKE is a utility for MS-DOS functionally equivalent to the Unix MAKE command. It automates the recompilation of any modified modules of a programme. This is an indispensible tool for any serious programmer using C or any other compiled language.

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SNAKE	$89.00
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BTREE & ISAM

BTree is a b-tree based index and data file manager supplied in C source code form. ISAM is a higher level set of routines providing powerful database management, also in C source form. ISAM requires BTree.

Prices

BTree	$119.00
BTree + ISAM	$179.00

A BOOK ON C

"A Book on C" by Al Kelley and Ira Pohl is an indispensable guide for every C programmer, whether a beginner or an experienced professional. An excellent introduction and a comprehensive reference to the C language, it has many examples and working programs.

Price: $32.95

MACRO ASSEMBLERS

HI-TECH Software has macro assemblers to run under MS-DOS or CP/M for the following micros: 8080, 8085, 8086, 80186, Z80, NSC800, 6800, 6801, 6805, 6809, 6301, 6303, and 64180. All use standard manufactures mnemonics and come with a powerful linker librarian and object code convertor. The assemblers produce absolute or relocatable code and Intel and Motorola Hex formats are supported.

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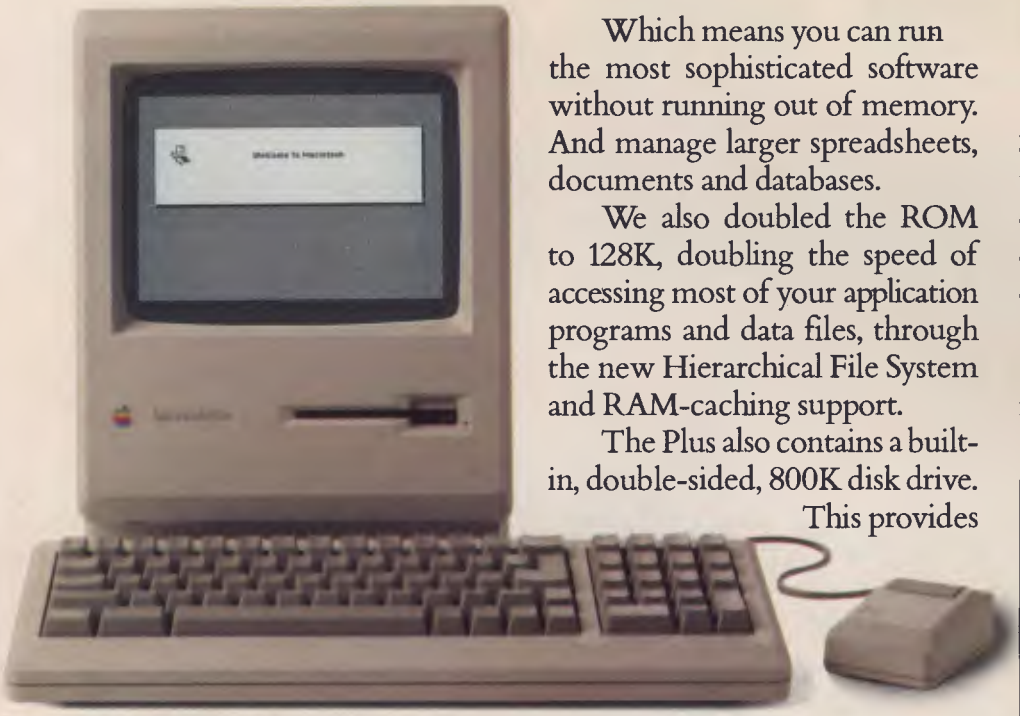


This year Apple introduces a new Macintosh.

Macintosh Plus.

As the name suggests, it's evolutionary, rather than revolutionary

(It's not our policy to bring out totally new computers for the sake of it. Instead we strive to perfect existing ones.)

Macintosh Plus is as simple to learn and use as before.

But there are some big differences, encouraged, we don't mind admitting, by current Macintosh owners.

Some of you asked for more power, others speed. Some needed greater storage capacity, others expandability.

Some heavy number-crunchers wanted a numeric key pad and conventional cursor keys built into the keyboard rather than remote.

Done. Done. And done.

The pluses of this new Macintosh include a full megabyte of RAM (expandable to four megabytes).

Which means you can run the most sophisticated software without running out of memory. And manage larger spreadsheets, documents and databases.

We also doubled the ROM to 128K, doubling the speed of accessing most of your application programs and data files, through the new Hierarchical File System and RAM-caching support.

The Plus also contains a built-in, double-sided, 800K disk drive. This provides twice the capacity of the previous Macintosh and the equivalent of 400 typed pages, or a bulging file drawer.

If that's still not enough, you can always plug in another 800K external drive.

Or you can really go all out and add our new Hard Disk 20.

(Its 20 megabytes are about 10,000 pages worth.)

Just plug in a Macintosh Hard Disk 20 and you can keep all your software, files, worksheets and documents within a moment's notice of your screen.

Add the Apple program Switcher, and you can actually work with several applications at once, moving information from one into another with the greatest of ease.

So you can transfer notes from an outline to a report – or numbers from a data file to a spreadsheet – as fast as you can click your mouse.

AppleCare.

All Apple products come with an automatic 3-month warranty covering all parts and labour.

But this year, Apple introduced a sort of "Warranty Plus" through the AppleCare service programme.

If you fill out and mail to us the registration form enclosed with your equipment, you will receive nine extra months' cover on top of the normal three.

Macintosh Plus also features a new SCSI connection port (dubbed "Scuzzy" in typical fashion by the development team).

SCSI stands for Small Computer Systems Interface and it's an industry standard.

We've virtually opened up the architecture. But what we've really done, of course, is open up a whole new world of possibilities.

The Scuzzy port let's you daisy-chain up to seven high-performance (and often low-priced) peripherals like hard disks, file servers and tape backups from all sorts of third parties.

Given all this power, it made sense to team it with equally impressive printers.

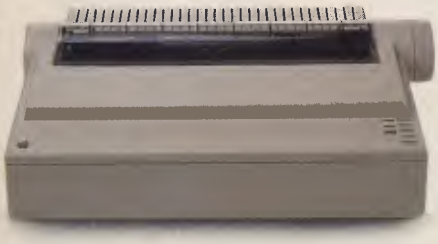
The new LaserWriter Plus is just such, producing documents with text and graphics of publishing quality.

everything except complications.

And it maintains this fidelity on copy paper, letterhead, labels, envelopes or overhead transparencies.

LaserWriter Plus has 35 different typefaces built in, a choice that would embarrass your local printer (and his invoices).

But if you don't need publication-quality printing, you can have near letter-quality by teaming up your Macintosh with the ImageWriter II.



It prints in three different modes: high-quality, standard and draft. And churns it out at speeds of up to 2½ pages per minute.

You can feed in single sheets automatically with the optional SheetFeeder.

And print up to seven colours using appropriate software.

ImageWriter II can also be shared with other Macintosh users via AppleTalk.

But this Macintosh isn't called Plus for nothing. You can just add and add.

Items like an AppleTalk Personal Network.

It's the most flexible, low-cost, easy-to-set-up, easy-to-use network around.

It'll connect up an office full of Macintoshes, LaserWriters, ImageWriters and file and disk servers – 32 devices in all.

Using an electronic mail package, you can send messages to any Macintosh screen on the network.

Or with EtherMac software you can share information with other computers. (Our computer is so friendly it'll even talk to IBMs.)

Add an Apple Modem 1200 to your Macintosh and you can talk to anyone virtually anywhere.

With a communications program like MacTerminal, a standard telephone and an Apple modem, your Macintosh can plug into electronic information services like Viatel, Minerva and Midas and communicate with mainframes and minicomputers.

If you already own a Macintosh, there's another plus.

You can upgrade your machine to the new one megabyte. Ask your dealer for upgrade details.

You can also upgrade your LaserWriter to become a LaserWriter Plus.

Get hands-on with the new Macintosh Plus.

You should like it.

You helped design it.

The Apple business card.

If you wish to own a Macintosh system, you can take advantage of the Apple Credit Card, available from participating dealers.

You can use it to purchase computers, peripheral equipment and software with no down-payment and less impact on your cash flow.

If you qualify, in most cases you can take your own Macintosh with you and dive straight into work with it the same day.

For an authorised Apple dealer near you outside Sydney, you call toll-free (008) 22 1555 or Sydney 908 9088. AP 219/Palace

Apple

NEWS

SEATTLE GUNSLINGER TAKES ON MICROSOFT

Giant software company Microsoft has become involved in a multi-million-dollar quarrel over the marketing rights to MS-DOS — Microsoft's flagship and the basis of its success — with a small company with just six employees, Seattle Computer Products — immediately dubbed by the United States trade press as the 'Seattle Gunslinger'.

When IBM approached Microsoft's founder, Bill Gates, back in 1981 for advice about a personal computer operating system, it seems he advised IBM to negotiate with Digital Research for its CP/M system, which was then the most widely used microprocessor operating system. For undisclosed reasons DRI didn't get involved with IBM in this project, which returned to Gates with its problem.

Gates then bought an operating system called QDOS (Quick and Dirty Operating System) — a CP/M lookalike — from SCP for $US60,000, modified it to become MS-DOS and then sold it to IBM for $US125,000. IBM's proprietary version of this operating system, PC-DOS, became a virtual industry standard, and Microsoft rose to become third-largest software company in the United States through licensing of its closely compatible MS-DOS to clone manufacturers. By 1984 it had achieved around 54 per cent penetration of US business computers.

Then, in 1985, SCP claimed that under the terms of the 1981 contract, Microsoft had the right to sell all new versions of MS-DOS, including the latest version 3.1, *as long as they were sold alongside an* SCP *microprocessor*. It gave Microsoft first option to buy the company — and thus the allegedly retained marketing rights. Microsoft maintained the rights were not transferrable and cast doubt on SCP's interpretation of the contract — at which stage SCP sued Microsoft for $US60 million in damages or the return of all marketing rights and back payment of all revenues from MS-DOS sales.

Officials at Microsoft have so far been restrained in their comments, probably because the timing of SCP's action clashed with the public listing of Microsoft Corporation. However, the issue is complex, and could take years to go through the courts if no intermediate settlement is reached. □

PIRACY CRACKDOWN

It seems times are becoming harder for computer industry pirates, with recent crackdowns and projected tougher laws in both the United States and South-East Asia.

The United States Government intends to apply to become a signatory to the Berne Convention covering international agreements for copyright protection, and may also limit special tariff preferences to developing countries where governments do not take sufficient steps to safeguard United States 'intellectual property'. It has identified the main violators as South-East Asian countries such as Taiwan and Korea.

Meanwhile, according to Lotus's director of security, Leo McCloskey, authorities in Malaysia, Thailand and Indonesia are taking a close look at software piracy problems, while Singapore, Taiwan and Korea intend to tighten up existing laws. This follows raids on Hong Kong retailers where around 20 people were arrested and a large number of software products seized following complaints by Lotus to Hong Kong Customs and Excise.

The Singapore High Court has also granted IBM Singapore permanent injunctions against six local traders for copyright infringements, and banned them from pirating and distributing IBM software and operating manuals. The software being pirated was IBM's BIOS.

Legislation to curb copyright violations based on the Australian Copyright Law is due to be presented to the Singapore parliament. The existing legislation is based on the British Imperial Copyright Act of 1911, but last August Singapore adopted the Australian model because it was up to date, suited for countries grounded in British common law, and provided for the protection of computer software. □

PAY-IF-YOU-LIKE SOFTWARE

An experiment in direct marketing of public domain and user-supported software for IBM PCs and compatibles has been started in Australia, and is claimed to offer a selection of thousands of programs from all over the world.

If the software proves useful, the purchaser is asked to register as a user and pay a small fee, which varies from program to program but is claimed to be generally only a few dollars. As a registered user, the purchaser will normally receive any updates. If the software isn't satisfactory, the purchaser simply doesn't register, but still keeps the disk.

The cost: $11 per diskette. The range: spreadsheets, word processors, utilities, games ... even a program called Deskmate featuring an alarm clock, calculator, calendar, notepad, printer control and typewriter mode, which can be resident in memory and work as an alternative to Sidekick. It comes complete with documentation on diskette.

If you wish you can join the PC Software Interest Group for a membership fee of $25, but this isn't necessary to buy software. However, the directory of available software is free to club members, who also receive newsletters with details of the latest releases.

Aspiring Australian authors can also join the experiment and have their software distributed on the same basis in the United States and other countries, at no cost to themselves.

Initially the software will be available by mail order only from Manaccom, PO Box 42W, West Pennant Hills 2120, or by phoning (02) 875 3538. □

TEACH YOUR PC TO READ

While PCs are generally purchased to improve office efficiency and speed up data processing, actually keying the information into the machine essentially hasn't changed since the first typewriter appeared on the scene over 100 years ago. Remington now claims to have produced a product which removes the keyboard bottleneck.

The PC-Scan optical character reader is a 41 by 29 by 10 cm box which fits between the PC and its screen, into which documents are simply 'posted' through a front slot. It is claimed to scan a standard A4 typewritten page in 25 seconds — 30 times faster than the average copy typist — and produce the text on the PC screen just as if it had been keyboarded. It can then be manipulated with your chosen word processor.

PC-Scan is claimed to be able to read all the popular fonts currently used in offices, even proportional spacing, so it should be able to operate with text created on almost any kind of typewriter. Remington's information doesn't state whether PC-Scan is able to 'read' print as well as typewritten text.

You can contact Remington at 175-183 Liverpool Street, Sydney 2000; (02) 269 0925. □

TRY BEFORE YOU BUY

If you'd always thought there really *should* be somewhere you can try out the computer or software you're considering buying, or compare different products in use — somewhere quite impartial, with no pressure on you to buy — you'll be pleased to hear there is. At least, if you live in Melbourne you'll be pleased.

The Australian Microcomputer Industry Clearinghouse (AMIC) is a division of Technisearch, the commercial arm of the Royal Melbourne Institute of Technology, and as such is both non-affiliated and impartial, and can draw on a vast range of computer experts from the Institute.

AMIC has been quite a success story in the past year, with more than 20,000 people having made use of its services, and its reputation as a consultant for large and small projects steadily growing.

AMIC's *raison d'etre*, however, is to give individuals and organisations impartial advice on all aspects of microcomputing, and to provide facilities for them to have hands-on experience of the products they're interested in.

AMIC has on permanent display such brands of computer as Apple, IBM, Hewlett-Packard, Labtam, Pantek, Barson and Tandy, as well as an extensive and rapidly growing library of software. It also has a number of peripherals such as printers and modems.

It costs just $6 an hour for a prospective purchaser to test and evaluate any number of hardware and software options. Staff are also on hand to demonstrate products, a service which costs $45 an hour.

AMIC is located at Gateway Plaza, 449 Swanston Street, Melbourne 3000. You can contact the manager, Peter Wilkinson, on (03) 663 6775, for further details. □

NOT JUST FOR YUPPIES

We've all known it wasn't true for a long time, of course (or you wouldn't be reading this magazine, would you?), but there's a prevailing belief *out there* that computers are really only for professional programmers and the upwardly aspiring young urban professional. To help disprove this prejudiced theory, a 13-year-old boy and a 56-year-old mother of two from the Hunter Valley have just won a Commodore 64 each for successfully completing 'The Hunter Valley Coal Chain Computer Game'.

This mouthful of a game was introduced at Maitland and Newcastle computer shows in a display by the Newcastle Coal Export Review Committee (NEWCERC), whose members represent the coal mining companies, coal transporters, cargo assembly and shiploading and port operations in the area.

The real Hunter Valley Coal Chain is the people who are involved in or benefit from the mining, transportation and exporting of coal to international markets. In the game, players were required to schedule trains from various loading points in the Hunter Valley to the port of Newcastle in time to complete cargoes for ships arriving at the port. The game was devised by three Newcastle High School students, and the winners were Brendan Frost and Edna McKendry.

Mrs McKendry was delighted to win her C64, but reports battles already with her two businessmen sons to keep her computer for home use.

As for Brendan, he already *has* a C64, and was in the process of negotiating with his parents to upgrade to a C128 — so now he'll trade in both his 64s for a 128. □

Just out of the box

The VT AT PROFESSIONAL

We've built the VT AT for long distance, high speed computing with an 8 mHz CPU as standard and, with optional 10 or 12.5 mHz already built in, there's plenty of room left to move ahead. A VT computer will expand with you — its designed that way. Built from the world's top components; we can offer 12 months warranty with Olivetti backed service Australia wide. The specs say it all: 1M RAM, 40 Mbyte hard disc, Gate Array technology, Zero Wait State, built in networking capability, 4 I/O ports — all at a very competitive price.

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AMERICAN GRAFFITI

BY HOWARD KARTEN

IT'S UNIVERSAL . . .

Occasionally, tax authorities experiment with alternatives aimed at easing the burden of preparing and filing returns. For example, in the United States, the Eternal Revenue Service several months ago began a test program in which a few selected commercial tax preparation services are filing returns electronically (that is, via PCs). Overall, however, the computer revolution seems hardly to have affected the way tax returns are prepared.

Indeed, for a time computers actually threatened to make things worse: United States tax law recently, briefly, required that home computer users claiming deductions for their PCs document when and why home usage occurred — presumably to prevent Mommy and Daddy from claiming a deduction for Junior's game-playing on the family computer. The Infernal Revenue Service beat a hasty retreat following a massive outcry by users that the record-keeping requirements were extremely burdensome.

Only a few years ago, AI researchers here envisioned incorporating AI techniques into a computer-based tax preparation program. That attempt was quickly abandoned, of course, when someone realised that even the best example of artificial intelligence would not be up to coping with the genuine stupidity of parts of our tax system. One micro's circuits blew out entirely in a futile attempt to follow IRS instructions and divide line 16 of the return (gross income) by line 4 (social security number). *Sic transit gloria* IRS.

Some entrepreneurs have attempted to meet the challenge in a less ambitious way. There are literally dozens of tax preparation packages for micros available on the market now, as well as dozens of templates for Lotus 1-2-3 and other worksheets used to help prepare tax returns. I've solved the problem in a less ambitious way: I've set aside one disk containing my financial records, and from time to time during the year, I update it — using my word processor. Thus, when I visit my accountant each year, I make sure I've placed that disk with my other papers in the big supermarket bag containing all my tax data.

Clearly, what this all points to is that the world desperately needs a piece of micro software for taxes, which would have universal applicability — that is, able not only to run on most computers, but also applicable to most governments around the world.

After exhaustive research in *Your Computer*'s American software labs, we've managed to perfect just such a program, which we've published below. We believe it should run on most computers with only slight modification.

```
10 PRINT "HOW MUCH DID YOU
MAKE LAST YEAR?"
20 INPUT X
30 PRINT "SEND IT. signed,
YOUR FRIENDLY TAX MAN"
```

KNIGHT-RIDDER HALTS VIEWTEXT SYSTEM

Knight-Ridder Newspapers, one of the United States's largest newspaper publishers and one of the first companies to actually institute a working videotex system, has thrown in the towel. In operation for less than 30 months, the company's Viewtron service has been permanently closed down. Company officials claimed that "despite steady growth in the number of subscribers", the actual usage fell short of projections.

The NAPLPS-based system reportedly had fewer than 20,000 subscribers, and required them to purchase a $US600 terminal in order to use the system. Transmitting data in NAPLPS is said to be considerably slower than transmitting ASCII, and this is widely regarded as one of the key problems Viewtron encountered. Another, of course, is that data was not easily transferrable to conventional PCs. However, Viewtron did add ASCII capability in 1985.

Meanwhile, other United States information utilities, such as Compuserve, are said to be thinking about experimenting with NAPLPS protocols — possibly adding that protocol to Compuserve's conventional transmission method.

UNIQUE TACK FOR NEW SOFTWARE VENDOR

A United States company has taken a unique tack in trying to break into the IBM word processor market. Ironically, however, technology advances may cut into the company's revenue.

The company, Brown Bag Software of Campbell, California, reasoned as follows. The word processor market is already crowded, and we've got to get the product out there so everyone can try it.

So the company arranged to have the actual disk, containing the full text of the word processor and a mini instruction manual, bound into every edition of a popular magazine here for IBM PC users. The gimmick is that users can print off the documentation, and use the disk a few times. After that, however, it won't work — unless users call the company and charge the $US89 price of the software to their credit card. At that point, Brown Bag tells users how to 'unlock' the software, mails out a complete manual, and also sends out a spelling checker.

So far, so good — except for one thing. The day after the software was in the hands of the magazine's readers, instructions for unlocking it appeared on several of the most popular bulletin board systems here.

APPLE ELIMINATES 600 OF ITS DEALERS

In early April, Apple Computer cut the number of authorised Apple dealers from about 3200 to 2600. This cutback follows a similar one by IBM several months ago, and, according to Apple, is aimed at shoring up the health of the remaining dealers. With computer sales generally in something of a slump here, Apple is clearly hoping to reduce its costs, particularly the costs of maintaining dealers through promotions, training, and so on. A secondary motive may be to reduce competition somewhat.

According to Apple, the stores being cut are the weaker ones, particularly independents, who accounted for less than 10 per cent of sales. However, 100 of them are Sears Business Centre stores operated by Sears, Roebuck & Co. Sears is the largest retailer in the United States, and had earlier said it would stop selling the Macintosh, which it had sold since the product's January 1984 introduction. While precise information concerning the hows and whys of Sears' action was difficult to come by, the move cannot be good news for the Mac, since Sears is regarded in some quarters as something of a barometer in terms of what's hot and what's not. □

NetComm have good news for those who thought the best modems cost an arm and a leg.

Now Australia's finest modem is within reach of everyone's pocket. NetComm's new Modem 3+12 can be yours for an incredible $324. This 300 **and** 1200/75 full duplex manual dial modem will open up a whole new dimension for your computer, allowing you to access most local and overseas data bases and other PC's throughout the world.

Unique Upgrade Facility

Unlike other economy modems which have to be tossed out when you want to upgrade, the NetComm Modem 3+12 can be easily upgraded to incorporate auto dial, auto disconnect and other SmartModem® features.

All this and Software as well?

The Modem 3+12 comes with a Videotex and Comms program that will enable your PC to directly access Telecom's Viatel, plus news, stock market reports and a host of other information.

Now there's no need to compromise on quality or price. See your PC dealer today, or contact NetComm for further information.

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☆ The world's largest range of software with industry standard MS-DOS operating system. With the SLE (software library expander) option the APC III runs previously "IBM only" software, including Lotus 1-2-3, Framework and Multimate.

☆ Superior networking technology – *available now*. Novell's Netware/O with Omninet provides high speed, secure access to programs and data for up to 16 users, up to 4,000 feet apart. Netware allows workstations to use MS-DOS version 2.11 – use the software you know, on the network.

We will give you a deal on NEC that is light years ahead as well. Call now, we'll prove we're also the best dealers in the galaxy, no kidding!!

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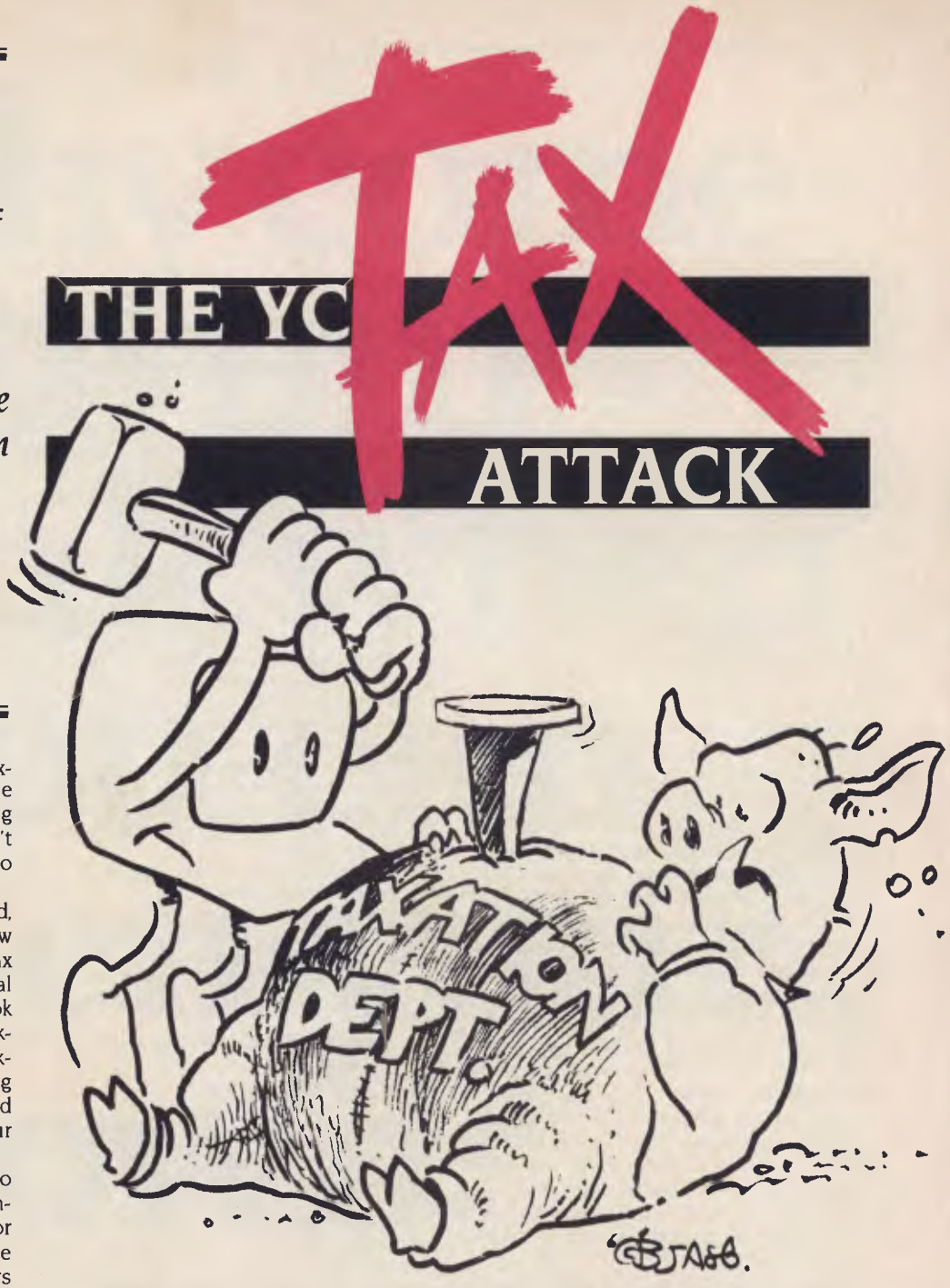
Phone (03) 781 4011

APC III

THE YC TAX ATTACK

It's that time of year again. "It's mine, I earnt it," you cry. "But I'm going to put you in jail if you don't give it to me," says the taxman poisonously. Well, Matt Whelan has brewed a little detaxicant to spray on him — pssst. The 'WARNING:' on the can reads "If this backfires, you can't just push the escape button."



Beat the Taxman! Beat the Taxman!" came the cries from the YC office at our forward-planning meeting back in January. "Don't bother," was the reply, "they're so far into S&M in that office they'd love it . . ."

No, our more serious staffers intoned, the idea would be to show everyone how to use micros to their advantage at tax time — the June issue would be the ideal vehicle for our tax attax. We'd simply look up the dozens of tax preparation packages, Lotus tax templates, tax ready-reckoner programs and expenditure-tracking systems we'd read or heard about and package them all together to help our readers in their annual June joust.

Simple, we said, as we went back to working on the March issue. In the meantime we sent our spotters out looking for suitable packages, and made appropriate noises in *Next Month* to give distributors time to get their tax act together and forward the details to our sumptuous, tax-deductible Joynton Avenue offices.

To say we were knocked down in the rush, our offices made impassable by the mountains of software crowding the corridors, would be . . . well, it would be an outright lie, ranking up there with Eve's "Taste this, Adam, it's heavenly".

What if we gave a party and nobody came? (And would it still be tax-deductible?) Well, it didn't turn out quite that badly, but we were worried for a while.

So *That's* Where We Saw It!

The penny didn't make a mark when it dropped on our thick skulls, in the form of the 'Tax Preparation Software' issue of PC

```
10 ' Copyright (C) 1986, Worthwords Pty Ltd.
20 ' permission granted for personal, non-profit use on
30 ' the condition the lines 10 to 100 inclusive are
40 ' retained and executed as is and the disclaimer
50 ' carried in subroutine 500 is included
60 PRINT : PRINT "-----------------------------"
70 PRINT "Income Tax Calculator 1985/86"
80 PRINT "Copyright, Worthwords Pty Ltd"
90 PRINT "-----------------------------"
100 PRINT : INPUT "Hit RETURN to get started . . .";X$
110 CLS$=CHR$(26)          ' ^Z = clear screen on ADM/TVI
115 DEFDBL A-Z             ' use double precision throughout
120 FALSE% = 0 : TRUE% = NOT FALSE%
130 PROV% = FALSE%         ' no provisional tax yet
140 GOSUB 500              ' explain ourselves
150 GOSUB 1000             ' get income, tax paid, income subj to prov tax
160 GOSUB 300              ' get appropriate tax scale
170 GOSUB 2000             ' check applicable rebates
180 GOSUB 3000             ' calculate tax, apply medicare levy and rebates
```

▶

Tax Attack

Magazine (the real one, not the chopped-down local version).

When we saw its reviews we realised everything we remembered reading and hearing about tax software was *American*. Their complex Form 1040 tax return is a mathematical nightmare which cries out for computer assistance — assistance that has been provided in more than 100 forms from Freeware to high-powered commercial programs.

The United States *Journal of Taxation* shows no less than 70 professional-level packages, and PC *Magazine* uncovered dozens more aimed at end users.

In contrast, you don't even need to dust off the calculator to complete our standard income tax return, unless you are particularly keen to know your refund to the last cent. The more complicated returns apply to so few people that there is no good reason for a software house to develop an end-user package.

We did uncover three professional-level packages (designed for accountancy firms to help them prepare your return for you), but that was about it. So, it was straight to Plan B (or Part B of Plan A), the second of our tax-time stories designed to give you a few pointers on what you can cheat — er, rightfully claim is what we meant to say — with your micro's help, whether you can claim any deductions for your electronic dependent, and whether you can use it to make tax-free money.

And, having failed to uncover a useful program to calculate your 1986 tax for you (people who do taxation things are still working on 1985, anyway), we sat down and wrote one. Talk about dedication! Oh, you'd prefer us to talk about tax? Okay then, if you insist.

Before we go on, it's disclaimer time. Our program is meant as a guide only, and if you go to jail because of it we won't even send you a postcard, let alone admit any liability.

Paul Bedford, our whizz accountant who gave us all the latest tax details ("Don't quote me," he said, "and make sure you have a disclaimer on every second line in case you botch it."), warns that no program — even one written by someone who knows what they're doing, unlike us — can replace a trained beancounter. We reckon you should phone him on (02) 922 3911 if you want to check up on our results. He takes Bankcard . . . (or cash, but don't tell the Deputy Commissioner about that!).

```
190 GOSUB 3500              show the result
200 SYSTEM
297 '
298 ' work out appropriate tax rate depending on income
299 '
300 IF TI>34999 THEN GOSUB 35000
310 IF (TI>27999 AND TI<35000) THEN GOSUB 28000
320 IF (TI>19499 AND TI<28000) THEN GOSUB 19500
330 IF (TI>12499 AND TI<19500) THEN GOSUB 12500
340 IF (TI>4594  AND TI<12500) THEN GOSUB 4595
350 IF TI<4595 THEN GOSUB 4000
360 RETURN
497 '
498 ' explain ourselves
499 '
500 PRINT CLS$
530 PRINT : PRINT
540 PRINT "This 'ready reckoner' calculates the tax owed or refund due based"
550 PRINT 'on your taxable income (as worked out on your 1985/86 return, after"
560 PRINT "deductions) and the tax already paid (either shown on your Group"
570 PRINT "Certificates, or remitted in Provisional Tax payments for the"
575 PRINT "1985/86 financial year). Your must know these figures BEFORE"
580 PRINT "you run the program"
590 PRINT:PRINT
600 PRINT "The program will take into account rebates available to you"
610 PRINT "and (where applicable) calculate provisional tax. However, it is"
620 PRINT "not intended as an absolute or complete analysis as the tax laws"
630 PRINT "are complex and individual cases will vary widely."
640 PRINT:PRINT
650 PRINT "We offer this program as a guide only and will accept no"
660 PRINT "responsibility for its accuracy or applicability..."
670 PRINT:PRINT
680 PRINT "Do you have your Taxable Income and Tax Paid figures to hand?"
690 INPUT "Enter (N)o to quit, any other key to continue";ANS$
700 IF ANS$="N" OR ANS$="n" THEN SYSTEM
710 RETURN
997 '
998 ' ask for total income, total tax paid, check if provisional applies
999 '
1000 PRINT CLS$
1020 PRINT:PRINT:PRINT
1040 PRINT TAB(20);"YC Income Tax Calculator 1986"
1050 PRINT TAB(20);"=========================="
1060 PRINT:PRINT
1070 PRINT TAB(15):INPUT "Total Taxable Income (from ALL sources)  ";TI
1080 PRINT
1090 PRINT TAB(15);       'Provisional Tax applies to any non-PAYE"
1100 PRINT TAB(15);       "income, such as contract work, investment"
1110 PRINT TAB(15);       "returns, and so on. Does this apply to"
1120 PRINT TAB(15):INPUT "any of your Total Income as shown above  ";ANS$
1130 IF LEFT$(ANS$,1)="Y" OR LEFT$(ANS$,1)="y" THEN GOSUB 1500
1140 PRINT
1150 PRINT TAB(15);"Tax Paid (shown on Group Certificates,"
1160 PRINT TAB(15):INPUT 'tax stamps, or Provisional Tax payments) ";TP
1170 RETURN
1497 '
1498 ' determine how much of income is subject to provisional tax
1499 '
1500 PRINT TAB(15):INPUT "Amount subject to provisional tax        ";PTI
1510 IF PTI>1000 THEN PROV% = TRUE%      ' prov tax shouldn't apply under $1000
1520 RETURN
1997 '
1998 ' check which rebates apply
1999 '
2000 REB=0 : IN = 99
2010 DIM CH(11) : DIM MSG$(11) : DIM RB(9)
2015 FOR I% = 1 TO 9 : RB(I%) = 0 : NEXT I%
2020 FOR I% = 0 TO 11 : CH(I%) = FALSE% : NEXT I%
2030 MSG$(0)=" 0 - Exit"
2031 MSG$(1)=" 1 - Spouse"
```

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Back to the Tax at Hand

First, let's have a quick look at the professional-level packages available. If you have some spare cash you can grab one and sell your services to your friends — they range from a mere $500 to an awesome $2500.

Unitax: Written by Brisbane accountant Trevor Watters, Unitax is distributed by Clarion Business Services, PO Box 394, Logan City 4114; (07) 208 7311. Claimed features include: the use of 'standard phrases' in returns; the ability to set up 'standard' taxpayers, and copy and merge tax returns; depreciation schedules; and a 'what-if' tax calculation program (the thought of a what-if tax calculator amuses us. Is the declaration of income/expenditure that flexible?)

Microtax: Based on the volume (and informative nature) of its information kit, Microtax is the package to beat. It lists features like: taxation department approval; all input schedules/forms; filing of lodgement records; preparation of standard letters and client mailings; while-you-wait tax returns; client billing; and too many others to cover here. What's really impressive is the fact it lists some of the things it *doesn't* do, so you don't have to remember to ask the question...

Microtax comes from Microtax Pty Ltd, 3 Hall Court, Dandenong 3175; (03) 791 7006.

Tax Return Package: Despite the outrageously imaginative name, this package really is for accountants who want to do tax returns. And it comes from CCH Australia, the self-confessed 'tax specialists' (yes, CCH publishes all those books you see on your accountant's shelves).

This package, branded CCH Solvware, seems to cover just about everything the taxation department is interested in (it carries department approval), plus invoicing, accounting and internal management documents. It seems to do it all well, with minimum user input.

You can find out more from CCH Australia, PO Box 230, North Ryde 2113; (02) 888-2555.

Getting Your Own Back

Your own money, that is: we spent a while talking with our accountant friends (you only get one plug, Paul) about things you can claim and ways you can make tax-free money.

"You can claim (disclaim) some (disclaim) things in your (disclaim) return

```
2032 MSG$(2)=" 2 - Daughter-housekeeper"
2033 MSG$(3)=" 3 - Invalid relative"
2034 MSG$(4)=" 4 - Parent"
2035 MSG$(5)=" 5 - Housekeeper"
2036 MSG$(6)=" 6 - Sole parent"
2037 MSG$(7)=" 7 - Pensioner"
2038 MSG$(8)=" 8 - Unemployment/Sickness benefits"
2039 MSG$(9)=" 9 - Medical expenses exceeding $1000"
2040 MSG$(10)="10 - Home loan interest"
2041 MSG$(11)="11 - Zone allowances"
2050 WHILE IN<>0
2060   PRINT CLS$
2070   PRINT:PRINT:PRINT
2080   PRINT TAB(10);"Select a rebate you qualify for:"
2090   PRINT
2100   FOR I% = 0 TO 11
2110     IF CH(I%)=FALSE% THEN PRINT TAB(15);MSG$(I%)
2120   NEXT I%
2130   PRINT
2140   PRINT TAB(15):INPUT "Select - ";IN
2150   IF IN=0 THEN RETURN
2160   IF (IN>11 OR CH(IN)<>FALSE%) THEN 2190
2170   CH(IN)=TRUE%
2180   ON IN GOSUB 2200,2200,2200,2200,2300,2400,2500,2600,2700,2800,2900
2190 WEND
2197 '
2198 ' spouse, daughter, relative or parent
2199 '
2200 PRINT:PRINT
2205 FOR I%=1 TO 6 : CH(I%)=TRUE% : NEXT I%     ' mutually exclusive rebates
2210 PRINT TAB(10):INPUT "What is the dependant's separate net income ";SI
2220 PRINT TAB(10):INPUT "Do you also have a dependant child/student  ";CS$
2230 IF IN<3 THEN TMP=830        ' rebate for spouse or daughter/hskpr
2240 IF IN=3 THEN TMP=376        ' invalid relative
2250 IF IN=4 THEN TMP=749        ' parent, etc
2260 IF SI>282 THEN GOSUB 2280   ' reduce for separate income
2265 RB(IN)=TMP
2270 IF LEFT$(CS$,1)="Y" OR LEFT$(CS$,1)="y" THEN RB(IN)=RB(IN)+200
2275 RETURN
2277 '
2278 ' Reduce rebate by $1 for every $4 separate net income > $282
2279 '
2280 SI=SI-282
2282 SI=INT(SI/4)
2284 TMP=TMP-SI
2286 IF TMP<0 THEN TMP=0
2288 RETURN
2297 '
2298 ' Housekeeper
2299 '
2300 RB(IN)=830 : PRINT : PRINT
2305 FOR I%=1 TO 6 : CH(I%)=TRUE% : NEXT I%     ' mutually exclusive rebates
2310 PRINT TAB(10):INPUT "Do you also have a dependant child/student  ";CS$
2320 IF LEFT$(CS$,1)="Y" OR LEFT$(CS$,1)="y" THEN RB(IN)=RB(IN)+200 ' child
2330 RETURN
2397 '
2398 ' sole parent - unconditional rebate
2399 '
2400 RB(IN)=780
2405 FOR I%=1 TO 6 : CH(I%)=TRUE% : NEXT I%     ' mutually exclusive rebates
2410 RETURN
2497 '
2498 ' pensioner gets 250 less 12.5c for every $1 income > $5595
2499 '
2500 TMP=250 : MAX=5595
2510 GOSUB 2550
2520 RETURN
2547 '
2548 ' calculates sliding scale for pension and unemployed/sickness
2549 '
2550 T2=TI-MAX
```

What works just like 1-2-3™ but costs just $249?

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1-2-3 is a trademark of Lotus Development Corp. TWIN is a trademark of Mosaic Software Inc. Price comparisons based on recommended retail prices current at time of going to press.

the TWIN™

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Glover & Assoc. 6123

(disclaim)," he said. What he meant was we can tell you about these things, but when you get nabbed (er, challenged) it's you who will have to prove them. The following tips will be valid for some people, and entirely irrelevant for others — if you get it wrong, *you* go to jail . . . not us.

Hobby Use: The proceeds of a hobby are not taxable. So if you have a bet on weekends and win a bundle, you don't pay tax. However, if you get so good at it you quit work and tramp around the racetracks it becomes a business, and you can start coughing up.

The same goes for the use of your PC. If you write programs for the fun of it and end up selling them (to YC for Pocket Programs, for example, or to someone with a particular need for the wheel you've invented) you should not have to declare that as income.

If your 'hobby income' becomes substantial the taxman will decide it's a business and ask for a slice — at what point that happens is up to you and he to fight out. Once (if ever) it does, you get to declare the costs as well as the income.

Cottage Industry: Whether you set up in business or continue your money-making micro activities as a sideline, you can claim the costs of running, feeding, and repairing your computer and, possibly, attendance at seminars and courses designed to raise your profit level.

Things to think about: if you have a dedicated office at home you can (disclaim, disclaim!) claim rent, electricity, and so on; if you have to travel to the Paris Computer Show (don't give its address as *Place Pigalle*) or even Comdex you may be able to claim your fare/expenses; computers depreciate rapidly (33 per cent a year) and you can claim that cost — or lease payments, if applicable; they consume paper, disks and ribbons at an alarming rate; and of course you have to buy software, maintenance contracts, repairs, and subscriptions to *Your Computer* (we're working on the tax office to disallow deductions claimed for other magazines!).

Then, of course, you'd better think about how you're going to prove your Sinclair ZX80 is used for business 99.85 per cent of the time, or that you really have a business going when your computer expenses add up to $10,000 and resultant income peaks at $500.

Be ready for a visit from the tax man. In the meantime, how *are* you going to type with those boxing gloves on . . . ? □

```
2555 IF T2>TMP/.125 THEN RETURN                    ' no rebate
2560 IF T2<1 THEN RB(IN)=RB(IN)+TMP : RETURN       ' full rebate
2565 RB(IN)=RB(IN)+(TMP-(T2*.125))                 ' calculate part rebate
2570 RETURN
2597 '
2598 ' unemployed/sickness benefits recipients (sliding scale like pension)
2599 '
2600 PRINT : PRINT
2610 PRINT TAB(10):INPUT "Are you married (Y/N) ";ANS$
2620 MAX=5275 : TMP=170
2630 IF LEFT$(ANS$,1)="Y" OR LEFT$(ANS$,1)="y" THEN MAX=8795 : TMP=220
2640 GOSUB 2550
2650 RETURN
2697 '
2698 ' 30% of net medical expenses > $1000 are rebated
2699 '
2700 PRINT : PRINT
2710 PRINT TAB(10);"Net medical expenses (i.e. after Medicare and insurance"
2720 PRINT TAB(10);"refunds) are subject to rebate if they exceed $1000"
2730 PRINT TAB(10);"By how much do your expenses exceed $1000"
2740 PRINT TAB(10):INPUT "(Enter 0 to exit)                                    ";NM
2750 IF NM>0 THEN RB(IN)=NM*.3
2760 RETURN
2797 '
2798 ' home loan interest rebate is now a rarity. only advise it is available
2799 '
2800 PRINT : PRINT
2810 PRINT TAB(10);"Home loan interest rebate is applicable the first five"
2820 PRINT TAB(10);"years of owner/occupancy of sole or principal residence."
2830 PRINT TAB(10);"It is limited to first occupation dates between"
2840 PRINT TAB(10);"June 1977 and October 1983. This must be calculated"
2850 PRINT TAB(10);"manually if it applies to you..."
2860 PRINT
2870 PRINT TAB(10):INPUT "Hit RETURN to continue . . .";TMP$
2880 RETURN
2896 '
2897 ' zone allowances apply to remote areas. people to whom
2898 ' it applies usually know it . . .
2899 '
2900 PRINT : PRINT : PRINT
2910 PRINT TAB(10);"The following zone rebates apply for 1985/86. Please"
2915 PRINT TAB(10);"calculate these manually if they apply to you. Note"
2920 PRINT TAB(10);"the percentage figure quoted is to be added to any"
2925 PRINT TAB(10);"dependant, housekeeper or sole parent rebates you"
2930 PRINT TAB(10);"qualify for:"
2935 PRINT:PRINT
2940 PRINT TAB(10);"Ordinary Zone A - $270 plus 50 per cent"
2945 PRINT TAB(10);" Special Zone A - $938 plus 50 per cent"
2950 PRINT TAB(10);"Ordinary Zone B - $ 45 plus 20 per cent"
2955 PRINT TAB(10);" Special Zone B - $938 plus 20 per cent"
2960 PRINT TAB(10);"Defence Force   - Same as Ordinary Zone A"
2965 PRINT : PRINT : PRINT
2970 PRINT TAB(10):INPUT "Hit RETURN to continue . . .";TMP$
2980 RETURN
2997 '
2998 ' calculate tax, medicare levy
2999 '
3000 TAX=BTAX+(XTRA*MRGN)        ' base tax plus extra amount at marginal rate
3010 '          Medicare levy 1% of taxable income (now flat rate, no limit)
3020 MEDI=TI*.01
3030 RETURN
3497 '
3498 ' Show the result
3499 '
3500 PRINT CLS$
3505 FMT$="##,###.##"
3510 PRINT : PRINT : PRINT
3520 PRINT TAB(15);"Taxable Income                    -   $";
3522 PRINT USING FMT$;TI
3525 PRINT
3530 PRINT TAB(15);"Tax Payable                       -   $";
```

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444 NA

Tax Attack

```
3531 PRINT USING FMT$;TAX
3533 PRINT TAB(15);"Medicare Levy                              -   $";
3534 PRINT USING FMT$;MEDI
3536 TAX=TAX+MEDI
3540 PRINT
3545 PRINT TAB(15);"Less:"
3550 PRINT TAB(15);"      Tax paid                             -   $";
3553 PRINT USING FMT$;TP
3555 PRINT TAB(15);"Rebates:"
3560 FOR I%=1 TO 9
3561   SPC$="                                                "
3562   MSG$(I%)=LEFT$(RIGHT$(MSG$(I%),LEN(MSG$(I%))-5)+SPC$,33)
3565   IF RB(I%)>0 THEN PRINT TAB(21);MSG$(I%);"-   $";
3567   IF RB(I%)>0 THEN PRINT USING FMT$;RB(I%)
3570   REB=REB+RB(I%)
3572 NEXT I%
3575 PRINT TAB(15);"Total Credits:                             -   $";
3577 PRINT USING FMT$;REB+TP
3580 PRINT
3585 IF PROV%=TRUE% THEN GOSUB 3800
3590 PRINT : PRINT TAB(15);
3600 AMT=TAX-(TP+REB)
3610 IF AMT<0 THEN PRINT "Your refund will be                  -   $";
3615 IF AMT<0 THEN PRINT USING FMT$;-AMT
3620 IF AMT>=0 THEN PRINT "You will have to pay                -   $";
3625 IF AMT>=0 THEN PRINT USING FMT$;AMT
3630 PRINT : PRINT
3640 PRINT TAB(15):INPUT "Hit P to Print, any other key to continue ';ANS$
3645 IF LEFT$(ANS$,1)="P" OR LEFT$(ANS$,1)="p" THEN GOSUB 3870
3650 RETURN
3797 '
3798 ' provisional tax payable for next year (at current+11%)
3799 '
3800 OTAX=TAX : OTI=TI : OMRGN=MRGN : OMEDI=MEDI : OTP=TP : OREB=REB
3803 TI=OTI*1.11          ' total income + 11 %
3806 GOSUB 300           ' work out tax scale for new rate
3809 GOSUB 3000          ' calculate tax on on new amount
3812 BIGTAX=TAX+MEDI     ' total tax payable on new amount
3815 TI=(OTI-PTI)*1.11   ' PAYE component next year (i.e. +11%)
3816 GOSUB 300           ' work out tax scale for PAYE amount
3818 GOSUB 3000          ' calc tax on PAYE amount
3819 PROVTAX=BIGTAX-TAX-MEDI    ' difference is the provisional amount
3820 ' so far this program ignores the potential rebates which could
3821 ' apply to next year's provisional tax. It could be calculated
3822 ' roughly using the next three lines which are based on taking a
3823 ' percentage of the current rebate amount equal to the percentage
3824 ' ratio of the current PAYE/provisional tax income.
3825 ' PROVPC=PROVTAX/BIGTAX     ' approximate the pro-rata rebates
3826 ' PROVREB=REB*PROVPC        ' which could then be applied to prov tax
3827 ' PROVTAX=PROVTAX-PROVREB  ' <-- like this
3828 TAX=OTAX : TI=OTI : MRGN=OMRGN : MEDI=OMEDI : TP=OTP : REB=OREB
3829 TAX=TAX+PROVTAX     ' add it to your tax payable
3830 PRINT TAB(15);"Add:"
3840 PRINT TAB(15);"      Provisional tax payable              -   $";
3845 PRINT USING FMT$;PROVTAX
3850 PRINT
3860 RETURN
3870 LPRINT : LPRINT : LPRINT : LPRINT : LPRINT
3875 LPRINT TAB(17);"Your Computer Magazine Tax Calculator for 1985/86"
3880 LPRINT TAB(17);"=================================================="
3885 LPRINT : LPRINT : LPRINT
3890 LPRINT TAB(15);"Taxable Income                            -   $";
3895 LPRINT USING FMT$;TI
3900 LPRINT
3905 LPRINT TAB(15);"Tax Payable                               -   $";
3910 LPRINT USING FMT$;TAX-MEDI-PROVTAX
3912 LPRINT TAB(15);"Medicare Levy                             -   $";
3914 LPRINT USING FMT$;MEDI
3916 LPRINT
3918 LPRINT TAB(15);"Less:"
3920 LPRINT TAB(15);"      Tax paid                            -   $";
```

(*Continued on page* 112)

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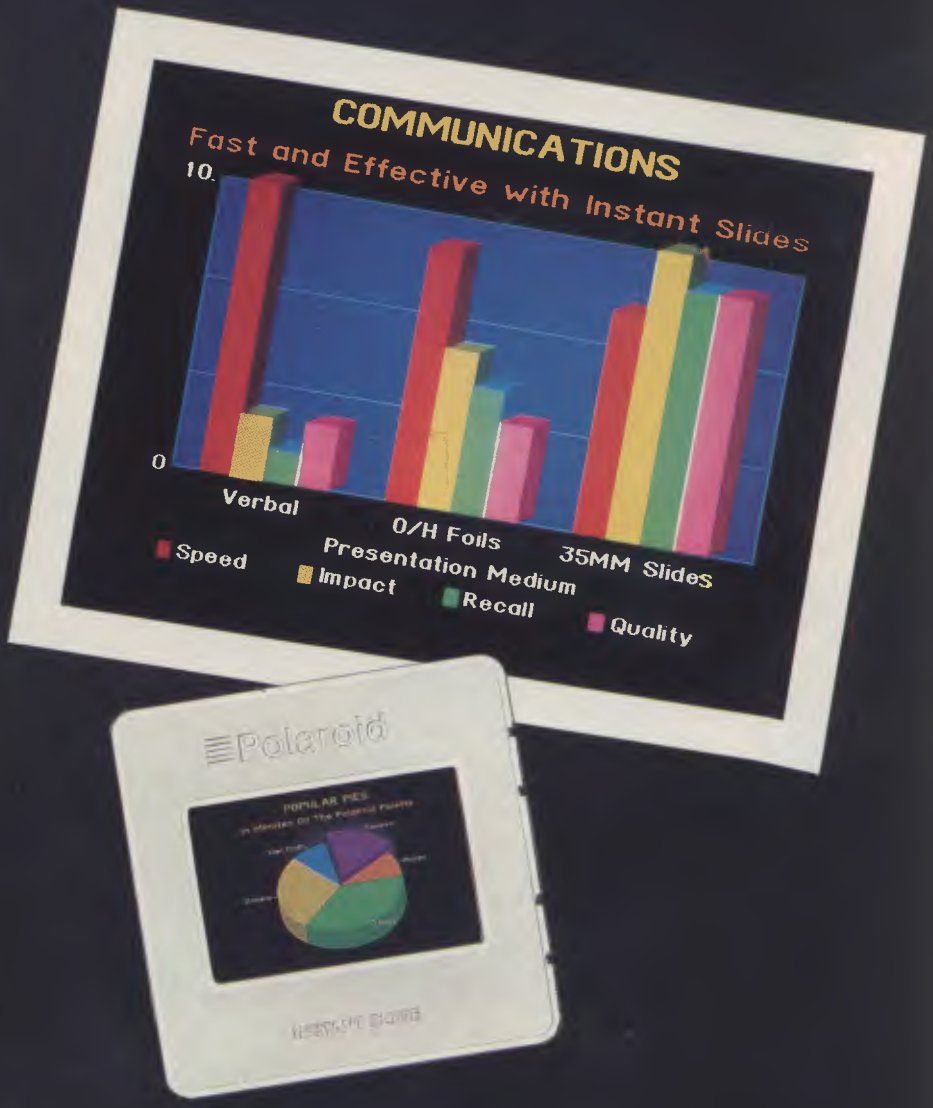

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Hear! Hear!

Ear to Ear

Smiling faces! That was the story of the 1986 Personal Computer of the Year award presentations at Sydney's Sebel Townhouse on April 2. Matt Whelan calls it as he saw it!

Smiling faces are just what you'd expect? Perhaps, but in past years the event has provoked a (barely) perceptible tinge of sour grapes from the unsuccessful finalists — even though we maintain their selection as finalists is a great honour in itself.

It may have been a sign of the now-mature Award's standing in the computer community, or simply graceful acceptance of the validity of the winners' crowns, but this year the atmosphere in the Sebel's Ballroom was totally positive.

Texas Instruments' Claudio Ellero set the scene by being one of the first to congratulate us on the event immediately after the announcement. There were no sour grapes showing between the teeth of his beaming smile, nor in his comment on the IBM AT pushing his Businesspro (a superior machine, and acknowledged favourite of the YC staff) into the runner-up position: he readily admitted IBM deserved the award for setting the new standard.

Even Fae Robinson (of Impact Systems, runner-up in the special commendation for Australian hardware with the Laser 800 printer) managed to smile in the face of a television report which credited her demonstration of brilliant graphics printouts to the 'digitising software which featured in the awards'.

Robyn Williams, mastermind of the ABC's Science Show and bearer of the amazing title Commissioner For The Future, raised many a smile with his description of his family's computing efforts before he presented the awards in front of an audience of 140 computer industry leaders, media representatives, and YC staffers (who were smiling because the hectic build-up to the awards was finally over!).

We're Laughing

The best news of all (so our beancounters tell us) is that none of the readers who responded to the 'User's Choice' survey from the March issue matched the Judges' selections for the awards — so we don't have to give away any free subscriptions!

However, just to ensure some further smiles from the most important people (you — the readers) we'll change the rules here and now. We'll award five free subscriptions, and ignore the beancounters' snarls.

W H Holdaway, of Moonee Ponds, and Neil Parker, of Greenacre, score for picking Matt Whelan's collection of favourites — The TI, Concurrent DOS, the Labtam, Impact's laser printer and dToolkit; F S Sakul-Thongbai, of Canberra, gets his subscription for writing the shortest nomination on the smallest piece of paper; John Pospisil gets lucky for being the first entry opened which correctly selected the PC of the Year; and Martin Drake of Wilson, Western Australia, scrapes in by being the last valid entry received (posted in Perth the night before the announcement).

What were the readers' favourite products? Well, if they were the judges this is how the awards would have gone:

PC of the Year: A tie between the TI Businesspro and the Sharp PC7000.

Software Product of the Year: Another tie, between Concurrent DOS and Newsroom.

Australian Hardware: Good old Microbee!

Australian Software: The dBase user's friend, dToolkit.

We detected a strong flavour of 'guesswork' in the replies — too many of them seemed to reflect the YC staff's personal bias (as gleaned from regular reading of the magazine), and we suspect that's a result of an attempt to outguess us rather than simply because you believe us. If that's so, you forgot one important factor: we bring in a team of independent judges specifically to balance our biases!

Can you see us smiling? □

Top: *Labtam's Don Dryden shows a broad smile — unfortunately, it's hidden by a moustache-trimming error made earlier in the day.* **Right:** YC Publisher Michael Hannan smiles as he threatens to choke Matt Whelan. **Bottom:** *Smiles all round as award presenter Robyn Williams congratulates the winners.*


WAYNE! TURN THAT BLOODY GAME OFF!
©B.J.AKHURST. 86.

CREATING YOUR OWN ADVENTURES

If you've ever wanted to write your own adventure programs, but have been discouraged by the amount of programming involved, take heart. In this article, Tim Hartnell gives you an empty 'adventure shell', which you can use as the framework for an infinite number of totally original adventures.

Why would intelligent people (such as you and I!) with access to massive amounts of computer power which could be doing something useful, want to bring their brainpower to bear on the problems of creating and exploring mythical landscapes? When your computer could be earning its keep telling you your cheque account is overdrawn, why are you forcing it to control a game in which you battle fierce monsters in labyrinthine caverns, invoke magic spells, and uncover vast hordes of elven gold?

The answer is obvious. Using your computer for serious things all the time is just plain boring. Trekking across alien landscapes, chopping up people with broadswords or axes and haggling with quasi-humanoid creatures in off-world taverns seems to many people a much better way to spend their time and their computer power.

But, if you decide you want to *write* your own adventure programs, instead of just playing commercial software adventures, you suddenly come up against one stubborn fact. If your adventure is going to be even half-way decent, an awful lot of meticulous programming is required to make the thing work.

That's where this article comes in.

The adventure shell is a sort of empty bucket into which you can pour your own imagination. The shell handles all the boring (but vital) bits, such as:

- Accepting the player's input and interpreting it.
- Acting on commands.
- Invoking monsters, getting them to fight you, deciding who has won a battle.
- Keeping track of whether or not the player is carrying a weapon or weapons, and the effect this can have on the outcome of a fight with a monster.
- Controlling movement around the adventure environment (whether it be inside the new Parliament House in Canberra, or in an underground tunnel below Ayer's Rock).
- Picking up and dropping treasure, and keeping track of what the player is carrying and how much it is worth.

The program will do all this, so you can save your energy to do such things as entering the PRINT statements which describe the adventure locations, the names of monsters, the kind of treasure and weapons hidden in various places within the adventure environment, and so on.

The shell is very flexible in its handling of player input. You can easily modify it to understand words which I have not catered for. As well, if you want a particular condition to be satisfied before the adventure can end (such as reaching a certain location, slaying a certain number of monsters, finding a certain number, or specified value, of treasured objects), it is extremely easy to include this.

Now, I'll not pretend you can just type the program in, play with it for an hour or so, and end up with a commercial-standard adventure. A fair degree of concentration is required to make sure you create a world which is geographically *consistent*, so the player can — even though it may take a great deal of effort — map your adventure world, and find that next time the world is visited, it still conforms to the map.

Map-making is one of the adventure player's skills and delights. To produce an adventure which is satisfying to play, your map must be consistent. The adventure shell looks after the map control, to ensure this consistency.

Using the Program

First of all, of course, you have to type the thing into your computer. In its present form, with lots and lots of REM statements, it occupies just under 13 Kbytes on my IBM PC, so it is likely to take around the same amount of space on your machine, whatever make it happens to be.

The REM statements are in this program for two reasons. The first is, naturally enough, to guide you through the program, so you know what each bit does. The second role is to 'make space' for you to add your own material. To see this, look at the lines from 860, and around 2700, in the listing. These allow you to get the shell to recognise additional words from the player input which have not been provided by the original program (although the shell, as it is, recognises all the important ones, controlling movement, fighting, and picking up and dropping objects).

Similarly, the REM statements from 3130 make space for you to put your descriptions of the adventure locations, or 'rooms', in which all the action takes place.

Therefore, I suggest you enter it just as it is, REMs and all, and save it in that form. Then all you have to do is load in the original shell whenever you wish to create a new adventure. Many of the REM statements are not referenced by GOTOs or GOSUBs, so they can be deleted from your ▶

Adventure Shell

final version of a particular adventure.

It might be worth getting your user club to make the shell available to members, to save everyone in the club having to type a copy in for their own use. The program can — either in its 'empty' form, or when changed into an adventure — be added freely to public domain collections. If you like, you can even sell programs produced using it. Although there will be no royalty payable on this, we would appreciate a mention that the shell was used, and that it came from *Your Computer* magazine, in the listing and/or documentation.

So, get the program into your computer, and then come back to this article to find out how to use it.

The adventure shell is a sort of empty bucket into which you can pour your own imagination. The shell handles all the boring (but vital) bits.

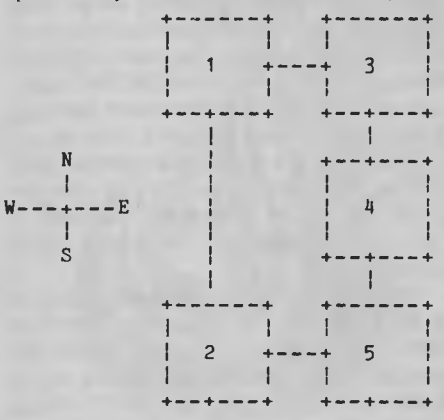
The Map

The first step in building an adventure program is to construct an environment which can be both mapped and represented in some way which the computer can store. You'll be pleased to know it is relatively easy to satisfy both these conditions.

Look at the five-room environment (map one). This is a very simple one, which we will treat as if it were an adventure environment.

The key to holding an environment like this in a way your computer can understand and manipulate is to set up an array, each element of which represents a room. The lines between rooms in diagram one are directions in which you can travel.

If you were in room one, you could move east into room three, or south into room two. In room four you can move north into room three and south into room five, and so on. Imagine we have set up an array, dimensioned as DIM A(5,4);



Map 1.

the first dimension is the room number, and the second is the four possible directions from that room, (that is, north, south, east and west).

Building a Travel Table

Armed with the map of the five-room environment, we can now build up what we in the adventure trade call a 'travel table', which can be fed into the array, to allow us to move from point to point within the environment.

Here's the travel table for the simple, five-room environment in map one:

Room	N	S	E	W
1	0	2	3	0
2	1	0	5	0
3	0	4	0	1
4	3	5	0	0
5	4	0	0	2

Take time to study this table, and the way it relates to the map, because it is probably the single most important key to building adventures using the shell.

Look at the table for room one. Under the 'N' (for north) column, you'll see a zero, which means you can't move north from room one (a fact which is easily verified by looking at our map). However, under the 'S' we see the number two, meaning if we travelled south from room one we would end up in room two (again, you can verify this from the map). Move east (the 'E' column, of course) from room one, and you'll end up in room three. The zero in the 'W' column means there is no travel possible west from room one.

You can work right through the table, if you like, checking the numbers on it correspond to the 'reality' of the map.

Now, to allow the player to move around the environment, we only need to (a) fill each element of the array with the relevant information from the travel table; (b) tell the player where he or she is; and (c) allow the decisions entered by the player regarding the direction in which he or she wants to move to be checked against the array. Then the player's new location has to be recorded, ready for the next move.

Using the shell, it is much easier to do this than you might think. In its present form, the shell caters for 16 rooms, and the DATA given (around line 4300 in the listing) is for a particular map which we will look at in due course. You can easily add more rooms, or use less if you want to do so.

We'll look at a simple program for controlling the five-room environment of map one, and once you see how this works, you'll be in a strong position to understand how to use the shell for a larger environment.

A simple program can be created to feed the relevant information from a travel table into an array:

```
10 DIM A(5,4)
20 FOR B=1 TO 5
30 FOR C=1 TO 4
40 READ A(B,C)
50 NEXT C
60 NEXT B
70 DATA 0,2,3,0
80 DATA 1,0,5,0
90 DATA 0,4,0,1
100 DATA 3,5,0,0
110 DATA 4,0,0,2
```

As you can see, the DATA statements correspond exactly to the items in our travel table.

If we decide the room (or cave, or location) which the player is currently occupying is to be designated by the variable RO (as we do in the shell), we could tell the player where he or she was as follows, as well as indicating which exits existed:

```
100 PRINT "YOU ARE IN ROOM
NUMBER";RO
110 IF A(RO,1)< >0 THEN PRINT
"A DOOR LEADS NORTH"
120 IF A(RO,2)< >0 THEN PRINT
"THERE IS AN EXIT TO THE SOUTH"
130 IF A(RO,3)< >0 THEN PRINT
"YOU CAN LEAVE VIA THE EAST EXIT"
140 IF A(RO,4)< >0 THEN PRINT
"A DOORWAY OPENS TO THE WEST" ▶
```

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The player's input, using the shell, is in the form of a two-word verb/noun phrase, such as 'Go north', 'Get diamond' or 'Slay monster'.

There is a 'string-parsing' routine, which strips the input down to two words, and sets the variable C$ equal to the second word. So the system knows if the first word is go, move or run, the second word must be the direction in which the player wishes to move. The shell only looks at the first three letters of the second word, as these are enough to discover the player's intentions.

Once the player has entered his or her decision, and the program has set C$ equal to the first three letters of the direction, the simple program we're working on here could check to see if an exit existed in that direction:

```
200 IF C$="NOR" AND A(RO,1)=0
THEN PRINT "YOU CANNOT MOVE
THAT WAY"
210 IF C$="SOU" AND A(RO,2)=0
THEN PRINT "YOU CAN'T WALK
THROUGH WALLS"
220 IF C$="EAS" AND A(RO,3)=0
THEN PRINT "TRY ANOTHER
DIRECTION"
230 IF C$="WES" AND A(RO,4)=0
THEN PRINT "THERE IS NO EXIT TO
THE WEST"
```

All that would be needed now would be a routine to go back for another input if the movement was not possible, and you'd have the bare framework of an adventure program. Of course, the shell does all this handling for you.

Once a valid input for direction has been accepted by the program, the movement itself takes place.

Note, by the way, that the room numbers are never referred to explicitly, as they are for the computer's internal consumption only. All the player reads is a description of the room: "You are in the dismal cellar, with old copies of *Your Computer* mouldering on the floor beside you . . ." The description can include information on the exits ("You see a tunnel leading off to the north") or it can be left up to the player to find them by blundering about.

Back in our little five-room environment, imagine the player was in room four (look at map one) and entered the command 'Go north'.

The computer would proceed as follows, once it was sure the move was a legal one. Firstly, the variable RO would equal 4 (the room the player is currently occupying). The computer sees the move wanted is 'nor' and converts that, in its electronic head, to 1 ('sou' would become 2, 'eas' becomes 3, and 'wes' 4), so the computer knows the player is about to enter the room number A(RO,1). It would have been A(RO,2) if the player was moving south, and so on.

As the room the player is currently in is room 4 (that is, RO equals 4), the computer simply looks at A(4,1) to see where the player is moving. In this case, it finds that A(4,1) equals 3, which is where a player would move by travelling north

from room 4 (check it on the map).

The variable RO is then set equal to the new room, 3, and the process of moving through the environment continues.

Consistency and Reality

Although the rooms exist only on paper, and as elements in an array, the fact that they behave like 'real rooms' allows them to be perceived as though they were solid and real in a way which is uncanny.

Add descriptions of each room — "You are in a small workman's hut in the backyard of the Lodge. By peeping through the door of the hut you can see the Prime Minister walking purposefully towards you. You turn around, and see a trapdoor in the far corner" — and you'll find the environment takes on quite solid dimensions in your mind.

A Map for the Shell

If you look at the DATA statements near the end of the shell listing, you'll see a travel table I set up which you can use for your first adventure, if you like. Map two shows the map this table is based on. As you can see, it is not one which can be easily solved. You start in room 9, and the end of the adventure occurs when you reach room 16 (which need not, of course, be a 'room', but can instead be 'outside the castle', 'at the mouth of the cave', 'safe back in your undersea home again', or whatever you choose).

Although the rooms exist only on paper, and as elements in an array, the fact that they behave like 'real rooms' allows them to be perceived as though they were solid and real in a way which is uncanny.

For your first practice with the shell, I suggest you use my map, giving the rooms your own names. Once you've given them names, you can use my treasures, and my monster names, and you'll instantly have a genuine adventure you can actually play.

It is extremely easy to test whether your travel table DATA is correct. Just get into the adventure environment, with your map, and then 'wander around it', to ensure it agrees with the map.

So you should copy map two, and give names to all the rooms. Perhaps a 'haunted castle' is as good an initial scenario as any other, and so the rooms can be called things like 'The Great Hall', 'The Castle Treasury', 'The Cruel Dungeon' and so on.

Once you've written in the names of the rooms on your map, you need to add some descriptive text for each room. Just suppose you had called room 12 'The Ma-▶

Adventure Shell

gician's Quarters'.

Most of the line numbers from 3120 on are REM statements just waiting for your room descriptions to be inserted. So, we move through this set of numbers looking for the heading 'Room Twelve' (which is at line 3670). You can use any of the immediately following lines, up to the return, for the description (and, of course, you can add lines between these in this section if you need more space). Then, when you play the adventure and you are in room 12, the correct description will automatically be printed on the screen.

Your description could read:

"You find yourself in the Magician's Quarters, where years ago weird spells were concocted. Exits leave to the north, east and west."

So to this point in this article we've learned how to create a travel table, how to change it into DATA statements, and how to put room descriptions in the relevant positions within the shell.

You do not yet, however, have every bit of knowledge you need to use the program.

Attributes

As the player, you have six 'attributes' — strength, charisma, dexterity, intelligence, wisdom and constitution. If any of these falls to zero, the adventure is over, and you die.

These are gradually depleted as time goes on, to ensure you do not simply spend an endless amount of time wandering through your adventure environment. Your final score is related to a number of factors, including how strong your attributes are at the end of the game.

Each monster you meet and fight is also blessed with six attributes. When you meet a monster, the fight begins like this:

"Look out! There is an Embihuund here! What do you want to do?"

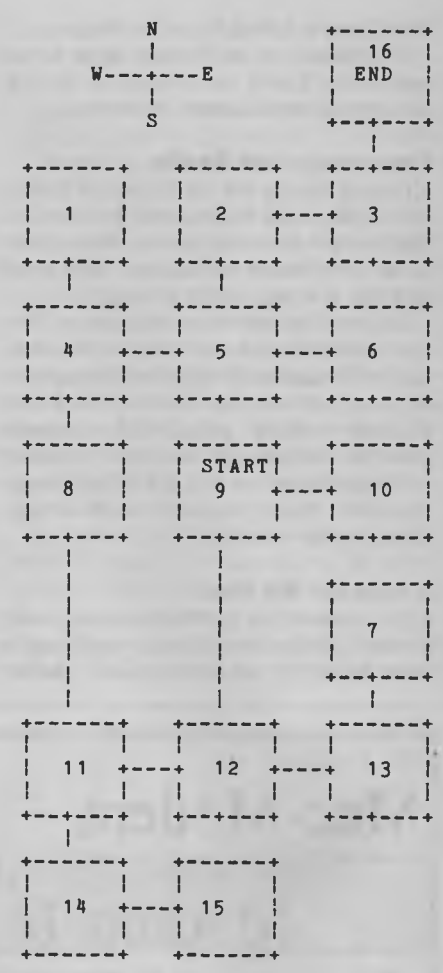
"Fight."

"Fight is just one word. I need two. What do you want to do?"

"Fight Embihuund."

"Your opponent is an Embihuund. The Embihuund's danger level is 6. You must fight the Embihuund with your bare hands. The Embihuund has the following attributes:

1 — Strength 6
2 — Charisma 15
3 — Dexterity 11
4 — Intelligence 13
5 — Wisdom 12
6 — Constitution 11.



Map 2.

Your attributes are:
1 — Strength 11
2 — Charisma 10
3 — Dexterity 10
4 — Intelligence 14
5 — Wisdom 16
6 — Constitution 10
Which attributes will you fight with – (2)?"
"1, 5"

As you can see, you are asked to enter your choice of the two attributes with which you will fight. Fairly obviously, you should choose the ones in which you most exceed the monster you are facing. The difference between your attributes and those of the monster, the 'ferocity factor' of the monster, and whether or not you are armed (with an axe, a sword, or both) all play a part in determining how well you will do in the coming battle.

Fortunately, the shell 'stage manages' the fight for you. As the fight progresses, your attributes are reduced if the monster scores a blow against you. At the end of the fight, the program reports the result, adding to your attributes if you have won.

Treasure and Terror

It is very simple to distribute the treasure throughout the adventure environment, as the shell does it for you.

If you look at the end of the listing, from line number 4180, you'll see that first the shell reads the names of the treasure and its value from DATA statements (and the two weapons, the sword and the axe, are given values of zero, so their worth won't be added to your growing fortune as you work your way around the environment). Then, with the routine from line 4210, the objects are distributed.

If you don't want a treasure in a particular room, all you have to do is add a line between 4220 and 4230 which reads as follows (where X is the number of the room which you want to remain without a treasure):

4225 IF Z=X THEN 4220

You'll see I've given you a set of sample treasures, which you can leave in for your first adventure, so you can concentrate on naming the rooms and getting to know how the shell works.

The monsters are distributed the same way, using the routine from line 4270. Again, if you want to ensure some of the rooms do not have monsters in them, a line to reject certain values, like the one used for treasure, can be inserted as line 4305.

The Vocabulary

It's fairly obvious which words the shell can act on at the moment. These are:

Kill or **Fight** (followed by the name of a monster).

Go, Move or **Run** (followed by a direction, such as east),

Get, Take or **Lift** (followed by the name of an object; you can carry up to five objects).

Drop, Put or **Leave** (followed by the name of an object; a room can hold up to three objects).

Help (doesn't do much good in the shell's present form, but you can add some real help if you like).

Quit (if you want to exit the adventure before getting to the end).

If you want to add additional words, you put these in lines 860 to 950, and then use the designated subroutines (2700, 2730, 2770, 2810 and 2850) to act on these additional words.

Your First Adventure

In summary, then, to create your first adventure, copy out map two and name the rooms. If you don't want to go to the trouble of writing full descriptions, you can just add lines like "You are in the drawing room", or even just the name of the room, such as "Mouldy cellar".

Leave my monster and treasure names in place. Wander around the map for a while, use the vocabulary as provided, and once you are familiar with the program in its present form, you can experiment by adding your own map, treasures and monsters.

Once you're happy with that, you can work on adding new material.

Note line 110, which sets QU to the value of one, and sends action to line 2950 if the player has reached room 16. This is the final room, and this line is the one which checks if the adventure has ended. Of course, once you start creating your own travel tables, you should change the 16 in this line into the number of the final room. (The starting room number, 9 in this case, is set equal to RO when the program begins, with line 4070.)

Further Ideas

Once you're familiar with the shell in the form it is presented here, there are several other ideas you might like to incorporate. These include:

- A monster which does not stay passively in one room, but follows you relentlessly once you've woken it up.
- A few other 'pseudo-players' under the computer's control which appear to be exploring the environment, too. The player can meet these people from time to time, possibly getting information about future dangers from them.
- A proper help command for the player to invoke if he or she feels hopelessly lost. A severe penalty (such as losing half the player's gold) should be charged to ensure this command is not used frequently.
- Doors can be locked, impassable, stuck or traps. Walls can fall in on players, floors give way to a gaping crevasse, and so on. Pictures can slide from walls, hitting our hapless player on the head. All these effects can be controlled within the subroutine which holds the room description, and a flag used to make sure the danger is not repeated if the room is revisited during one particular run of the adventure

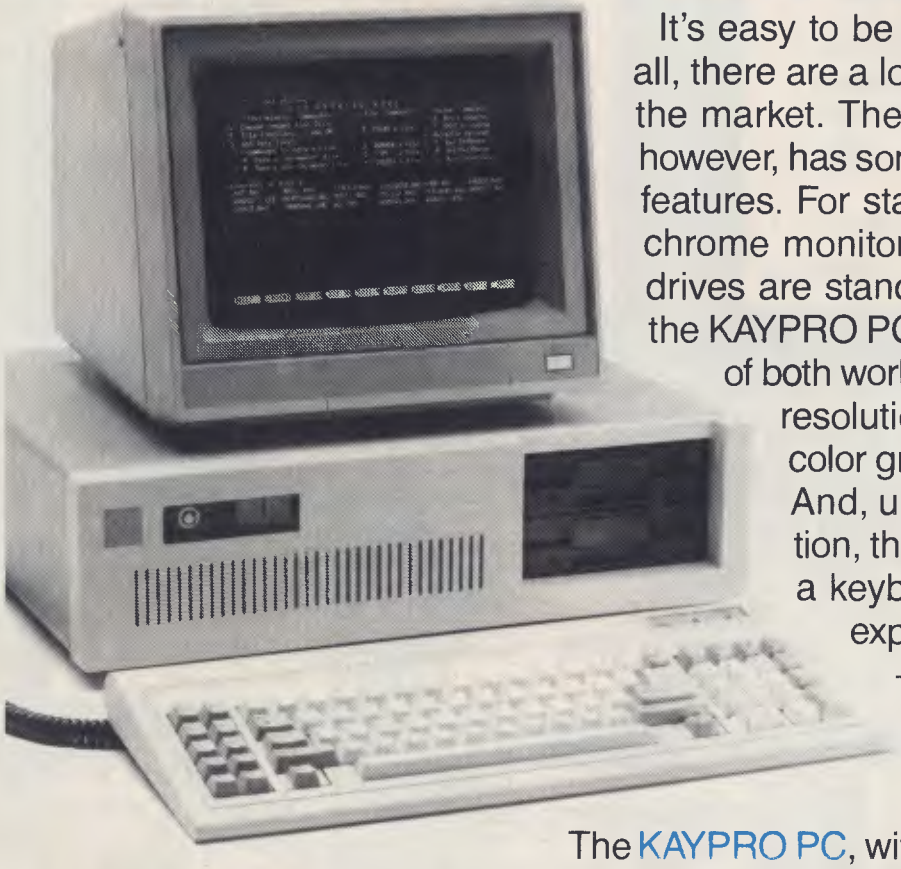
I'd be extremely interested in seeing what you come up with using the shell. Please write to me care of *Your Computer*. May the Dreaded Ice-Dragon not molest you, and may all your chests be filled with Elven Gold.

```
10 REM     ADVENTURE SHELL
20 REM ************************
30 REM      By Tim Hartnell
40 REM  Interface Publications
50 REM ************************
60 GOSUB 3950:REM INITIALISE
70 REM ************************
80 REM REPORT TO PLAYER
90 FOR Z=1 TO 1000:NEXT Z
100 CLS
110 IF RO=16 THEN QU=1:GOTO 2950
120 REM ************************************
130 GOSUB 3060:REM ** ROOM DESCRIPTIONS **
140 REM ** NEXT LINE ACTIVATED IF OBJECT IN ROOM **
150 IF A(RO,5)<>0 OR A(RO,6)<>0 OR A(RO,7)<>0 THEN GOSUB 3850:REM OBJECTS
160 IF A(RO,8)=0 THEN 210:REM ** NO MONSTER IN ROOM **
170 PRINT TAB(3);"LOOK OUT!":PRINT "THERE IS AN ";MS(A(RO,8));" HERE!"
180 IF RND(1)>.7 THEN PRINT MS(A(RO,8));" ATTACKS!":KW=1:GOSUB 1670:GOTO 80
190 REM ************************************
200 REM ** NEXT LINES DECREMENT ATTRIBUTES **
210 IF RND(1)>.94 THEN ST=ST-1:IF ST<0 THEN ST=0
220 IF RND(1)>.94 THEN CH=CH-1:IF CH<0 THEN CH=0
230 IF RND(1)>.94 THEN DE=DE-1:IF DE<0 THEN DE=0
240 IF RND(1)>.94 THEN IT=IT-1:IF IT<0 THEN IT=0
250 IF RND(1)>.94 THEN WI=WI-1:IF WI<0 THEN WI=0
260 IF RND(1)>.94 THEN CO=CO-1:IF CO<0 THEN CO=0
270 REM ** NEXT LINES REPORT ATTRIBUTES TO PLAYER **
280 PRINT:PRINT "Your attributes are:"
290 PRINT TAB(4);"Strength -"ST"  Charisma -"CH
300 PRINT TAB(4);"Dexterity -"DE"  Intelligence -"IT
310 PRINT TAB(4);"Wisdom -"WI"  Constitution -"CO
320 REM ** NEXT LINE CHECKS IF ANY ATTRIBUTE IS ZERO **
330 IF ST*CH*DE*IT*WI*CO<>0 THEN 380
340 PRINT:PRINT "Unfortunately, you are exhausted..."
350 PRINT 'so this adventure must end":QU=2:GOTO 2990
360 REM ************************************
370 REM ** NEXT LINES CHECK TO SEE IF PLAYER CARRYING ANYTHING **
380 FLAG=0
390 FOR J=1 TO 5
400 IF P(J)<>0 THEN FLAG=1
410 NEXT J
420 IF FLAG=0 THEN 490
430 CASH=0
440 PRINT:PRINT "You are carrying:"
450 FOR J=1 TO 5
460 IF P(J)<>0 THEN PRINT TAB(4);OS(P(J)):CASH=CASH+V(P(J))
470 NEXT J
480 IF CASH>0 THEN PRINT TAB(8);"Total value - $";STR$(CASH)
490 PRINT
500 REM ************************************
510 REM ** NEXT LINES ACCEPT PLAYER INPUT **
```

Adventure Shell

```
520 KW=0:REM ** KW STANDS FOR KEYWORD - EQUALS 1 IF WORD UNDERSTOOD **
530 FOR Z=1 TO 1000:NEXT Z
540 INPUT "What do you want to do";A$
550 REM ** NEXT LINES ADD SPACES IF LESS THAN 7 LONG **
560 IF A$="" THEN 540
570 A$=A$(A$)
580 M=LEN(A$):IF M<7 THEN A$=A$+" ":GOTO 580
590 REM ************************************
600 REM ** GET FIRST THREE CHARACTERS, CHECK IF 'HELP' OR 'QUIT'
610 B$=LEFT$(A$,3)
620 IF B$="HEL" THEN PRINT TAB(3);"YOU MUST BE JOKING!":GOTO 1050
630 IF B$="QUI" THEN QU=4:GDTO 2890
640 REM ************************************
650 REM ** NOW BREAK DOWN PLAYER INPUT **
660 N=1
670 IF MID$(A$,N,1)<>" " THEN 700
680 C$=MID$(A$,N+1,3):IF LEFT$(C$,1)<>" " THEN 770
690 IF LEFT$(C$,1)=" " THEN 730
700 IF N<M THEN N=N+1:GOTO 670
710 REM ************************************
720 REM ** GETS HERE IF ONLY ONE WDRD ENTERED BY PLAYER, CHOOSE REPLY **
730 IF RND(1)>.5 THEN 750
740 PRINT TAB(6);"BY ITSELF,";A$:PRINT TAB(6);"CAN'T BE ACTED ON":GOTO 540
750 PRINT A$;" IS JUST DNE WORD":PRINT TAB(4);"I NEED TWO":GOTO 540
760 REM ************************************
770 REM ** NEXT LINES 'UNDERSTAND' INPUT
780 REM ** NEXT LINE ACCEPTS 'KILL' OR 'FIGHT' **
790 IF B$="KIL" DR B$="FIG" THEN KW=1:GOSUB 1670
820 REM ** NEXT LINE UNDERSTANDS 'GO/MOVE/RUN' **
830 IF B$="GO " OR B$="MOV" OR B$="RUN" THEN KW=1:GOSUB 1080
840 REM ** NEXT LINE UNDERSTANDS 'GET/TAKE/LIFT' **
850 IF B$="GET" DR B$="TAK" OR B$="LIF" THEN KW=1:GOSUB 1200
860 REM ** NEXT LINE UNDERSTANDS 'DROP/PUT/LEAVE' **
870 IF B$="DRD" DR B$="PUT" OR B$="LEA" THEN KW=1:GOSUB 1440
880 REM ** ADD OWN COMMANDS HERE **
890 REM IF B$=... THEN GOSUB 2700
900 REM ** ADD OWN COMMANDS HERE **
910 REM IF B$=... THEN GOSUB 2730
920 REM ** ADD OWN COMMANDS HERE **
930 REM IF B$=... THEN GOSUB 2770
940 REM ** ADD OWN COMMANOS HERE **
950 REM IF B$=... THEN GOSUB 2810
960 REM ** ADD OWN COMMANDS HERE **
970 REM IF B$=... THEN GOSUB 2850
980 IF KW=1 THEN 1050
990 REM ************************************
1000 REM ** CHOOSE "I DON'T UNDERSTAND" MESSAGE
1010 R=INT(RND(1)*3)
1020 IF R=0 THEN PRINT "IT WOULD NOT BE WISE TO ";A$
1030 IF R=1 THEN PRINT "DNLY A FOOL WOULD TRY TO ";A$
1040 IF R=2 THEN PRINT "I DON'T UNDERSTAND ";A$
1050 FOR Z=1 TO 500:NEXT Z
1060 GOTO 80
1070 REM ************************************
1080 REM MOVEMENT
1090 C$=LEFT$(C$,1)
1100 IF C$="N" AND A(RO,1)=0 THEN PRINT "You cannot go that way":RETURN
1110 IF C$="S" AND A(RO,2)=0 THEN PRINT "There is no exit south":RETURN
1120 IF C$="E" AND A(RO,3)=0 THEN PRINT "I see nowhere to the east to go":RETURN
1130 IF C$="W" AND A(RO,4)=0 THEN PRINT "You can't walk through walls":RETURN
1140 IF C$="N" THEN RO=A(RO,1)
1150 IF C$="S" THEN RO=A(RO,2)
1160 IF C$="E" THEN RO=A(RO,3)
1170 IF C$="W" THEN RO=A(RO,4)
1180 RETURN
1190 REM ********************
1200 REM GET OBJECTS ROUTINE
1210 FLAG=0
1220 FOR J=1 TO 5
1230 IF P(J)<>0 THEN FLAG=FLAG+1
1240 NEXT J
1250 IF FLAG=5 THEN PRINT "You are already carrying five objects":RETURN
1260 REM ** CHECK IF ANYTHING IN ROOM TO BE PICKED UP **
1270 IF A(RD,5)<>0 OR A(RO,6)<>0 OR A(RO,7)<>0 THEN 1310
1280 PRINT "I see nothing to pick up":RETURN
1290 REM ************************************
1300 REM NOW PICK IT UP
1310 D$="":E$="":F$=""
1320 D$=LEFT$(O$(A(RO,5)),3)
1330 E$=LEFT$(O$(A(RO,6)),3)
1340 F$=LEFT$(O$(A(RO,7)),3)
1350 IF C$=D$ THEN N=A(RO,5):A(RO,5)=0:GOTO 1380
1360 IF C$=E$ THEN N=A(RO,6):A(RO,6)=0:GOTO 1380
1370 IF C$=F$ THEN N=A(RO,7):A(RO,7)=0
1380 J=1
1390 IF P(J)=0 THEN P(J)=N:GOTO 1410
1400 IF J<5 THEN J=J+1:GOTO 1390
1410 PRINT TAB(3);">-> YOU NOW HAVE THE ";O$(N)
1420 RETURN
1430 REM ************************************
1440 REM DROP ROUTINE
1450 FLAG=0
1460 FOR J=1 TO 5
1470 IF P(J)<>0 THEN FLAG=1
1480 NEXT J
1490 IF FLAG=0 THEN PRINT "You are not carrying anything":RETURN
1500 IF A(RO,5)=0 OR A(RO,6)=0 OR A(RO,7)=0 THEN 1520
1510 PRINT "This room already holds its maximum number of objects":RETURN
1520 D$="":D=0
1530 FOR J=1 TO 8
1540 IF LEFT$(O$(J),3)=C$ THEN D$=O$(J):D=J
1550 NEXT J
1560 IF D$<>"" THEN 1580
1570 PRINT "How can you when you're not holding it?":RETURN
1580 FOR J=1 TO 5
1590 IF P(J)=D THEN P(J)=0
1600 NEXT J
1610 IF A(RO,5)=0 THEN A(RO,5)=D:GOTO 1640
1620 IF A(RO,6)=0 THEN A(RO,6)=D:GOTO 1640
1630 IF A(RD,7)=0 THEN A(RO,7)=D
1640 PRINT "YDU HAVE DROPPED THE ";D$
1650 RETURN
1660 REM *************
1670 REM FIGHT ROUTINE
1680 REM ** NEXT LINES CHECK IF MDNSTER PRESENT TD FIGHT **
1690 IF A(RO,8)<>0 THEN 1750
1700 R=RND(1)
1710 IF R<.5 THEN PRINT "There is nothing to fight here"
1720 IF R>=.5 THEN PRINT "You can't fight empty air!"
1730 RETURN
1740 REM ** SET G$ EQUAL TO NAME OF MONSTER/CREATE ITS ATTRIBUTES **
1750 G$=M$(A(RO,8))
1760 S1=INT(RNO(1)*6+RND(1)*6+RND(1)*6)+3
1770 H1=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
1780 D1=INT(RND(1)*6+RND(1)*6+RNO(1)*6)+3
1790 I1=INT(RNO(1)*6+RND(1)*6+RND(1)*6)+3
1800 W1=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
1810 C1=INT(RND(1)*6+RNO(1)*6+RND(1)*6)+3
1820 PRINT "----------------------------------------"
1830 PRINT "YOUR OPPONENT IS AN ";G$
1840 MT=0:HT=0:REM MONSTER TALLY, HUMAN TALLY
1850 FF=S1*(INT(RND(1)*6)+1)
1860 PRINT "----------------------------------------"
1870 PRINT "THE ";G$;"'S DANGER LEVEL IS"FF
1880 PRINT "----------------------------------------"
1890 FOR Z=1 TO 1500:NEXT Z
1900 REM ** CHECK IF CARRYING WEAPONS **
1910 FOR J=1 TO 5
1920 T(J)=0
1930 IF P(J)=6 THEN PRINT "YOUR AXE COULD BE HANDY":T(J)=6
1940 IF P(J)=5 THEN PRINT "YOUR SWORD MAY STAND YOU IN GOOD STEAD":T(J)=5
1950 NEXT J
1960 FLAG=0
1970 FOR J=1 TO 5
1980 IF T(J)<>0 THEN FLAG=FLAG+1
1990 NEXT J
2000 IF FLAG<>0 THEN 2020
2010 PRINT "YOU MUST FIGHT THE ";G$;" WITH":PRINT "YOUR BARE HANDS":GOTD 2170
2020 IF FLAG>1 THEN 2090
2030 FOR J=1 TO 5
2040 IF T(J)<>0 THEN FLAG=T(J)
2050 NEXT J
2060 PRINT "YOU MUST FIGHT WITH YOUR ";O$(FLAG)
2070 FF=INT(FF*2/FLAG)
2080 GOTO 2170
2090 PRINT "CHOOSE YOUR WEAPON:"
2100 FOR J=1 TO 5
2110 IF P(J)<>0 THEN PRINT J;" - ";O$(P(J))
2120 NEXT J
2130 INPUT "Enter the number to choose";J
2140 IF P(J)=0 THEN PRINT "YOU DO NOT HAVE THE ";O$(J):GOTO 2130
2150 PRINT "RIGHT, SO YOU CHOOSE TO FIGHT":PRINT "WITH THE ";O$(P(J))
2160 FF=INT(FF*2/J)
2170 FOR Z=1 TO 1500:NEXT Z
2180 PRINT "----------------------------------------"
2190 PRINT "THE ";G$;" HAS THE FOLLOWING ATTRIBUTES:"
2200 PRINT "1 - Strength"S1"  2 - Charisma";H1
2210 PRINT "3 - Oexterity"D1" 4 - Intelligence"I1
2220 PRINT "5 - Wisdom"W1"    6 - Constitution"C1
2230 PRINT:PRINT "YOUR ATTRIBUTES ARE:"
2240 PRINT "1 - Strength"ST"  2 - Charisma"CH
2250 PRINT "3 - Dexterity"DE" 4 - Intelligence"IT
2260 PRINT "5 - Wisdom"WI"    6 - Constitution"CO
2270 PRINT:PRINT "Which attributes will you fight":PRINT "with (2)";
2280 INPUT Z,Q
2290 IF Z>0 AND Z<7 AND Q>0 AND Q<7 AND Z<>Q THEN 2310
2300 PRINT "DON'T FOOL AROUND WITH A ";G$;" IN THE ROOM WITH YDU!":GOTO 2280
2310 IF Z=1 DR Q=1 THEN MT=MT+S1:HT=HT+ST
2320 IF Z=2 OR Q=2 THEN MT=MT+H1:HT=HT+CH
2330 IF Z=3 OR Q=3 THEN MT=MT+D1:HT=HT+DE
2340 IF Z=4 OR Q=4 THEN MT=MT+I1:HT=HT+IT
2350 IF Z=5 OR Q=5 THEN HT=MT+W1:HT=HT+WI
2360 IF Z=6 OR Q=6 THEN MT=MT+C1:HT=HT+CO
2370 IF HT=MT THEN PRINT TAB(10);"You are evenly matched":GOTO 2420
2380 PRINT "IT LOOKS LIKE THE ODOS"
2390 PRINT "ARE IN FAVOUR OF ";
2400 IF HT>MT THEN PRINT "YDU"
2410 IF HT<MT THEN PRINT "THE ";G$
2420 PRINT "----------------------------------------"
2430 REM ** NEXT LINES CONTROL THE FIGHT ITSELF **
2435 KK=0
2440 K=INT(RND(1)*7):IF K=KK THEN 2440
```

Don't Be Fooled By Expensive Imitations



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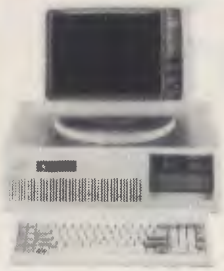

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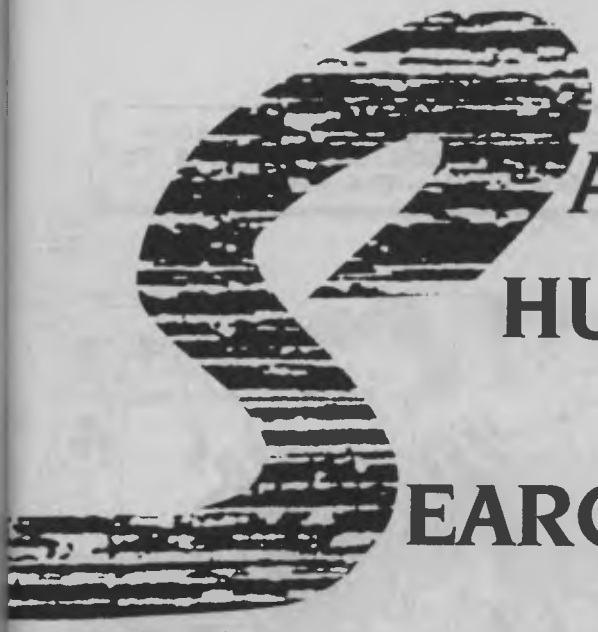
```
2445 KK=K
2450 FOR Z=1 TO 700:NEXT Z
2460 PRINT "THE ";G$;" ="MT
2470 PRINT "     YOU ="HT
2480 PRINT "----------------------------------------"
2490 IF K=0 THEN PRINT "You struck a splendid blow!":MT=MT-1
2500 IF K=1 THEN PRINT "THE ";G$;" STRIKES OUT":HT=HT-1:CH=CH-1
2510 IF K=2 THEN PRINT "YOU DRAW THE ";G$;"'S BLOOD":ST=ST-1
2520 IF K=3 THEN PRINT "You are wounded!!":IT=IT-1
2530 IF K=4 THEN PRINT "THE ";G$;" IS TIRING":DE=DE-1
2540 IF K=5 THEN PRINT "You are bleeding...":WI=WI-1
2550 IF K=6 THEN PRINT "YOU WOUND THE ";G$:MT=MT-1
2560 IF RND(1)>.25 AND HT>0 AND MT>0 THEN FOR T=1 TO 1600:NEXT T:GOTO 2440
2570 IF HT<MT THEN 2600
2580 PRINT "YOU HAVE SLAIN THE ";G$
2590 ST=ST+2:DE=DE+2:WI=WI+2:CH=CH+2:IT=IT+2:CO=CO+2:MK=MK+2:GOTO 2670
2600 PRINT "THE ";G$;" GOT THE BETTER OF":PRINT "YOU THAT TIME..."
2610 IF Z=1 OR Q=1 THEN ST=4*INT(ST/5)
2620 IF Z=2 OR Q=2 THEN CH=3*INT(CH/4)
2630 IF Z=3 OR Q=3 THEN DE=6*INT(DE/7)
2640 IF Z=4 OR Q=4 THEN IT=2*INT(IT/3)
2650 IF Z=5 OR Q=5 THEN WI=5*INT(WI/6)
2660 IF Z=6 OR Q=6 THEN CO=INT(CO/2)
2670 A(RO,8)=0
2680 FOR Z=1 TO 500:NEXT Z
2690 RETURN
2700 REM OWN COMMANDS ACTED ON HERE
2710 REM OWN COMMANDS ACTED ON HERE
2720 REM OWN COMMANDS ACTED ON HERE
2730 REM OWN COMMANDS ACTED ON HERE
2740 REM OWN COMMANDS ACTED ON HERE
2750 REM OWN COMMANDS ACTED ON HERE
2760 REM DWN COMMANDS ACTED ON HERE
2770 REM OWN COMMANDS ACTED ON HERE
2780 REM OWN COMMANDS ACTED ON HERE
2790 REM OWN COMMANDS ACTED ON HERE
2800 REM OWN COMMANDS ACTED ON HERE
2810 REM OWN COMMANDS ACTED ON HERE
2820 REM OWN COMMANDS ACTED DN HERE
2830 REM OWN COMMANDS ACTED ON HERE
2840 REM OWN COMMANDS ACTED ON HERE
2850 REM OWN CDMMANDS ACTED DN HERE
2860 REM OWN COMMANDS ACTED ON HERE
2870 REM OWN COMMANDS ACTED DN HERE
2880 REM ***********
2890 REM END OF GAME
2900 PRINT
2910 SC=0:REM SCORE
2920 IF QU<>4 THEN 2950
2930 PRINT "I did not imagine you would turn"
2940 PRINT TAB(5);"out to be a quitter!":GOTD 2990
2950 PRINT:PRINT "CONGRATULATIONS! You have completed"
2960 PRINT TAB(7);"THE ADVENTURE"
2970 SC=100
2980 PRINT:PRINT
2990 SC=99*(SC+20*CASH+47*MK+ST+2*CH+3*DE+4+IT+5*WI+6*CO)/QU
3000 IF MK>0 THEN PRINT TAB(7);"YOU KILLED"MK"MONSTERS"
3010 PRINT:PRINT TAB(7);"YOU FOUND $";STR$(CASH);" WORTH"
3020 PRINT TAB(8);"OF TREASURE":PRINT
3030 PRINT:PRINT "Your score for this Adventure is"SC
3040 END
3050 REM *********
3060 REM ROOM DESCRIPTIONS
3065 PRINT "YOU ARE IN ";
3070 IF RO<9 THEN ON RO GOSUB 3090,3140,3190,3240,3290,3340,3390,3440
3075 IF RO>8 THEN ON RO-8 GOSUB 3490,3540,3590,3640,3690,3740,3790
3080 RETURN
3090 REH ** ROOM ONE **
3100 PRINT "ROOM ONE"
3110 REM
3120 REM
3130 RETURN
3140 REM ** ROOM TWO **
3150 PRINT "ROOM TWO"
3160 REM
3170 REM
```

```
3180 RETURN
3190 REM ** ROOM THREE **
3200 PRINT "ROOM THREE"
3210 REM
3220 REM
3230 RETURN
3240 REM ** ROOM FOUR **
3250 PRINT "ROOM FOUR"
3260 REM
3270 REM
3280 RETURN
3290 REM ** ROOM FIVE **
3300 PRINT "ROOM FIVE"
3310 REM
3320 REM
3330 RETURN
3340 REM ** ROOM SIX **
3350 PRINT "ROOM SIX"
3360 REM
3370 REM
3380 RETURN
3390 REM ** RDOM SEVEN **
3400 PRINT "ROOM SEVEN"
3410 REM
3420 REM
3430 RETURN
3440 REM ** ROOM EIGHT **
3450 PRINT "RODM EIGHT"
3460 REM
3470 REM
3480 RETURN
3490 REM ** ROOM NINE **
3500 PRINT "ROOM NINE"
3510 REM
3520 REM
3530 RETURN
3540 REM ** ROOM TEN **
3550 PRINT "ROOM TEN"
3560 REM
3570 REM
3580 RETURN
3590 REM ** ROOM ELEVEN **
3600 PRINT "ROOM ELEVEN"
3610 REM
3620 REM
3630 RETURN
3640 REM ** ROOM TWELVE **
3650 PRINT "ROOM TWELVE"
3660 REM
3670 REM
3680 RETURN
3690 REM ** RDOM THIRTEEN **
3700 PRINT "ROOM THIRTEEN"
3710 REM
3720 REM
3730 RETURN
3740 REM ** ROOM FOURTEEN **
3750 PRINT "ROOM FOURTEEN"
3760 REM
3770 REM
3780 RETURN
3790 REM ** ROOM FIFTEEN **
3800 PRINT "ROOM FIFTEEN"
3810 REM
3820 REM
3830 RETURN
3840 REM *****************
3850 REM DESCRIBE OBJECTS
3860 PRINT
3870 PRINT TAB(3)"YOU CAN SEE:"
3880 IF A(RO,5)<>0 THEN PRINT TAB(4);OS(A(RO,5))
3890 IF A(RO,6)<>0 THEN PRINT TAB(4);OS(A(RO,6))
3900 IF A(RO,7)<>0 THEN PRINT TAB(4);DS(A(RO,7))
3910 FOR Z=1 TO 500:NEXT Z
3920 PRINT
3930 RETURN
3940 REM **********
3950 REM INITIALISE
3960 DIM A(16,8),P(5),OS(8),V(20),MS(8),T(5)
3970 REM ** REM NEXT LINES DECIDE
     HUMAN ATTRIBUTES **
3980 ST=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
3990 CH=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
4000 DE=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
4010 IT=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
4020 WI=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
4030 CO=INT(RND(1)*6+RND(1)*6+RND(1)*6)+3
4040 CASH=0:REM TREASURE
4050 RO=9:REM STARTING RODM
4060 QU=1:REM END OF GAME FLAG
4070 MK=0:REM MONSTERS KILLED
4080 CS=""
4090 REM ** SET UP ROOMS **
4100 FOR X=1 TO 16
4110 FOR Y=1 TO 4
4120 READ A(X,Y)
4130 NEXT Y
4140 NEXT X
4150 REM ** DISTRIBUTE TREASURE **
4160 FOR Z=1 TO 8
4170 READ OS(Z), V(Z)
4180 NEXT Z
4190 FOR Q=5 TO 8
4200 Z=INT(RND(1)*15+1)
4210 IF A(Z,5)<>0 THEN 4200
4220 A(Z,5)=Q:REM OBJECT NO. IN ROOM
4230 NEXT Q
4240 PRINT
4250 REM ** DISTRIBUTE MONSTERS **
4260 FDR J=1 TO 8
4270 READ MS(J)
4280 Z=INT(RND(1)*15+1)
4290 IF A(Z,8)<>0 THEN 4280
4300 A(Z,8)=J
4310 NEXT J
4330 CLS
4340 RETURN
4350 REM ******************************
4360 REM ROOM DATA
4370 DATA 0,4,0,0:REM ROOM ONE
4380 DATA 0,5,3,0:REM RDOM TWD
4390 DATA 16,0,0,2:REM ROOM THREE
4400 DATA 1,8,5,0:REM ROOM FOUR
4410 DATA 2,0,6,4:REM ROOM FIVE
4420 DATA 0,0,0,5:REM ROOM SIX
4430 DATA 0,13,0,0:REM ROOM SEVEN
4440 DATA 4,11,0,0:REM ROOM EIGHT
4450 DATA 0,12,10,0:REM ROOM NINE
4460 DATA 0,0,0,9:REM ROOM TEN
4470 DATA 8,14,12,0:REM ROOM ELEVEN
4480 DATA 9,0,13,11:REM ROOM TWELVE
4490 DATA 7,0,0,12:REM ROOM THIRTEEN
4500 DATA 11,0,15,0:REM FOOM FOURTEEN
4510 DATA 0,0,0,14:REM ROOM FIFTEEN
4520 DATA 0,3,0,0:REM RDOM SIXTEEN
4530 REM ** OBJECT DATA **
4540 DATA "RING",567
4550 DATA "KEY",2
4560 DATA "LDCKET",15
4570 DATA "ELVEN-GOLD",799
4580 DATA "SWORD",0,"AXE",0
4590 DATA "AMYTHEST",27
4600 DATA "CRYSTAL",45
4610 REM ** MONSTER NAMES **
4620 DATA "ENTANGLER"
4630 DATA "ARTIFACTUM"
4640 DATA "INKBLOTT"
4650 DATA "UGLY UNDEAD"
4660 DATA "'ORRIBLE ORC"
4670 DATA "ICE-DRAGON"
4680 DATA "EMBIHUUND"
4690 DATA "INSALIVATE"
```



EXAMPLES, SHUFFLES AND SEARCHES

If you thought shuffles, soft-shoe or otherwise, were the province of Fred Astaire, and searches the prerogative of the Customs Department, Tim Hartnell is about to shed a whole new light on tap-dancing your way around random routines.

Many computer programs are dedicated to the laudable aim of bringing order into an increasingly chaotic universe. Industrious little routines spend their time sorting numbers and names into order, comparing them, taking actions on the basis of those comparisons, and assigning the results of their deliberations into neatly defined pigeonholes.

However, order is not always wanted. Just suppose you wanted to survey a randomly selected 10 per cent of the registered voters of Wagga Wagga. It would not do to simply take the first 10 per cent of the names on the list, nor those who live in 10 per cent of the residential part of town. To get a fair, genuinely random sample, you would need to select the names on some other basis.

This month I'm going to look at a couple of routines for selecting items at random from a list. Then, instead of doing a survey of Wagga Wagga, I'll use one of the routines to do something far more important, shuffle a deck of cards.

Finally, I'll be looking at three ways of finding specific elements of data within lists. The method chosen can radically alter the time it takes for an item in a list to be located.

The Non-recurring Shuffle

We'll start by supposing we wanted to question three Wagga Wagga residents in each street. Suppose, further, that each street in the town only has houses numbered one to 10. How would you go about deciding, for any particular street, which three numbers you would go to? One way would be to generate lists of random numbers, between one and 10, and go to the first three house numbers from that list. But what would you do if your random-number generator came up with a list like 5, 3, 5, 3, 5? You need a routine which, while producing random numbers, does not produce each one more than once.

It's pretty simple to create a routine to fill an array of 10 elements with random numbers in the range one to 10. It is also simple, although it requires a bit more thought, to write a routine which fills the array with numbers chosen randomly in the range one to 10, but which does not repeat any number. That is, each number from one to 10 must appear in the array, in randomly determined positions, but no number can appear more than once.

If you run Listing 1 and enter the number '10' when prompted to do so by the question 'Range of numbers?', you'll see it rapidly produces the numbers you need. The elements of the B array keep track of whether or not a number has been previously produced.

But when you run it with, say, a range of 1 to 1000, you'll see it almost grinds to a halt as it tries to find numbers it has not used before.

Moses/Oakford Soft-Shoe?

In 1963, according to *Algorithms: Programmer Instant Reference Card* (J D Lewis, Micro Logo Corp, 1981), two gentlemen named L E Moses and R V Oakford developed a shuffle routine which randomises the elements of an array. Whereas the time it takes for the routine given in Listing 1 to complete a list increases exponentially as the range increases, the time taken by the Moses/Oakford routine only increases in direct proportion to the range (so it takes just 10 times longer to shuffle the numbers 1 to 100 than it does to shuffle those from 1 to 10 with Moses/Oakford, while the first routine takes time related to the number of elements raised to a power to do it).

Try the Moses/Oakford shuffle, given as Listing 2, and compare it with the first program, to see how long it takes to produce vast arrays of shuffled numbers.

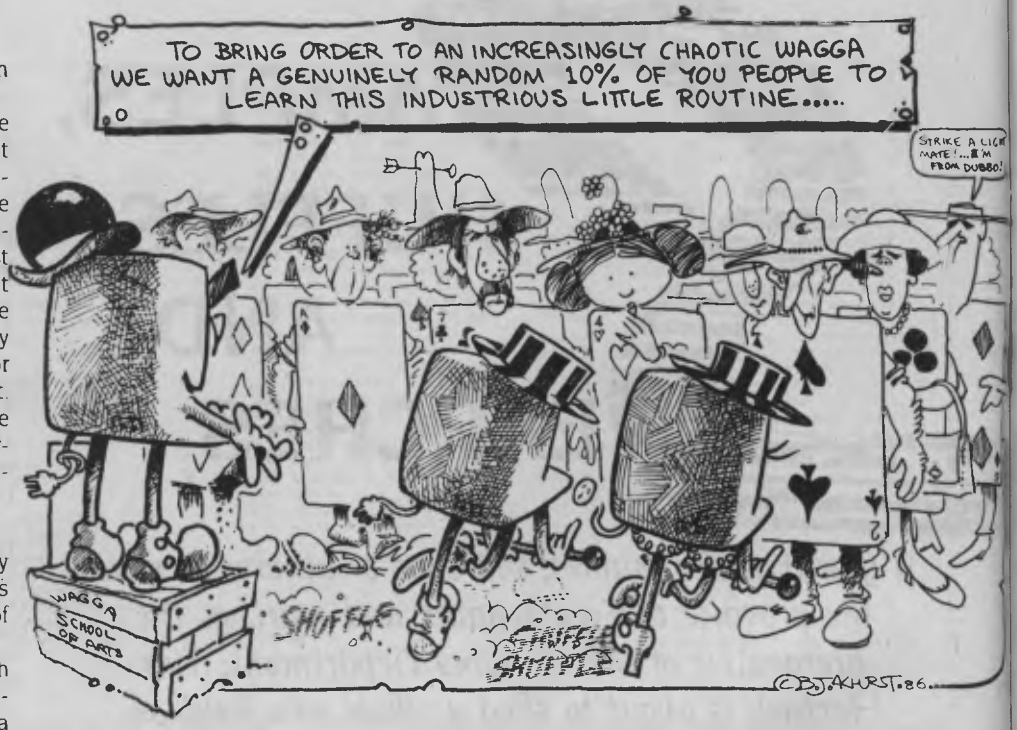
Listing 3 shows Moses/Oakford in action simulating a deck (or more: up to eight decks) of cards. This program proves quite convincingly the routine's two major advantages: genuinely random output, and speed. The routine would be just as useful for shuffling the residents of Wagga Wagga, so the top 10 per cent could be dealt out to those doing the survey.

Sequential Searches

Suppose, instead of wanting a sample chosen at random from the whole population of Wagga Wagga, you wanted to question those who had reported incomes in excess of $20,000 a year in the last census. And further suppose that no list has been made, in numerical order, of income size. To locate those in the income bracket you want, you'd have to go through the whole census output, figure by figure, to isolate the ones you wanted.

And, sad to say, a computer would have to do the same thing. If the list is disordered, there is no way of cutting short the process of going through it, element by element, until the one required is found.

Listing 4 demonstrates a sequential search: a variation of Moses/Oakford is used to fill an array with randomly gener-



ated numbers, and then the program looks for them.

What is the relationship between the number of items in the list, and the time it takes to locate any one of them? A moment's thought will show that if there are N items, on average half the time the element you're looking for will be in the first half of the list, and the rest of the time it will be in the second half. That is, the 'average position' (to use the term very loosely) of the element you're looking for will be exactly halfway through the list. The longer the list, the longer it will take to reach the halfway point, so — on average — it takes N/2 time to search sequentially through a list of N items.

Self-organising List

In real life we rarely deal with completely random lists, in which every item is needed an approximately equal number of times.

As I live in an extremely low-tech household, the 10 or so telephone numbers I use most often are written on a piece of cardboard near the phone (no auto-dial facilities for me). If I bothered to log the calls I made in any four-week period, I am sure one or two of the numbers would be used far more often than the rest. Of the remainder, perhaps three or four would be the next-most-often used, with the final few hardly ever being dialled. Your telephone usage is probably very much the same.

Now, assume I had my telephone directory on disk, and it contained some 1000 names and numbers, added from time to time over the years. Whenever I needed a number, the computer would have to search through the list. And, if my two most-often-used numbers were right at the end of the list, it would always take the computer close to the maximum possible time to find them. A list which 'knew' which elements were needed more often than others, and could rearrange itself so often-used items were closer to the start of the list than the end, would be very useful. Then, at the end of each day's work, I could resave my directory on disk, and eventually the numbers I called every day would be at the start of the list, where they would be found almost instantly from the 1000 numbers, and those I used rarely would be closer to the end of the list.

For a more realistic example of the usefulness of a self-organising list, imagine a car-parts warehouse where every item in stock has a reference number. However, most people who ring up to find out if an item is in stock do not use the warehouse's reference number, preferring instead to say things like "a rear-wheel brake shoe for the 1968 model". To save having to look up, in some vast ledger, the relevant reference number so an order can be raised, the warehouse has a computer system set up. The clerk types in 'brake shoe, rear, 1968', the computer searches through its thousands of parts, and eventually prints up on screen 'IV663' as the part number, which the clerk writes on the order.

The binary search is much faster than the sequential search, and is ideal in any case when the items you're searching through are in order.

Now, some parts will be asked for far more often than others. Brakes, for example, wear out on all cars, so there will be a constant call on those parts. Other things, such as a replacement winder for the left rear window, are probably requested far less often. So if the 'rear brake shoe' is near the end of the computer's list of parts, it will take an unnecessarily long time to find out that the part number is 'IV663', compared to the time it would take if this particular part was closer to the start of the list.

Listing 5, the self-organising search, goes some of the way toward solving this problem. Once it finds a requested item (X in this case, which is located at element number P), it swaps it with the item preceding it, moving it closer to the start of the list. You can test this program by asking for the same item over and over again, seeing how it moves closer to the beginning of the list each time. (Lines 100 and 190 use the IBM PC's time variable TIME$ to time how long it takes the program to find a particular item. Replace these lines with whatever variable your computer uses for accessing its internal clock.)

Binary Searching

If I asked you to guess a number I was thinking of, between one and 100, you'd probably start by saying "50". When I said "higher", your next guess would then sensibly be "75". A reply of "lower" would prompt you to guess "62" or "63" and so on, until you'd narrowed down the field to the correct number.

Even though you may not have known it, you were conducting a binary search for

the needed number. The binary search is much faster than the sequential search, and is ideal in any case when the items you're searching through are in order. If you had a list of Wagga Wagga incomes, ranked from my income level of $110.07 a year, up to $245,000 (Les Bell), and you told the computer to find the first occurrence in the list of $20,000, a binary search would probably find the $20,000 before a sequential search did.

The binary search, Listing 6, works in exactly the same way as you would when trying to guess the number I was thinking of between one and 100. It compares X (the number you're looking for) with the middle element of the list (line 170). If they are the same, the search is over, and the program goes to line 230 to tell you where the needed element is in the list. If the middle element is not the item you're looking for, the comparison in line 160 tells it which half of the list to examine next.

It searches this half in the same way, starting by looking at the middle element. In the program, the variables L and R stand for 'left' and 'right' of the section of the list being examined (which is why, in line 140, L is set equal to the lowest number in the list, 1, and R is set to N, the highest one).

I'd be interested to see any other computer search routines you come across or develop, as well as any comments you may have on the material in this month's column. Please write to me care of *Your Computer*. □

Suppose you wanted to question the population of Wagga Wagga with incomes in excess of $20,000 a year in the last census. And further suppose no list has been made, in numerical order, of income size. To locate those you want, you'd have to go through the whole census output, figure by figure, to isolate the ones you wanted. And, sad to say, a computer would have to do the same thing.

Listing 1

```
10 REM Shuffle
20 REM Non-recurring Random Numbers
30 CLS:INPUT "Range of numbers";N:CLS
40 DIM A(N),B(N)
50 FOR J=1 TO N
60 X=INT(RND(1)*N+1):IF B(X)=1 THEN 60
70 B(X)=1:A(J)=X
80 NEXT J
90 FOR J=1 TO N:PRINT A(J),:NEXT J
```

Listing 2

```
10 REM Moses/Oakford Shuffle
20 REM Non-recurring Random Numbers
30 CLS:INPUT "Range of numbers";N:CLS
40 DIM A(N)
50 FOR J=1 TO N:A(J)=J:NEXT J
60 PRINT "Starting now:"
70 FOR J=N TO 1 STEP -1
80 T=INT(RND(1)*J)+1
90 TEMP=A(T):A(T)=A(J):A(J)=TEMP
100 NEXT J
110 PRINT "Finished:"
120 FOR J=1 TO N:PRINT A(J),:NEXT J
```

Listing 3

```
10 REM Card Shuffle - using Moses/Oakford
20 DIM A$(416),B$(4),C$(13)
30 REM      e$ = cards
40 REM      b$ = suits
50 REM      c$ = pips
60 CLS:PRINT "How many decks (1 to 8)";
70 INPUT DE:IF DE<1 OR DE>8 THEN 60
80 CD=52*DE
90 PRINT:PRINT "OK, I'll shuffle"DE"deck";:IF
 DE<>1 THEN PRINT "s";
100 PRINT " of cards"
110 REM ********************
120 REM Allot cards to array elements
130 RESTORE
140 FOR Z=1 TO 4:READ N$
150 B$(Z)=N$:NEXT Z
160 FOR Z=1 TO 13:READ N$
170 C$(Z)=N$:NEXT Z
180 REM ********************
190 REM Fill array with card names
200 FOR Z=0 TO CD-1 STEP 52
210 FOR X=0 TO 51 STEP 4:FOR Y=1 TO 4
220 A$(X+Y+Z)=C$(1+(X/4))+" of "+B$(Y)
230 NEXT Y:NEXT X:NEXT Z
240 FOR Z=CD TO 1 STEP -1
250 X=INT(RND(1)*Z)+1
260 N$=A$(X):A$(X)=A$(Z):A$(Z)=N$
270 NEXT Z
280 REM **********************
290 REM Print out
300 CLS
310 FOR J=1 TO CD STEP 3
320 IF J<10 THEN PRINT " ";
330 IF J<100 THEN PRINT " ";
340 PRINT J;MID$(A$(J),3);
350 X=25:IF J<10 THEN X=27:GOTO 370
360 IF J<100 THEN X=26
370 PRINT TAB(X);J+1;MID$(A$(J+1),3);
380 X=50:IF J<10 THEN X=52:GOTO 400
390 IF J<100 THEN X=51
400 PRINT TAB(X);J+2;MID$(A$(J+2),3)
410 NEXT J
420 END
430 REM ****************************
440 DATA "HEARTS","DIAMONDS","CLUBS","SPADES"
450 DATA "01ACE","02TWO","03THREE","04FOUR","
05FIVE","06SIX"
460 DATA "07SEVEN","08EIGHT","09NINE","10TEN"
,"00JACK","00QUEEN","00KING"
```

Listing 4

```
10 REM Sequential Search
20 CLS:INPUT "How many elements to search thr
ough";Q
30 CLS:DIM A(Q)
40 PRINT "Please stand by..."
50 FOR J=1 TO Q:A(J)=J:NEXT J
60 FOR J=Q TO 1 STEP -1:T=INT(RND(1)*J)+1
70 TEMP=A(T):A(T)=A(J):A(J)=TEMP:NEXT J
80 CLS:INPUT "Enter number to be searched for
";N
90 N=INT(N):IF N<1 OR N>Q THEN 80
100 TIME$="00:00:00"
110 X=0
120 X=X+1:IF A(X)=N THEN 150
130 IF X<Q THEN 120
140 PRINT "I cannot find"N:GOTO 160
150 PRINT TIME$:PRINT "Search complete"
160 PRINT:PRINT "Press any key then <RETURN>
for a new search,"
170 INPUT "or just <RETURN> to end";A$
180 IF A$<>"" THEN 80
```

Listing 5

```
10 REM Self-Organizing Search
20 CLS:INPUT "How many elements to search thr
ough";N
30 CLS:DIM A(N+1)
40 PRINT "Please stand by..."
50 FOR J=1 TO N:A(J)=J:NEXT J
60 FOR J=N TO 2 STEP -1:T=INT(RND(1)*J)+1
70 TEMP=A(T):A(T)=A(J):A(J)=TEMP:NEXT J
80 CLS:INPUT "Enter number to be searched for
";X
90 X=INT(X):IF X<1 OR X>N THEN 80
100 TIME$="00:00:00"
110 A(N+1)=X
120 P=0
130 P=P+1
140 IF A(P)=X THEN 170
150 IF P<N THEN 130
160 PRINT "Element not found":GOTO 220
170 IF P=1 THEN 210
180 TEMP=A(P-1):A(P-1)=A(P):A(P)=TEMP
190 PRINT TIME$
200 P=P-1
210 PRINT "It is at element"P
220 PRINT "Press any key then <RETURN> to loo
k for"
230 INPUT "another number, or just <RETURN> t
o end";K$
240 IF K$<>"" THEN 80
```

Listing 6

```
10 REM Binary Search
20 CLS:INPUT "How many elements to search thr
ough";N
30 CLS:DIM A(N),Q(N),C(N)
40 PRINT "Please stand by..."
50 FOR J=1 TO N:A(J)=INT(RND(1)*J+1):NEXT J
60 FOR J=1 TO N:C(A(J))=C(A(J))+1:NEXT J
70 FOR J=2 TO N:C(J)=C(J)+C(J-1):NEXT J
80 FOR K=N TO 1 STEP-1
90 TEMP=A(K):J=C(TEMP):Q(J)=TEMP:C(TEMP)=J-1
100 NEXT K
110 FOR J=1 TO N:A(J)=Q(J):NEXT J
120 CLS:INPUT "Enter number to be searched fo
r";X
130 TIME$="00:00:00"
140 L=1:R=N
150 P=INT((L+R)/2)
160 IF X<A(P) THEN 190
170 IF X=A(P) THEN 220
180 L=P+1:GOTO 200
190 R=P-1
200 IF L<=R THEN 150
210 P=0
220 PRINT TIME$
230 IF P<>0 THEN PRINT "It is at position"P:G
OTO 250
240 PRINT "It is not in the list"
250 PRINT "Press any key, then <RETURN> for a
nother"
260 INPUT "search, or just press <RETURN> to
end";E$
270 IF E$<>"" THEN 120
```

ALL HAIL THE AMIGA

And you thought Tim Hartnell was a hard-bitten old hacker who couldn't be impressed by anything the computing world might have to offer . . . he's seen it all. Well, he probably thought so too — until he got his hands on Commodore's new Amiga. Now he's as excited about it as any novice on his first computer — and his only worry is whether enough people will buy it to keep Commodore in business.

I THINK I'M in love. Not since the day I took home my very first computer — a 1 Kbyte ZX80 — have I felt such anticipation and excitement about booting up yet another new computer.

I hoped the Amiga — the latest whizz-bang, all-singing, all-dancing wonder machine from Commodore — was going to be special. After all, hadn't reviewers from around the world been having orgasms over it for months, drooling over the keyboard in ecstasy?

And yet, I was a little dubious. I feared that like a movie which has been oversold and then proves a disappointment, all the fireworks of praise around the Amiga might turn out to be a combination of hype and wish-fulfilment.

I needn't have worried. The Amiga is the most exciting computer I've ever used, even more exciting than the 1 Kbyte ZX80 which launched me into the world of computers.

As a music synthesiser it practically rivals the Fairlight. As a graphics machine it almost challenges photography and just about beats television in the quality of the images it produces. For a musician or graphic artist it is a tool of immense potential.

Now, that's fine if you make your living creating woo-wah noises from synthesisers, or dashing off state-of-the-art electronic abstracts for Yuppie living rooms.

What about the rest of us, who are not professional musicians, and who don't have a rewarding career creating brilliant new album covers? What use could the Amiga possibly be to us?

As Faraday (I think) said when asked what use electricity could be: "What use is a new-born baby?" And a new-born baby is very much what the Amiga is. It is virtually untried, with few software houses having spent enough time to do more than scratch the surface of its potential, even though it has been available in America for a year or so. I suspect when the true depths of the Amiga's possibilities are

tried, we will see software which will put every single program ever written Before Amiga to shame.

But let's step back from this rapture for a moment, and ask the real question, the one financially fractured Commodore in the United States is asking: "Will anybody buy the thing?"

Sure the graphics are magic (with a resolution of 640 by 400, and 4096 colours!) and the sound is unbelievable (four independent channels so you can wow 'em in stereo), but — and this is a big but — is that enough?

While the 'high-tech nut' fringe of the world (such as me, and possibly you) would kill to possess a toy of such wonder, that does not make a market. There are not, I suggest, enough high-tech freaks in this world to support Commodore, and help it pay back the millions it owes to the bank.

So, if there are not enough people who will buy the machine simply because it is there, like Mount Everest, where will the market come from?

Commodore fervently hopes the business market will pick it up. I can understand why. For a start, the Amiga is not cheap: $2495 for the whole box and dice including super-sharp Amiga monitor, and another $500 or so if you want a second disk drive.

In Australia, that means the Amiga is still more expensive than your average IBM-compatible. There have to be some pretty good reasons for paying more for a 'non-standard' business machine. There is no software to speak of for the Amiga (around one hundred packages, according to the last figures I've been quoted, compared with the 15,000-plus for the IBM PC), and the majority of what is available is explosive sound and graphics wonders, with a scarcity of the Lotus/Symphony/dBase type of program.

Commodore could hardly ignore this gloomy fact, so it has set its engineers to produce a little black box which effectively de-skills the Amiga, so it will run IBM PC software (which is like emptying the tank of your car so you can drag it along behind a horse). The 'make it work like a PC' black box has not, in fact, yet appeared, and even if it does, thus giving Amiga owners access to the PC software mountain, that sort of misses the point. If you want a bicycle you don't buy a car, then pay a mechanic to take the engine out, rip off two of the wheels, and add pedals. ▶

Commodore itself certainly didn't think the business market was where it was aiming the machine when it was launched in New York. You don't have the *enfant terrible* of the sixties, pop artist Andy Warhol, creating Campbell's soup cans at the launch, and Debbie Harry singing "I love my Amiga, 'cause it gives me high-res goosebumps" if you want the sober-suited business fraternity to come a-calling.

Commodore seems to have changed its mind somewhere along the way. Perhaps it's the threat of bankruptcy. Commodore would also dearly love the Amiga to be a world-record success just to say "up yours" to Atari-come-lately turncoat Tramiel.

The original 128 is quietly proving to be a dismal flop for Commodore, the C16 and the Plus/4 were marketing non-events, while the old, much-discounted warhorse C64 chugs on, seemingly forever. But you can't make a million with a machine which has long passed its prime, regardless of how many are out there in the marketplace.

Let's just recap a moment before we go on. I said the graphics and sound were the best in the universe, and that anyone who is a card-carrying member of the High-Tech Freak Society will want to trade in their windsurfer and all their Dire Straits CDs to get one. I then added the cautionary note that one high-tech freak does not a mass market make. Commodore needs money; it is desperately praying the Amiga will deliver it.

Let's have a look at what you get for your $2495, so you can decide for yourself the likely future of this dream incarnate.

As a music synthesiser the Amiga practically rivals the Fairlight. As a graphics machine it almost challenges photography and just about beats television in the quality of the images it produces.

Speed and Graphics

First of all, the Amiga is a 16-bit machine, which gives it its incredible speed and graphics-handling ability. I'm used to using windows with GEM on the PC, so I was startled by the speed and smoothness of window manipulation on the Amiga. You can have a window as big as the whole screen, and pull the *whole thing* down pixel by pixel, as a program (or two, or more) is happily running on the window you're moving and/or on the window which is being revealed as you pull the first window down. The system will support — given enough memory — 50 simultaneous windows.

The low-resolution screen is 320 by 200, with up to 32 colours; high resolution is 640 by 200 and 16 colours, with interlaced mode doubling the vertical resolution to 400 pixels. The colours are chosen from a total palette of 4096, and although you are generally restricted to 16 or 32 colours, I have seen one demo program in which all 4096 were on the screen at once, and I'll explain how that was done in a moment.

The Amiga has three screen modes (any of which, so far as I could tell, could function in an interlaced manner, as mentioned above): single playfield, dual playfield and hold-and-modify. Single playfield essentially gets the screen to behave like any other computer's display: there is one picture, and the computer manipulates that one. The exception with the Amiga is that this display can consist of a number of screen-sized windows, which can be set to different resolutions, use different palettes and be quickly interchanged.

With dual playfield you have one screen sitting on top of another, and you can 'see through' holes in the first screen to the one behind it. The graphics potential of that idea is extraordinary. Imagine an animated horse on the front screen, running in one place, and the scenery whizzing away behind it on the second screen; or the front screen having an image of a magnifying glass which you can move around, and the magnified image, seen 'through' the magnifying glass on screen one, held on screen two.

The third screen mode, hold-and-modify, allows you to produce non-animated pictures of the most extraordinary complexity. Hold-and-modify is the mode in which the '4096 colours at once' demonstration was created.

Up to eight sprites can be under simul-

taneous hardware control, and you can use software to switch between these as the display is produced, so many more than eight can be handled at once (although there is a limit as to how many can appear on a single horizontal scan). These sprites have limitations: no more that 16 pixels wide, although they can be of any depth, and they can only be in one of three colours, or transparent.

Greater flexibility is afforded by 'blitter objects' (or 'bobs', as Commodore would have us call them), which come under the control of the 'blitter', which I'll be talking about a little later in this article.

What You Get For Your Money

The $2495 Amiga comes with 512 Kbytes of memory, the keyboard, high-res monitor, four disks, the system unit with a single built-in 9 cm disk drive and a mouse. The review machine came with an additional disk drive, which I decided not to hook up because it seemed the review would be more realistic if I stuck to the 'base model', and I didn't find any problems working with just one drive. A disk can be copied, for example, in just three passes.

The Amiga I had was the smaller memory (256 Kbyte) model. I added the other 256 Kbytes in about three seconds, just by opening a panel on the front of the system unit and plugging the extra memory in, just like plugging in a cartridge program. (To add 256 Kbytes to my PC took me nearly half an hour, so you can see that even in this relatively small matter of adding extra memory, intelligent forethought has gone into the Amiga's design.) I suggest 512 Kbytes is the minimum you would need; even one of the demo programs on the BASIC disk refused to run with a 'meagre' 256 Kbytes, returning an 'insufficient memory' error message.

In America they get the 256 Kbyte Amiga, with monitor, for $US1790, so at the quoted price of $A2495 for the 512 Kbyte model we're doing pretty well over here.

Starting Off

When you turn the computer on (and the monitor needs a power point of its own) the screen lights up almost instantly, a little ten-note tune comes from the speaker and a good, clear, high-resolution picture of a hand holding an upside-down (so you can't read the label) disk appears. If you stand on your head, you see the label on the disk in the picture reads 'Kickstart'. This is the boot disk.

Commodore has set its engineers to produce a little black box which effectively de-skills the Amiga, so it will run IBM PC software (which is like emptying the tank of your car so you can drag it along behind a horse).

You'll notice that if the disk drive is ever empty, the Amiga checks it out every few seconds. You can hear something which to my ignorant ears sounds like gentle mechanical probing to see if a disk is in place. Therefore, when you put your Kickstart disk in place, you don't need to click on the mouse or press Return or anything like that; the boot procedure starts automatically. (The picture of the disk is upside-down because that's the way the label faces — away from you — if you have the disk the right way round to stick it in the drive. Wouldn't it have been more logical to put the label on the disk the other way, so you could see what you were doing?)

The disk drive light comes on and the disk spins for a few times. Then, after about 10 seconds, a new picture appears: another stand-on-your-head picture of a disk reading 'Workbench'. You take out Kickstart and insert Workbench, and this disk is automatically read.

The screen clears to show first what appears to be a standard DOS 'front end', and then this clears to an empty blue screen, with a forlorn little disk icon up in the right-hand corner, labelled 'Workbench'. You do a double-click with the left button on your two-button mouse, and the drive whirrs yet again.

Next, the Workbench window appears, occupying around a third of the screen. It looks like a close cousin of the Macintosh, and of the GEM Desktop before Apple took Digital Research to court and got them to change it (I wonder why Apple hasn't yelled at Commodore yet?). One by one the contents of the bench are pulled off the disk and deposited in the window: a rubbish bin (called, naturally enough, a trashcan), a circular clock face with hands (labelled, for the blind, 'clock'), and four little drawer icons called 'Demos', 'Utilities', 'System' and 'Empty'. A fifth drawer icon has a big orange question mark over it and the label 'Preferences'.

If you move the arrow-head pointer to the Preferences icon and click twice on the button, you very quickly start to appreciate some of the Amiga's attraction. (While the Macintosh uses a clock face to mean 'wait an eternity while I load something in', and GEM displays an hourglass picture to transmit the same message, the Amiga has a little 'speech balloon' with a couple of 'zzzzz . . .' snores in it. In fact, the speech balloon only stays on the screen for a couple of seconds in this case, although some of the software I tried seemed to take an eternity to load, so the snores looked a little less whimsical.)

With Preferences, you can use the mouse to move little pointers on the screen to set such things as the date and clock, the baud rate for the RS232 output, the number of characters across the screen in text (60 or 80), the position of the overall image on the screen, and so on. You can also modify any of the four basic colours (which start off as blue, white, black and a sickly orange) to make them any of the 4096 possible colours you like. Allowing all these things to be user-modified is an indication of the care which has been taken to make the Amiga as flexible as possible.

As well as the Kickstart and Workbench disks, the Amiga comes with a disk called 'Extras', which contains an easy-to-follow and most worthwhile tutorial on using the computer and Amiga BASIC. When you load Extras, a new window appears, filled with the options from the disk. I selected 'BASIC Demos', and when a new window appeared, clicked on an icon just labelled 'Demos'.

When it came up, I found my first and only software bug (but a bug on the BASIC master disk, even if a minor one, is a little worrying). 'Demos' puts four windows on the screen, each containing an independently moving picture, including bouncing balls and flashing squares. All four pictures move at once, and true to the▶

Amiga's claim to be multi-tasking, you can move the windows around, do some calculations, play a tune, and so on — all at once (although you do notice some degradation of speed, especially if all the things you want to do at once access the same parts of the system).

And the bug?

Every window you open on the Amiga has a 'close window' box in the top left-hand corner. When you've finished with that window, you click on the close box, and the window vanishes. The 'bouncing balls' window does not have a close box that I could find. Once you open it, you're stuck with it, unless you decide to reboot the machine, or so it seemed to me. And if you accidentally click the button while the pointer is within this unclosable box, the image of the end of your pointer detaches itself from the rest of the pointer, and stays behind in the window, moves around with it, and is detected by the balls as an obstacle, so they bounce off it. Being stuck with these balls is not too bad, I guess, but they consume processor speed (seriously affecting the music demo from the same disk) and memory.

Getting Down to Programming

All these magic demos are fine, but the machine is not going to be much use to you if you can't program it. The Mac first appeared without any means of programming it, and it was some eighteen months before a reasonable BASIC that actually allowed you to do things like set windows within a program appeared. Commodore has not made that mistake.

Amiga BASIC is great, a professional language which — given the incredible speed of the machine — allows you to weave some pretty good spells of your own. It contains all the standard Microsoft (which wrote it) BASIC commands, so if you've used one of this company's BASICs on any other machine, you'll be instantly at home.

But to provide a standard plain-vanilla BASIC on a machine like the Amiga would have been criminal, so Microsoft pulled out all the stops to hand you the keys to the magic kingdom.

Line numbers are optional. You can send such things as GOSUBs to labels. You run BASIC programs using one window for the listing, and one or more for the output. You can have local or what are called 'shared' variables. IF/THEN commands can control a whole block of lines if desired, rather than just the remainder of a single line which begins with the IF/THEN. The BASIC also supports 16- and 32-bit integers, as well as 32- and 64-bit floating-point numbers. These things alone indicate the quality of Amiga BASIC.

*You don't have the **enfant terrible** of the Sixties, pop artist Andy Warhol, creating Campbell's soup cans at the launch, and Debbie Harry singing "I love my Amiga, 'cause it gives me high-res goosebumps" if you want the sober-suited business fraternity to come a-calling.*

However, of greater interest, and certainly the part of the BASIC which will get a good workout, are the commands which control use of the Amiga's specialised features. You don't need to read the manual to understand the value of the following commands:

COLLISION ON enables ON COLLISION . . . GOSUB.

GET and PUT are used to move graphic images held as a series of points within an array around the screen.

SCROLL lets you define an area of the screen, and say by how much and which way you want it to move.

MOUSE is used with commands to detect button pressing, and the X-Y co-ordinates of the pointer on the screen.

MENU allows you to create your own drop-down menus to use within your own programs.

SAY and TRANSLATE$ are used for speech. TRANSLATE$ changes a sentence written in English into phonemes, and SAY makes the Amiga say the translation. The spoken English sounds like a Swedish man who has a cold, and who learnt to speak English in northern Scotland.

The music command SOUND allows you to specify notes to be produced by up to four voices at once, with a frequency range of 20 to 15,000 Hertz, with a duration from an eighteenth of a second to just over four seconds.

WAVE allows you to create an envelope for the SOUND command, and also controls which channel a sound will come from. WAVE can be simply SIN, so a sine-wave is used, or an array of at least 256 elements in the range –128 to 127. You can see this command alone could keep you occupied for the next century.

PATTERN is used to indicate the texture of text, lines and the interior of polygons.

PALETTE: you can set up to 32 of these, and each one allows you to control precisely — to two decimal places — how much red, blue and green will be in a specified colour. The manual gives the mixtures for such things as 'fire-engine red', 'sky blue' and 'lime green'. The colour proportions can also be assigned randomly.

PTAB moves the cursor to a specified *pixel*(!), a number which, the manual informs us, "must be in the range 0 to 32767".

SLEEP suspends execution of a program until a specified event, such as the click of a mouse button or an object collision, occurs.

If this wasn't enough, the BASIC disk also contains a program written in BASIC, called 'Object Editor', which helps you create images of objects to use for animation within your own BASIC programs. A whole chapter of the BASIC manual is dedicated to explaining the use of this editor.

Demos Set High Standards

The extraordinary potential of the Amiga's graphics is shown in demonstration programs, even though few of us will ever attain the standards they set.

For a start, the fourth disk supplied with the Amiga is 'Kaleidoscope', a dazzle-your-eyeballs duo of graphic demonstration programs from the United States software company Electronic Arts. The first program on this disk is called 'Slide Show', and is a selection of screen shots from other Electronic Arts software.

Of far greater interest is the second program, 'Polyscope', which is a set of 10 constantly evolving animated programs which I could only sit and gaze at in awe. Moving spheres, leaving coloured, tunnel-like

'worms' of other spheres behind them, engage in complicated choreography in some of the programs, while in others multi-dimensioned snowflakes reflected in up to eight axes grow and die before your very eyes, folks.

The introductory text says the program takes over two hours to run through completely. I can well believe it. I wasted most of my first morning on the Amiga just watching this particular demonstration program. Once the machine gets out into the shops you can be sure the only thing it will be running in the store will be either the famous bouncing red-and-white soccer ball, or a track from Polyscope. See it, and believe.

Other demo programs I saw showed sprites as large as about one quarter the size of the screen moving rapidly behind each other, as individual parts of the program (such as a yoyo going up and down) continued to move. You could move the whole picture down, in a smooth pixel-by-pixel descent, and see the animation continuing.

One demonstration program, which shows a standard few of us will ever reach, is called Robot City. In this, against a fearfully complicated picture of roads and twisted houses, four objects move independently (including a high-class hooker walking smoothly from one side of the screen to another, and a fire hydrant doing aerobics!).

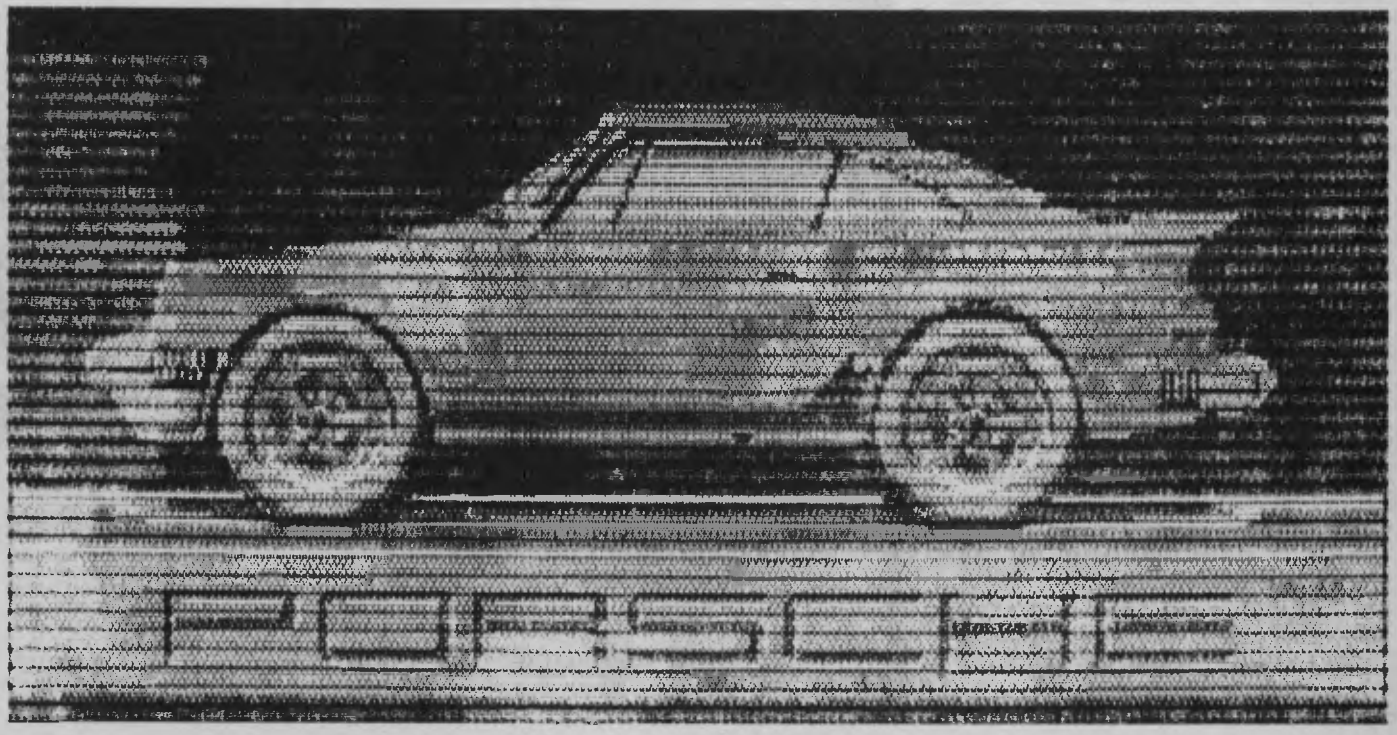
Imagine an animated horse on the front screen, running in one place, and the scenery whizzing away behind it on the second screen; or the front screen having an image of a magnifying glass which you can move around, and the magnified image, seen 'through' the magnifying glass on screen one, held on screen two.

It is possible to cycle through a selection of colours, which means very good animation effects can be produced without a single sprite being used. Other demo programs show such things as snow falling and water flowing. But the real magic one is where Captain Kirk gets into the action, and flies his starship at warp speed into a kaleidoscope of stars. The impression of rapid speed down a 'tunnel' of stars is very good, and it is all done simply by turning the pixels which represent stars off and on as the colour is cycled.

The Hardware

The Amiga's power comes essentially from three custom-designed chips which work with the Motorola MC68000 central processor. Although the machine comes with 256 or 512 Kbytes, and the custom-designed chips can only directly address 512 Kbytes, the Amiga can handle up to 8 Mbytes when fitted with an external board.

The 68000 is the heart of the system, acting as the traffic cop which directs and co-ordinates the work of the other parts. The 68000 is rated at 8 MHz, and unlike other computers (such as the Atari ST or the Sinclair QL) which use this chip, on the Amiga it runs at close to the rated speed, at a shade over 7 MHz. I believe the QL, where the chip must do everything, actually runs at a third of this speed. ▶



The most important chip the 68000 controls is the Address Generator, called Agnus. It has three primary functions:

1. The first of these functions is to take charge of the controls for 26 direct memory access channels, which enable different sections of the system to use the memory without first 'getting permission' from the CPU to take data from one location and put it somewhere else. These direct memory channels look after things like the disk drives, the sound and the graphics, so the CPU is not slowed down by housekeeping.

2. On most other computers, the main processor spends a lot of time waiting for just the right instant to put an image on the screen, so that it will be synchronised with the creation of the VDU scanning. Agnus looks after this on the Amiga.

3. The third of these functions, and one which has received a lot of interest, is the 'blitter', a strange word which stands for 'block image transferrer'. This is used primarily for transferring areas of display memory extremely quickly, although it can be used to move other portions of memory around. As well as relieving the CPU of this task, the blitter works around 10 times faster than the 68000 (I'll look at the blitter in more detail a little later in this review).

The display encoder chip, known as Daphne, has one main task in life — to directly translate the complex internal way in which display information is held inside the Amiga into the actual image on the monitor screen. The display information is held in this internal complex format because it gives maximum flexibility to the programmer. However, if the CPU had to decode the internal format before you could see it, the system would be much, much slower, so Daphne does the work, relieving the CPU of yet another task. Daphne also looks after sprites, and — perhaps surprisingly, because it seems unrelated to the chip's main task — reads the mouse port.

The third custom chip is Portia, which looks after the ports, audio and the UART chip. Portia controls the four audio channels (which you can run as a single, mono channel through the speaker built into the monitor, or directly via leads with RCA plugs into your stereo amplifier to shatter windows, frighten magpies and annoy neighbours), with a little assistance from Agnus. Portia also looks after communication with the disk drives, and the Amiga's serial port (which is at the back of the system unit, along with slots for a modem and an extra disk drive, and the RCA sockets for the sound, monitor output, direct video output and TV output.

While the Macintosh uses a clock face to mean 'wait an eternity while I load something in', and GEM displays an hourglass picture to transmit the same message, the Amiga has a little 'speech balloon' with a couple of 'zzzzz . . .' snores in it.

Although Portia, Daphne and Agnus are not particularly complex devices in their own right, they have been carefully designed to perform their tasks in the best possible way, and to dovetail precisely with the 68000, leading to the computer's incredible performance.

Blitting your Graphics

The blitter part of Agnus lies behind the Amiga's remarkable graphics, and it is the graphic power of the computer which is the simplest to recognise. Just think what happens when one window, which is currently overlapping another, is placed *under* the window it was on top of (a process which occurs virtually instantaneously on the Amiga), and the new top window is printed. The computer must store the graphic data of the window which is being obscured (so it can recreate it if necessary), must retrieve the data for the window which is being revealed, and then print it. Add to this the fact that the window can include moving graphics (like those bouncing balls I was unable to delete), and you have some idea of how much work the blitter must do.

Although the blitter is only designed to work directly with rectangular objects, it can use the four dedicated memory channels it has at its command to move irregularly shaped objects around. Grossly simplifying what happens (and trying to ex-

PRODUCT DETAILS

Processor:	MC68000, 32-bit internal bus; 16-bit data bus; 7.16 MHz clock speed.
RAM:	256 Kbytes, expandable with plug-in cartridge to 512 Kbytes; externally expandable to 8 Mbytes.
ROM:	128 Kbytes (192 Kbytes possible).
Custom graphics chip:	Palette of 4096 colours. Eight reusable 16-bit-wide sprites. 60/80-column coloured text. Programmable inter-object priority and collision detection.
Resolutions:	320 by 200 or 320 by 400, 32 colours; 640 by 200 or 640 by 400, 16 colours.
Custom animation chip:	Uses 'blitter' for high-speed movement of graphical data, for rapid animation. Controls 26 direct memory access channels.
Custom sound/ peripherals chip:	Four voices output on two channels. Nine octaves. Complex waveforms allow high-quality speech and musical instrument synthesis. I/O controls for disk, mouse, joystick.
Provided language:	Microsoft BASIC.
Operating system:	AmigaDOS; multi-tasking; hierarchial file system allows fast file access and hard disk compatibility. Windows/icons mouse-controlled environment called 'Intuition'.
Disk drive:	Built-in 9 cm drive; capacity of 880 Kbytes formatted.
Keyboard:	Detachable, 89 keys, 13-key numeric keypad, 10 programmable function keys, four arrow keys, HELP key.
Mouse:	Two-button, connects to joystick port.
Input/output:	Two reconfigurable controller ports — support mouse, joysticks, paddles, lightpens. Additional disk drive port. Centronics parallel printer port. RS232C serial communications port. RAM expansion (256 Kbytes) port. Stereo audio output (two RCA jacks; signal-to-noise ratio 70 dB; frequency response 20-6000 Hz). Monitor, TV, RGB, video.
Physical measurements:	Weighs around 6 kg; measures 10.8 cm high by 45 cm wide by 33 cm deep.
Price:	$2495; includes one disk drive, high-res monitor, 512 Kbytes of RAM.

plain so that I can understand it), the blitter can do this by calling up a black 'shadow' image of the irregular shape from one part of the memory, the colour information from another source, and then putting them together, while instructing the computer only to block out those parts of the background covered by the 'shadow'.

As the Amiga stores its data, including graphic image data, as 16-bit words, it can manipulate this data by doing a 'shift left' or 'shift right' to the word, so an object can move pixel by pixel, thus leading to the ultimate in smoothness.

The blitter also looks after painting an area full of colour, and controls the drawing of lines. To see a shape with an irregular border fill with colour in a flash is a revelation after seeing other PAINT commands which crawl slowly from inside the shape to its borders.

Third-party Software

Despite Commodore's claims that there would be a hundred Amiga software titles available from the day the computer was launched in the United States, it took a long time for the initial software trickle to become anything approaching a flood. Commodore claims there are over 900 Amigas in the hands of software developers in the States at the moment, and that more than 200 programs are available. No doubt most of these will find their way to Australia in due course.

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Programs which are available include a set for 'real programmers', who do not soil their hands with BASIC. Metacomco (which wrote the operating system) has Pascal, Lisp and Assembler packages for the Amiga, and Lattice has converted its acclaimed 'C' for the machine.

Lattice also has a spreadsheet program, Unicalc, which has a degree of Lotus compatibility, a dBase III-like file and database package, and some programming utilities.

The word processor Textcraft (which allows you, among a huge range of options, to enlarge the text on screen, like one of those 'big print' books; shows sub- and superscripts in their correct positions — and these can be in italics, bold or standard text — and so they appear as such on the screen; uses a little pair-of-scissors icon for cut-and-paste work, and so on) is available in the United States from Arktronic.

The game Hacker comes from Activision (and it's a bit of a hoot to see the Amiga being forced to emulate a lowly old line printer in this game), and Electronic Arts has its Deluxe Paintbox and the basketball simulation (complete with digitised crowd noises, and some guy yelling out to sell hot dogs and popcorn). ▶

You've not lived until you've played 'Smoke on the Water' with one finger, through a large stereo system, with the Power Chord (a sort of heavy metal guitar blast) option from this package.

One-on-One

The program which consumed most of my time, though, is the 'You too can be Emerson, Lake and Palmer' package, Musicraft. You can use the computer keyboard (or an external music keyboard) to play a vast number of instruments, most of which have been stored as digitised sounds from the real instruments. You've not lived until you've played 'Smoke on the Water' with one finger, through a large stereo system, with the Power Chord (a sort of heavy-metal guitar blast) option from this package!

You can use the mouse to draw your own wave forms on a little chart, and play those, as well as modify such things as attack and decay, rate and depth of reverberation and the rest, all on screen, and hear the results instantly.

The program allows you to 'write' music directly onto staves, using the mouse to pick up the notes and rests and what-have-you from the bottom of the screen, and then move them to the correct position. You can have four voices at once, each of which can be independently programmed. Musicraft also allows you to step through the music note by note, or just have one or two of the voices playing. You can transpose the whole piece into any key instantly, and can even 'tune' the program, to fit in with another external instrument, while the piece is playing.

For a would-be Deep Purple person like myself, Musicraft represents sufficient reason alone to consider buying an Amiga.

Conclusions

So there you have it. In a world where the only choices seem to be a me-too IBM-compatible or a Mac, it's great that a third — and exciting — choice exists. And if only to preserve this third option, if for no other reason, let us hope Commodore survives, so the marvellous potential the Amiga represents can be realised.

If the thought of being somewhat out of step with the crowd doesn't bother you, and you can afford to buy one of the most enthralling executive entertainment machines ever developed, get one. I think I'm going to sell off my windsurfer immediately. □

Thanks to High Technology Computer Systems, 290 Bay Street, Brighton North 3186, (03) 596 6211, for providing the review machine.

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APC

PRINTERS GALORE......

Such a range of printers is available today it's often hard to know which type to choose. Ewart Stronach *examines five printers in varying price ranges — two dot matrix, a printwheel model and two laser printers — and tries to show where the features of each would be best utilised.*

The art of using a computer to put words on paper has, like computing itself, come a long way in a short time. The earliest useful hard-copy output came from teletype machines, painstakingly modified to read computer output. These early machines still turn up in the homes of impoverished amateurs, and because of their construction, which resembles a stone ablution block, seem destined to outlast many of today's cheaper printers.

Printing today falls into eight categories: band printers, matrix impact, printwheel or daisywheel, electro-photographic, electro-erosion, inkjet, thermal transfer and plotter.

Perhaps the most widely used is the **dot matrix** printer, which uses an array of dots to create each character; the printhead moves across a stationary platen as each letter or graphic character is formed. Such printers are available in a wide price and quality range, starting at less than $500 retail for bottom-line units capable of handling standard A4 paper with pinfeed, and printing about 80 characters per second, to fancy ones which can print up to 340 characters per second, the equivalent of 1.2 million dots per minute.

```
I'VE BEEN stuck on my back in hospital for several days after an
operation and I decided to use the time to review some of the
computer text books that have influenced me over the years.<

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Top left: NEC *Spinwriter.*

The **band printer** consists of a flexible band with embossed letters moving across the paper, with a row of hammers at each letter position which transfer the letter to the paper through an inked ribbon. This style of printer is most used for very high-speed output and can attain speeds of up to 2500 lines per minute (that's *lines*, not characters) and costs well over $10,000.

The **printwheel** or **daisywheel** is perhaps the most common printer used in office situations, where a very high quality of type is called for at medium cost. This kind of printer is a development of existing typewriter technology and follows the style of the IBM Golfball and derivatives.

Laser printers (electro-photographic) are starting to make their way onto the market at reasonable cost. The laser in the unit writes the image on a photo-conductor and the printer fuses the image onto the paper in the same manner as a photocopier. The fastest of the laser printers can

Right: *Impact* 800 *Laser Printer*. **Bottom left:** C. *Itoh* C130EP. **Right** *Sakata* SP-1200 *Plus*.

attain a speed of 215 *pages* a minute, still maintaining very high quality. Like the dot matrix printer, the laser is not restricted to printing only the physically available letters contained in a type font but can handle complex graphics in very high resolution.

Electro-erosion is a system that depends on a special paper coated with aluminium. Tungsten brushes pass over the paper and an electrical discharge vaporises the top layer of aluminium and exposes a black layer underneath. The bottom-end models of this type produce hard-to-read copy which gradually fades away, but at the top level they are capable of resolving up to 360,000 dots per inch and producing camera-ready artwork.

The fairly recent development of **inkjet** printers was hampered by problems of clogging of the inkjets when not used regularly. The advantage of inkjet technology is in colour application, with the better models being able to handle up to seven colours at up to 50 characters per second.

The **thermal transfer** system uses heat to transfer the print from a special ribbon to the paper. As the heat transfer takes place very close to the ribbon, small dots are attainable, allowing good resolution. The very quiet operation of this type of printer makes it ideal for small-office applications.

Last comes the **plotter**. Not in regular use for correspondence, the plotter, as its name suggests, is a device which holds a pen or series of pens of different colours, and literally draws on a piece of flat paper. It is particularly useful for plan-drawing types of applications and is capable of producing high quality and very large plans or graphs.

Pricing

The price range for printers is astounding. Dot matrix printers start at as little as $400 and go to around $6000. The cheapest daisywheel is around $394, rising to about $5000, with additional costs for specific paper-handling devices such as envelope feeders. Lasers run from about $5000 to $24,000 and thermal transfers from $329 to $2700. Inkjet printers start at around $700 and can cost up to $11,500.

There is fierce competition between retailers and the first price quoted is seldom the last. Price is not necessarily the indication of quality, either, with a wide disparity between manufacturers offering units with similar specifications.

Finally, before looking at specific printers you should decide what your needs are. If you are looking for an alternative to a typewriter, the printwheel or daisywheel will fill your needs at reasonable speed and cost. This type of printer is not capable of printing any graphics and cannot be used for displaying graphs and charts in anything but a typewriter style. It is fairly safe to assume you will be using your unit in conjunction with a computer capable of more than word processing, and the ability to print the output of spreadsheets in graphic form must be considered. Having decided to utilise the graphics capability, your decision becomes simply one of capability versus price.

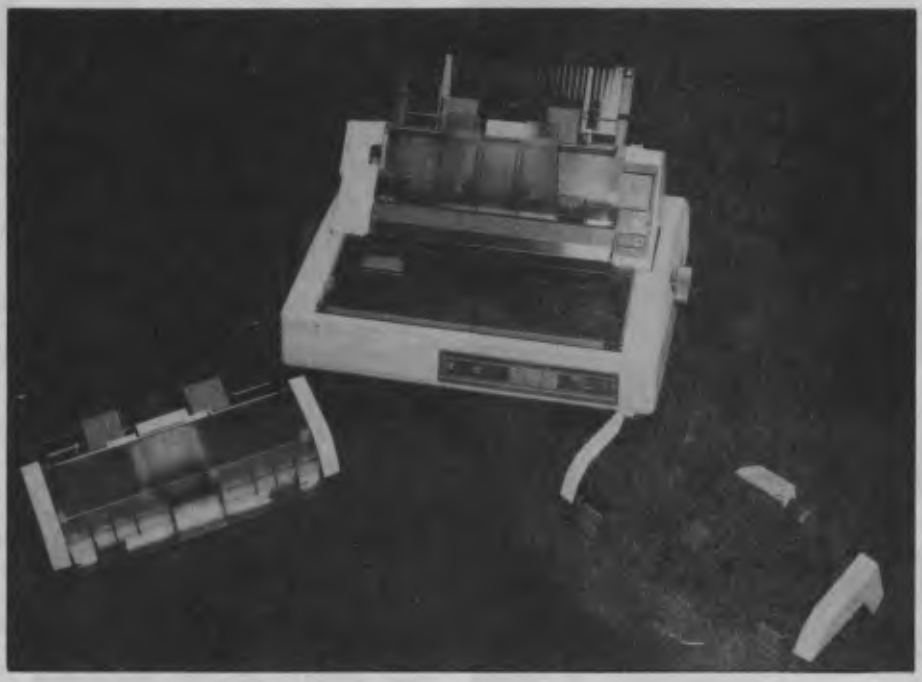
Sakata SP-1200 Plus

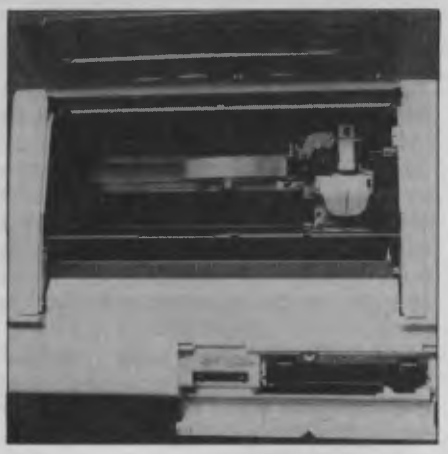
The Sakata SP-1200 Plus is typical of the smaller dot matrix printers available on the market today. It is a standard 80-column model capable of handling sprocket-feed paper of up to 25 cm width, roll paper or cut sheet. It is compact, measuring 401 mm by 337 mm by 104 mm. Paper feed is from the back only, with no provision for bottom feed. The maximum print width is 20 cm and the unit weighs 7.8 kg.

The printhead is made up of a matrix of 9 by 9 pins, which afford a number of graphic modes up to 8 by 1920 dots or 9 by 960 dots. The printheads have a life expectancy of 100 by 10 to the power of six characters. Don't bother working it out — it's a lot. The ribbon should last through 2.5 by 10 to the power of six, so you should change the printheads every 40 ribbons. At the quoted speed of 120 characters per second the whole kit should last quite a while.

The print styles are standard fixed print with software-controlled proportional mode. The print types include seven language fonts with characters exclusive to English, French, German, Swedish, Danish, Italian and Spanish — plus Japanese. These print types are selected before use by means of dip switch settings inside the case of the printer.

The Sakata has a switch-selectable





Top: *The* NEC *Spinwriter with its various 'feeders'.* Left: *An inside view.*

mode which it calls 'Near Letter Quality'. This may be selected by software or with a dip switch, which is unfortunately hidden inside the printer and requires the removal of the top cover. I say unfortunately because what Sakata calls near letter quality rivals the print of what many proudly boast as letter quality. If the switch were on the front panel, life would be just that much easier.

Connection to your computer is by standard Centronics cable and the factory switch settings allow straight plug-in operation to most computers. The front panel is simple, with two lights and three buttons. One light indicates power on and the other that the printer is on-line and awaiting input. The buttons control line and form feed and switch the printer off-line. The case is cream with smoke-coloured plastic covers over the mechanism and paper-handling departments, and a wire rack to collect output is provided.

The instruction manual is a small, soft-covered booklet written in Jinglish — a quaint combination of English words and Japanese syntax and spelling. It clearly describes set-up procedure and control codes. There is a series of short BASIC programs designed to demonstrate all the functions available. Despite the fairly comprehensive list of functions this is a bottom-line printer by today's standards, but seems well constructed and should give totally adequate service, particularly in a personal computing environment.

C. Itoh C130EP

Despite being in the highly priced bracket for a narrow-carriage dot matrix printer, the C310EP could well win out in the price-versus-quality-and-features race. Sturdily constructed and pleasing to look at, the printer is very quiet in operation, deadly accurate in paper handling and very versatile. It has a letter-quality mode, selectable from the front panel, and the output in this mode is nearly as good as a daisywheel.

Many manuals assume a fairly solid background in computing and are difficult to follow for a first-time user. Ideally they should read: "The printer is set for standard A4 paper. If you want to use foolscap paper, push the little red thingummy on the right and when the green light comes on push the second button from the left twice."

The body of the printer is off-white with a smoke-coloured plastic cover over half the top area. The back section of the top is also hinged and designed to be propped open to act as a guide for single-sheet operation, or to make the copy more readable when using the optional bottom-feed mode.

Paper handling can be carried out in four different ways: friction-feed for single sheet, a push-through tractor, a pull-through tractor and bottom-feed. I have found with most printers that they excel in one mode and falter in others, but the C. Itoh is precise in all modes. All modes are enhanced by the auto paper-feed function, which requires only that you line up your paper and pull the auto-load lever for perfect loading every time.

The chapter in the manual entitled *Initial Function Status Set Mode* is a little daunting. Many manuals assume a fairly solid background in computing and are difficult to follow for a first-time user. Ideally they should read: "The printer is set for standard A4 paper. If you want to use foolscap paper, push the little red thingummy on the right and when the green light comes on push the second button from the left twice."

As it is, the instructions offer such solid advice as: "Be sure to insert the paper and reliably close to cover" (*sic*) — nothing quite as bad as an unreliably closed cover.

Printers Galore!

I spent nearly an hour fiddling with the front panel, resetting the power-up status and then trying to get it back to standard default mode. It is not a function which you would need to alter very often in an office situation, but would crop up regularly in a hobby environment.

The rest of the manual is comprehensive and once again gives far more information than a normal user would need to know. The manual is perfect-bound (that is, it has a flat spine rather than being stapled) and won't lie flat, which can be a bother if you are trying to read it while actually following the instructions. The main lesson I learnt from the exercise is that I hate setting up printers.

Physically, the C. Itoh is heavier than cheaper models, weighing 9.5 kg and measuring 438 mm by 330 mm by 122 mm. Its manufacturer's claimed speed is 300 cps in data processing mode, 50 cps in near-letter-quality mode and 33 cps in letter-quality mode. These figures are maximum, and actual rates over a test file seem to fall short.

All the normal functions of a dot matrix printer are present. Character pitches of 10 to the inch (Pica), 12 per inch (Elite), 17.1 per inch (condensed) and proportional are software selectable, plus the letter-quality mode, which is selected by a button on the front panel. The life of the printer is claimed to be five million lines, and our test of this should be finished just before Halley's Comet is due back.

There can be no doubt this is a quality printer, and seeing 300 cps in action is going to make my old 160 cps machine seem slow. The C. Itoh could well stand in place of a typewriter in a small office, but its narrow carriage would be a limiting factor. Obviously C. Itoh makes wider models, but this would reflect in the price.

I liked its versatility and speed and was impressed with its letter-quality mode despite the drastic reduction in speed. Its paper handling is excellent and it is much quieter than most dot matrix printers I have tried.

NEC Spinwriter 8850

The Spinwriter is described in its manual as: "A fully formed character printer designed especially for the IBM Personal Computer". It is of the impact type, using a print thimble or basket with the letters embossed on 'fingers' which strike through a ribbon to transfer the type to paper.

Looking more like an electric typewriter without a keyboard than its dot matrix brothers, the Spinwriter is quite large and heavy by comparison. Weighing 17 kg and measuring 172 mm by 570 mm by 409 mm, it's not the sort of machine you would want to carry home each night. When supplied with the optional paper-handling devices such as an envelope feeder, a cut-sheet feeder and a double-bin adapter, you would be hard pressed to get it all in the boot of the average sedan.

Significantly less versatile than a dot matrix or laser printer, the Spinwriter is designed primarily for word processing use in an office or medium-volume environment, where speed is secondary to type quality. The type quality is superb and impossible to tell from the best-quality electric typewriter. With no less than 71 typefaces and sizes to choose from, including many foreign language fonts, you should have no trouble in selecting the right type for the job. The type fonts are plastic and appear very fragile; the pounding they take when the unit is spitting out its maximum of 55 characters per second suggests they are more hardy than they look. Changing a typeface is a ten-second job and most offices would keep a range of popular styles available.

The machine prints bi-directionally with full logic seeking. That means your layout, complete with any justification, is worked out before printing starts, and the type is put on paper as the printhead moves backward as well as forward over the paper without the delay of a normal carriage return.

Paper widths of up to 40 cm may be used. There is no provision for pin-feed stationery, and the platen is set up like a normal typewriter. Paper handling is precise, with the capability of 136 columns at 10 characters per inch, 163 columns at 12 cpi or 203 columns at 15 cpi. The paper can move in horizontal increments of up to 48 per inch.

The Spinwriter is quite noisy in operation, at least as noisy as an electric typewriter, but because of its speed it seems noisier. The quoted noise level is 58 dBA, and in an office situation this might be acceptable, though a printer hood could be desirable.

Connection to an IBM PC is simple, as the machine is designed to be totally compatible. A Centronics cable connects from the port on the computer and no set-up procedure is required. Compatibility is

ensured by the interface module supplied with the printer. This module plugs into the back of the Spinwriter when you first unpack the unit and is pre-configured for the IBM. Other modules are available, and a series of dip switches on the module allows minor alterations for other Centronics applications.

On power-up, the Spinwriter automatically carries out a self-diagnosis check, and a self-test is available. The chosen type font is scanned by the printer, and in most cases automatic selection of the required print size takes place. When a print font which can operate in either size is selected, the user is prompted on the front panel for size requirement.

The front panel indicates the printer status with a digital display which shows the default number of lines per page or reports error codes. A button either side of the display allows changing of the default. To the right of this display is the pitch select display, which indicates the pitch of the selected print thimble, and a control alongside the display changes between 10, 12 and 15 characters per inch. The next control is for paper feeding, providing either form-feed or line-feed, and also initiates the self-test facility. The final button is a pause/continue function.

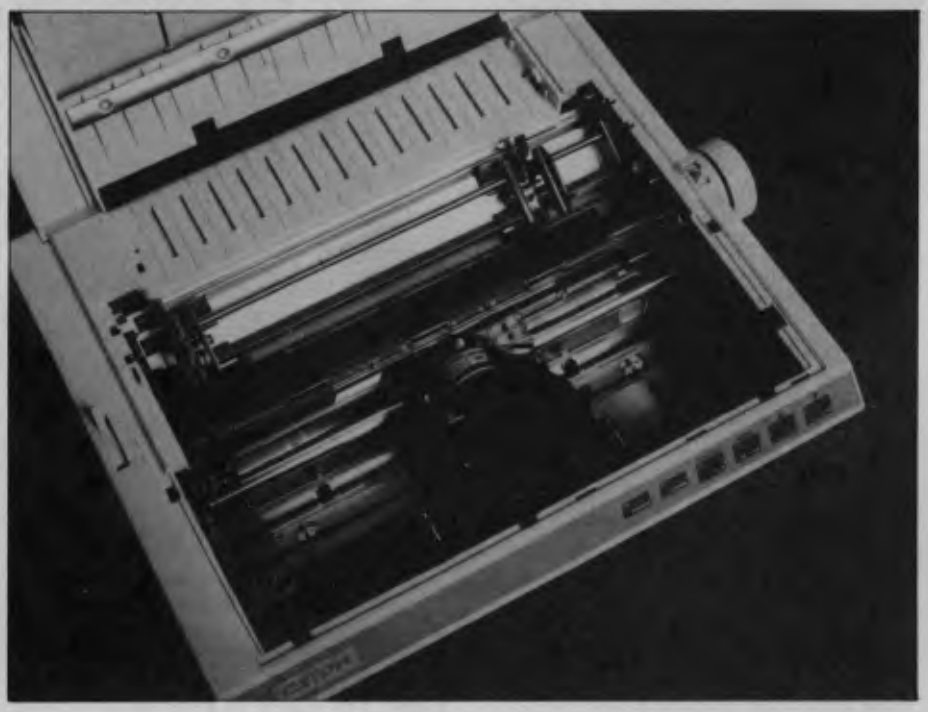
Hewlett-Packard HP 2686A Laserjet

Now for the big guns, and I mean *big*. The instructions for unpacking the HP 2686A include the very timely reminder that perhaps two people should co-operate in removing the printer from its packaging as it weighs in at a whopping 32 kg! In appearance it resembles a photocopier much more than a printer, and while its footprint is only 47.5 cm by 41.5 cm, the recommended working area should be more than 105 cm by 108 cm to allow for paper handling. This demands almost a separate desk and precludes moving the printer around the office too often.

Significantly less versatile than a dot matrix or laser printer, the Spinwriter is designed primarily for word processing use in an office or medium-volume environment, where speed is secondary to type quality. The type quality is superb.

The principal on which this type of printer works is also very similar to photocopy techniques, and combination units cannot be far off. The noise factor bothers me: it is so quiet I can no longer mutter my usual expletives when the copy is not what I expected or I find a spelling mistake after 36 copies have been run.

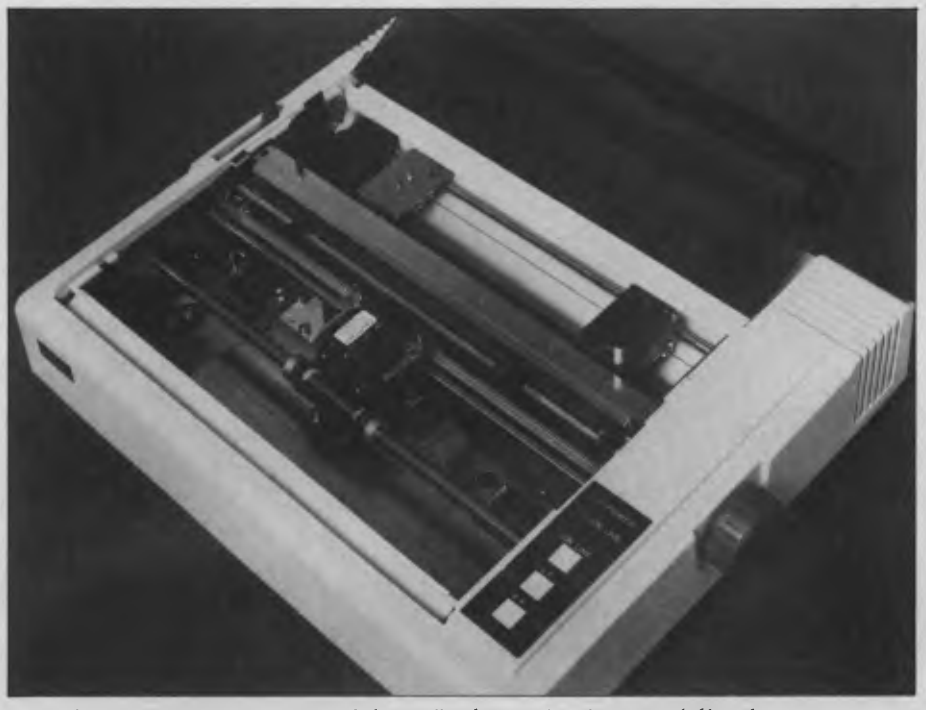
Paper handling (cut sheet only) follows the copier style, with a wide range of paper sizes usable from envelopes to foolscap, A4, B5 or Legal. The printer determines the paper size from the cartridge which holds your blank sheets or by instruction from the front panel. All the paper handling is automatic, and the printed forms are stacked in the out tray ready for reinsertion for printing on the reverse side if required. Portrait (vertical) or landscape (horizontal) modes can be selected for placing your print either way on the paper — a feature you wouldn't get on most dot matrix printers.



Left: *The C. Itoh C130EP is relatively expensive, but rates highly on quality and features.*

Make	Model	Price	Type	Width	Feed	Connect
Sakata	SP-1200 Plus	$526	Dot matrix	10 inch	Sprocket/friction	Centronics
C. Itoh	C130 EP	$1699	Dot matrix	10 inch	Sprocket/friction	Centronics
NEC	Spinwriter 8850	$4656	Printwheel	15 inch	Friction	Centronics
HewlettPackard	HP2686A	$5594	Laser	'Legal'-sized sheet	Single sheet from cartridge	Centronics
Impact	800 Model II	$6200	Laser	'Legal'-sized sheets	Single sheet from cartridge	Centronics

Printers Galore!



The Sakata SP-1200 Plus is typical of the smaller dot matrix printers available today.

Setting up the HP Laserjet is very clearly defined in the spiral-bound manual. Definitive line drawings demonstrate what to lift, turn, remove and adjust before trying the self-test mode. All the supplies required for operation are cartridge-contained and simply slide into position. For connection to an IBM or compatible a five-wire connection is required from your RS232 port. Line one is straight through, lines two and three are crossed, line seven is straight through and lines five and six on the computer are tied to line 20. A simple batch file is described which will configure your IBM to the printer on boot. A simple five-line BASIC program allows an instant test of your skill at soldering if you made your own cable.

A digital display on the left side of the operator control panel indicates the printer status and reports errors in coded form. Mechanical problems such as paper jams or simply being out of paper are reported, along with a series of machine faults like laser temperature control malfunction, ROM checksum error or RAM controller error. I have been assured a laser temperature control error can not result in a smoking, smelly hole where your desk used to be.

An on-line key allows the printer to start communicating with your computer, and a self-test key causes a test page to be printed. The form-feed key feeds single sheets of paper to the printer when on-line, but when off-line empties the printer's memory one page at a time. If the memory holds less than one page, all the remaining data will be printed. A manual feed-select switch allows the insertion of unusual-sized documents, and a print density dial controls the intensity of your copy.

The Laserjet is capable of printing in a very wide range of print styles, and font cartridges are available which simply slide into a slot on the right-hand side of the unit. Inside each font is the full usual range of options for selecting enlarged, compressed, underlining and so on.

The stroke weight may be set for bolder output within a textfile, and pitch and letter height are adjustable.

Graphics resolution is an area where the HP 2686A shines. Capable of resolving up to 300 dots per inch, the Laserjet can combine both graphics and text in the one document, so the production of complicated graphs and charts can be combined with data.

The escape codes for driving the beast differ completely from those required for dot matrix printers and would take some time to learn. Fortunately the manual is

Features	Rated Speed	Test Time Draft	Test Time LQ
Draft, NLQ, italic, compressed, expanded, double-strike, enhanced, proportional, dot graphics, adjustable pitch	180 cps max.	199.9 sec	587.6 sec
Draft, LQ, italic, compressed, expanded, double-strike, enhanced, proportional, multi-language, dot graphics, adjustable pitch	300 cps max.	71.6 sec	387.3 sec
71 standard printwheels, adjustable pitch, no graphics	55 cps		235.3 sec
Standard print fonts, combined text and graphics	8 sheets/min		45.0 sec
Standard print fonts, combined text and graphics	8 sheets/min		45.0 sec

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very precise, and its spiral-bound format makes it easy to read while operating the machine.

Impact 800 Laser Printer

Why on earth call a laser printer Impact? If your friendly dealer advertised a dot matrix called Laser, the local chapter of Consumer Affairs would send him to the salt mines. The Impact 800 follows the philosophy of the HP 2686A (or vice versa) and the specifications are very similar. There are enough similarities in the two machines for the uninitiated to suspect a degree of 'badge engineering' — that's natural, as most of the current laser printers are based on Canon's mechanism and vary only in the electronic control circuitry fitted.

The specification sheets list such features as high resolution (up to 300 by 300 dots per square inch), high speed, with a throughput of up to eight A4 sheets per minute, and quiet operation. Additionally described is an 'intelligent operator control panel' with a 16-character liquid-crystal display. There is no mention of an optional display for unintelligent operators.

The noise factor of the laser printers bothers me: they are so quiet I can no longer mutter my usual expletives when the copy is not what I expected or I find a spelling mistake after 36 copies have been run.

The basic model (Model I) comes equipped with four type fonts, which can be chosen from a large range. Model II has six, and the fonts may be additionally purchased and exchanged by changing ROMs. Up to 10 library fonts can be accommodated, and the data must be transferred to one of 15 'immediate font access areas' by software before use. This approach provides one of the Impact's major features, the ability to vary the fonts (making them bold, italic, double height, double width and so on) as they are loaded into the IFA.

An additional feature offered by the Impact 800 is the ability to emulate other printers. Software selection calls up the control codes of the Diablo 630 and the HP 2686A on the Model I and also the Qume and Epson FX-100 on the Model II.

Connection to your choice of computer is by Centronics-standard 36-way connector with a maximum lead length of three metres between host and printer. Connection can also be made by way of Data Products' 50-way connector or RS232. With RS232, baud rates may be set from 300 bps to 19,200 bps.

A facility called Forms Overlay allows a

complete page of information to be sent to the printer and stored rather than printed directly. This stored page can then be superimposed over as many subsequent pages of information as required. The benefit of this is that an invoice or letterhead can be designed and printed as part of the text, or graphics can be inserted at any time. Two type fonts may be selected at any one time and called as alternate fonts during printing. This together with the overlay facility should allow some fairly sophisticated forms designs, which should be indistinguishable from commercially printed products.

The warm-up time for this type of printer is pretty standard at about two minutes, with a delay of about 18 seconds after that for your first copy. Thereafter you can expect 8.1 A4 sheets per minute, 6.9 foolscap sheets per minute or 5.1 sheets of either size if manually fed. The paper recommended is copier bond from 60 to 80 gsm for cassette feed or up to 128 gsm for hand feed. The heavier paper is recommended for double-sided printing. Additionally the Impact Laser 800 will print on a variety of stock, including transparencies for overhead projection.

In operation the unit is, of course, quiet and trouble-free. Like its photostat brothers, the only regular problem is paper jams, which are easily cleared and can be minimised by using quality paper of the right weight. To help clear a jam, the entire top of the unit hinges up to expose the paper path. The cassettes hold up to 100 sheets of 80 gsm paper, and removal and replacement are straightforward. Replacement of the EP cartridge, which contains the photosensitive drum, and the supply of toner and charging corona are simple procedures and should be done every 3000 A4 sheets.

Running costs on a laser printer of any make will not vary much. They are not cheap to buy or run, with single-copy costs in the order of 15 cents a copy by the time you amortise capital costs and supplies. On the positive side, with the right software and a modicum of expertise in driving the printer, you may never fall into the hands of your local offset printer again.

Summary

The object of this review was not to directly compare specific printers but rather to examine a range of printers across a

Why on earth call a laser printer Impact? If your friendly dealer advertised a dot matrix called Laser, the local chapter of Consumer Affairs would send him to the salt mines.

price scale and relate their attributes to that. Every printer reviewed did all its manufacturer claimed.

There is no doubt a small office could survive very happily with the Sakata SP-1200 Plus, with its better-than-average near-letter-quality mode. At its recommended retail price of $526, it represents real value on today's market. It would most certainly also fit extremely well into a home situation, where price is often the major criterion.

The C. Itoh C130EP is a high-quality machine, and the noise level a most acceptable feature for a dot matrix. Its paper handling is also a strong point, and the easily selectable letter-quality mode makes it acceptable for small office situations. Retailing at $1699 for the parallel version and $1799 for the serial, it is not cheap for a narrow-carriage dot matrix, but is certainly likely to outlast and outperform many of the cheaper models. C. Itoh has been building printers since day one and it is significant that so many manufacturers follow its lead.

The Spinwriter is in a class of its own in terms of print quality. Compared to the dot matrix printers there is no contest for anyone who needs high-quality text output. Designed to retail at $4656, complete with a single-sheet feeder, it offers you many years of trouble-free printing. The wide variety of type styles available adds to its appeal. A dual-bin feeder would add $236 to the price and an envelope feeder a further $300. It is a noisier beast than the dot matrix but it wins in the quality-versus-time race.

The Hewlett-Packard HP 2686A is designed to retail at $5594 plus tax. While this might seem a lot at first glance, consider what you are buying. The ability to design and print a combination of graphics and text at a very rapid rate could save an enormous amount of time and money in a big office situation. The printer can be shared by a number of computers and could well replace several lower-quality units.

The Impact 800 shares these qualities, adds new features, and its ability to emulate other printers could save set-up time in an office with an already divergent range of printing equipment. The retail price of the Impact 800 Model II is a recommended $6200 plus tax. □

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Pocket Programs

Microbee

VARIABLE DISPLAYER

This program is relocatable; however, to operate it the keyboard vectors located at 00C2H and 00C3H or 194 and 195 decimal must be modified to point at the routine. This can be done with the monitor, changing 00C2H from E9H to 00H and 00C3H from A3H to 70H. Alternatively you can do it in BASIC with the following routine:

IN#5 ON: POKE 194,0:
POKE 195,112: IN#5 OFF

Pressing Ctrl U will list the variables that have been used during programming, in immediate mode or since the last CLEAR or NEW. Assembled thus the routine is located from 7000H to 705DH. If it is located elsewhere, the keyboard vectors must be changed, as explained above. This routine is useful if you need to use an unassigned variable when programming, or to see if one is mucking up your program.

Phillip Pulle
Lethbridge Park, NSW

```
                        00100 ;DISPLAYS ON SCREEN VARIABLES USED
                        00110 ;INTERCEPTS KEYBOARD SCAN AND CHECKS FOR CTRL U
                        00120 ;IF PRESSED ROUTINE IS CALLED
                        00130 ;NORMAL OPERATION IS PROVIDED
                        00140 ;NOTE: KEYBOARD VECTORS AT 00C2 AND 00C3 (194 & 195)
                        00150 ;MUST BE ALTERED TO POINT AT START ADDRESS OF ROUTINE
                        00160 ;WRITTEN BY PHILIP PULLE 19/8/84
                        00170 ;
                        00180 ;
                        00190 ;
A3E9                    00200 BASKEY  EQU     0A3E9H  ;FOR NORMAL OPERATION
0015                    00210 CTRLU   EQU     00015H  ;CTRL U VALUE
800C                    00220 DISPL   EQU     0800CH  ;SHOW CHAR IS B REGISTER
 06B0                    00230 INTVA   EQU     006B0H  ;START OF INTEGER VARIABLE POINTERS
0500                    00240 RLVAR   EQU     00500H  ;START OF REAL VARIABLE POINTERS
                        00250 ;
                        00260 ;
                        00270 ;
                        00280 ;
7000                    00290         ORG     07000H  ;START OF ROUTINE
7000 CDE9A3             00300         CALL    BASKEY  ;GET A KEY IN 'A
7003 F5                 00310         PUSH    AF      ;SAVE IT
7004 FE15               00320         CP      CTRLU   ;IS IT WHAT WE WANT
7006 2802               00330         JR      Z,INTDIS;YES GOTO ROUTINE
                        00340 ;
                        00350 ;HERE PUT CHECKS FOR OTHER ROUTINES
                        00360 ;
                        00370 ;
7008 F1                 00380         POP     AF      ;NOTHING SPECIAL BRING KEY BACK
7009 C9                 00390         RET             ;AND RETURN TO BASIC
700A 1641               00400 INTDIS  LD      D,'A    ;START WITH VAR 'A'
700C 1E2C               00410         LD      E,','   ;A COMMA FOR PRINTING ROUTINE
700E 21B106             00420         LD      HL,INTVA+1;GET START ADDRESS OF POINTERS+1 F
OR MSB
7011 7E                 00430 CHECK   LD      A,(HL)  ;GET MSB OF POINTER
7012 FE00               00440         CP      00H     ;IS IT 0 IE:NOT USED
7014 200C               00450         JR      NZ,SHOW ;IF USED SHOW IT
7016 14                 00460 NXTINT  INC     D       ;ELSE ONTO NEXT VAR
7017 7A                 00470         LD      A,D
7018 FE5B               00480         CP      'Z'+1   ;SEE IF ALL CHARS FINISHED
701A 2002               00490         JR      NZ,INCR ;IF NOT GOTO TO INCR
701C 180E               00500         JR      RLDIS   ;IF SO DO REAL VARIABLES
701E 23                 00510 INCR    INC     HL      ;GO ON TO MSB OF
701F 23                 00520         INC     HL      ;NEXT POINTER
7020 18EF               00530         JR      CHECK   ;DO IT ALL AGAIN
7022 42                 00540 SHOW    LD      B,D     ;CHAR OF VARIABLE
7023 CD0C80             00550         CALL    DISPL   ;SHOW IT
7026 43                 00560         LD      B,E     ;CHAR OF COMMA
7027 CD0C80             00570         CALL    DISPL   ;SHOW IT
702A 18EA               00580         JR      NXTINT  ;GO ON TO NEXT POINTER
702C 210105             00590 PLDIS   LD      HL,RLVAR+1;GET START OF REAL POINTERS+1
702F 1E2C               00600         LD      E,','   ;COMMA
7031 1641               00610         LD      D,'A'   ;START WITH AN A
7033 0E30               00620         LD      C,'0'   ;START WITH A0
7035 7E                 00630 CHCKRL  LD      A,(HL)  ;GET MSB OF POINTER
7036 FE00               00640         CP      00H     ;SEE IF USED
7038 2016               00650         JR      NZ,SHWRL;IS SO SHOW IT
703A 0C                 00660 NXTRL   INC     C       ;NEXT IN SET EG:A1,A2,A3,A4 ETC
703B 79                 00670         LD      A,C
```

```
703C FE38      00680          CP      'Z'+1   ;ARE ALL 8 VARS IN SET DONE?
703E 200C      00690          JR      NZ,NXTPT;NO GO ON TO NEXT POINTER
7040 14        00700          INC     D       ;YES SO NEXT SET IE A0,B0,C0 ETC
7041 0E30      00710          LD      C,'0'   ;AND RESET NUMBERS TO '0'
7043 7A        00720          LD      A,D     ;AND CHECK TO SEE
7044 FE5B      00730          CP      'Z'+1   ;IF ALL 26 SETS HAVE BEEN DONE
7046 2004      00740          JR      NZ,NXTPT;IF NOT GO ON TO NEXT POINTER
7048 F1        00750          POP     AF      ;IF SO CLEAN UP STACK
7049 3E0D      00760          LD      A,0DH   ;PUT A [CR] IN A
704B C9        00770          RET             ;AND RETURN TO BASIC
704C 23        00780 NXTPT    INC     HL      ;GO ON TO MSB OF
704D 23        00790          INC     HL      ;NEXT POINTER
704E 18E5      00800          JR      CHCKRL  ;THEN CHECK THE NEXT POINTER
7050 42        00810 SHWRL    LD      B,D     ;ALFA OF VARIABLE IN QUESTION
7051 CD0C80    00820          CALL    DISPL   ;SHOW IT
7054 41        00830          LD      B,C     ;NUMERIC OF VARIABLE
7055 CD0C80    00840          CALL    DISPL   ;SHOW IT
7058 43        00850          LD      B,E     ;A COMMA TO MAKE THINGS NEAT
7059 CD0C80    00860          CALL    DISPL   ;SHOW THAT
705C 18DC      00870          JR      NXTRL   ;AND DO IT ALL AGAIN
0000           00880          END
00000 Total errors

NXTPT   704C    NXTRL   703A    SHWRL   7050    CHCKRL  7035
RLDIS   702C    INCR    701E    NXTINT  7016    SHOW    7022
CHECK   7011    INTDIS  700A    RLVAR   0500    INTVA   06B0
DISPL   800C    CTRLU   0015    BASKEY  A3E9
```

EXAMPLE:

```
00010 A=12: B=26: F=18: Z=24
00020 A1=34: G5=32.342: G6$="hello this is a test"
00030 DIM R4(9),D(9)
00040 R4$(1)="for VARIABLE DISPLAYER"
00050 PRINT G6$\R4$(1)
00060 GOTO 60

>run

hello this is a test
for VARIABLE DISPLAYER

Stop at 00060
>A,B,D,F,Z,A1,G5,G6,R4,
>
```

TRS-80

BOOK FILE

This program was written on my TRS-80 Model I, 48 Kbyte Level II, but will run on a Model III or 4, or even a 48 Kbyte System-80.

You can enter the information on a book or perhaps software, and save it to tape for later retrieval and printing.

```
10 REM BOOK-FILE.       VER 02.00.00.       RAM: 48K.
20 REM (C) 1985 D. K. MINEHAN.
30 REM PROGRAM DESIGNED TO TAKE THE TITLE, AUTHOR, CLASSIF.,
40 REM VOLUME, NUMBER, THE YEAR OF PUBLICATION, AND PUBLISHER
50 REM OF BOOKS, MAGAZINES, AND SOFTWARE, AND SAVE THEM ON
60 REM CASSETTE-TAPE DATA FILES. PROGRAM ALSO DESIGNED
70 REM TO GIVE A HARD-COPY IF REQUIRED.
80 REM
90 CLS:CLEAR10000:POKE16396,23
```

TRS-80

The program also allows for viewing and updating of files, and has an on-line help command.

David Mineman
Lambton East, NSW

```
100 DIMT$(1100),A$(1100),C$(1100),V$(1100),N$(1100),Y$(1100),P$(1100)
110 PRINTTAB(23)"BOOK-FILE MAIN MENU"
120 PRINT:PRINT
130 PRINTTAB(24)"1 CREATE A FILE"
140 PRINTTAB(24)"2 VIEW   A FILE"
150 PRINTTAB(24)"3 UPDATE A FILE"
160 PRINTTAB(24)"4 SAVE   A FILE"
170 PRINTTAB(24)"5 LOAD   A FILE"
180 PRINTTAB(24)"6 VERIFY A FILE"
190 PRINTTAB(24)"7 PRINT  A FILE"
200 PRINTTAB(24)"8 HELP"
210 PRINTTAB(24)"9 QUIT"
220 PRINT:PRINT
230 PRINTTAB(23)"ENTER CHOICE:";:INPUTQ:CLS
240 ONQGOTO270,420,570,670,740,800,980,1170,1340
250 GOTO110
260 REM *****CREATE A FILE*****
270 INPUT"WHEN READY, HIT <ENTER> (TO CLOSE FILE TYPE 'Q' FOR TITLE)";X:CLS
280 FORI=1TO1100:PRINT:PRINT"ITEM NUMBER:";I
290 PRINT"TITLE";:INPUTT$(I)
300 IFT$(I)="Q"THENP1=I:GOTO400
310 PRINT"AUTHOR";:INPUTA$(I)
320 PRINT"CLASSIFICATION";:INPUTC$(I)
330 PRINT"VOLUME";:INPUTV$(I)
340 PRINT"NUMBER";:INPUTN$(I)
350 PRINT"YEAR OF PUBLICATION";:INPUTY$(I)
360 PRINT"PUBLISHER";:INPUTP$(I)
370 CLS
380 IFI<1100THEN390:IFI=1100THENPRINT:PRINT"FILE FULL":PRINT:INPUT"PRESS <ENTER>
 TO RETURN TO MENU";X:CLS:GOTO110
390 NEXT
400 PRINT:PRINT"FILE CLOSED --":PRINT:INPUT"TO SEE MENU, HIT <ENTER>";X:CLS:GOTO
110
410 REM *****VIEW A FILE*****
420 FORI=1TOP1:IFT$(I)="Q"ORT$(I)=""THEN540
430 PRINT@0,"ITEM NUMBER:";I
440 PRINT"TITLE:  ";T$(I)
450 PRINT"AUTHOR:  ";A$(I)
460 PRINT"CLASSIFICATION:  ";C$(I)
470 PRINT"VOLUME:  ";V$(I)
480 PRINT"NUMBER:  ";N$(I)
490 PRINT"YEAR OF PUBLICATION:  ";Y$(I)
500 PRINT"PUBLISHER:  ";P$(I)
510 PRINT:PRINT"PRESS 1 FOR MORE ENTRIES, OR 0 TO RETURN TO MENU";:INPUTX
520 IFX=1THENNEXT
530 IFX=0THENCLS:GOTO110
540 PRINT:PRINT"FILE CONTAINS:";I-1;"ITEMS.":PRINT
550 INPUT"TO RETURN TO MENU, HIT <ENTER>";X:CLS:GOTO110
560 REM *****UPDATE A FILE*****
570 PRINT"ENTER THE TITLE FOR THE FILE YOU WISH TO CHANGE"
580 INPUTT$:IFT$=""THEN600ELSECLS
590 FORI=1TOP1:IFT$=T$(I)GOTO610ELSENEXT
600 CLS:PRINT"TITLE NOT IN FILE --":GOTO640
610 CLS:PRINT"FILE FOUND --":PRINT"ENTER THE CORRECTED INFO."
620 PRINT"ITEM NUMBER:";I:INPUT"TITLE";T$(I):INPUT"AUTHOR";A$(I):INPUT"CLASSIFIC
ATION";C$(I):INPUT"VOLUME";V$(I):INPUT"NUMBER";N$(I):INPUT"YEAR OF PUBLICATION";
Y$(I):INPUT"PUBLISHER";P$(I)
630 CLS:PRINT"THE FILE READS:":PRINT"ITEM NUMBER:";I:PRINT"TITLE:  ";T$(I):PRINT"
AUTHOR:  ";A$(I):PRINT"CLASSIFICATION:  ";C$(I):PRINT"VOLUME:  ";V$(I):PRINT"NUMBER
```

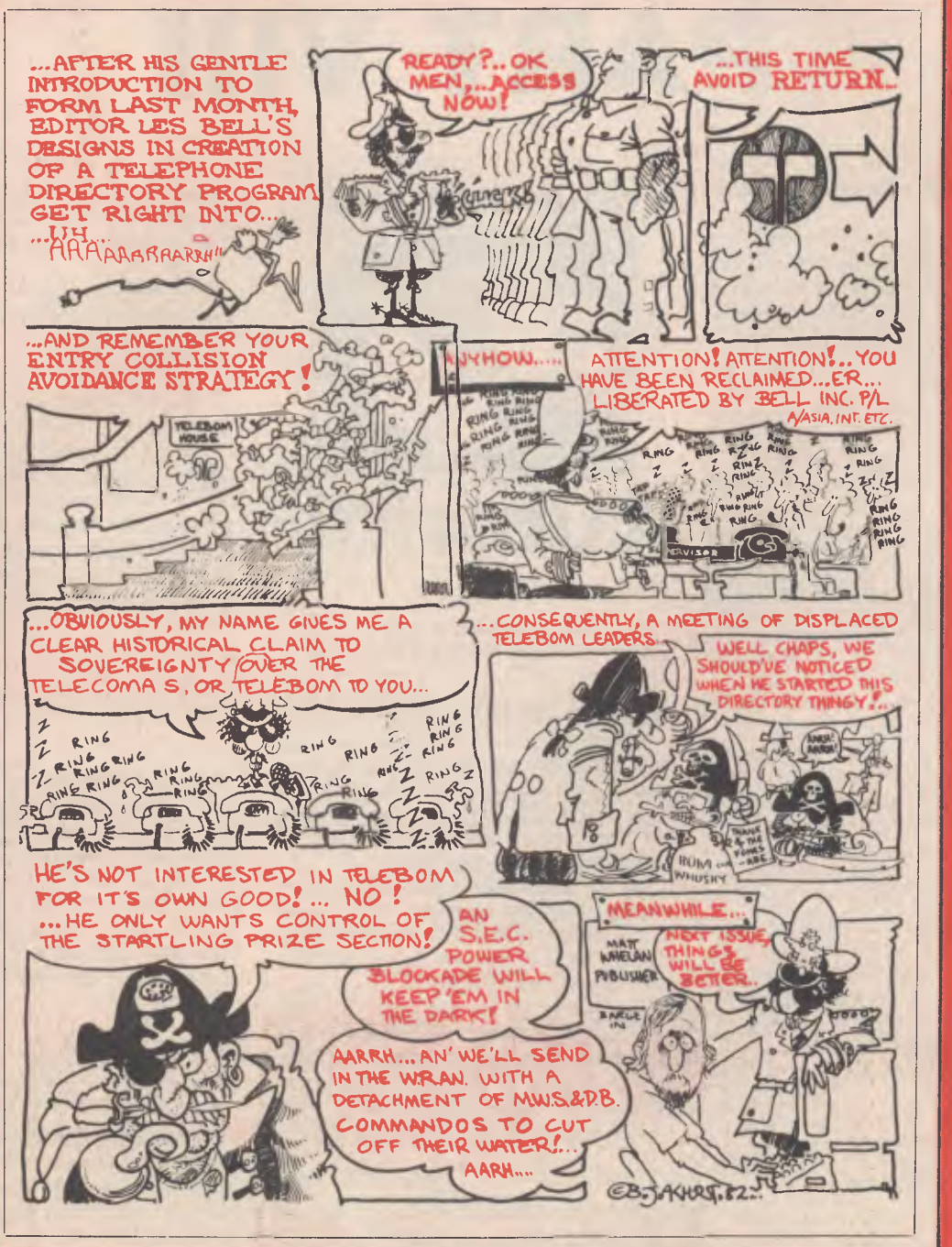
TRS-80

```
;"N$(I):PRINT"YEAR OF PUBLICATION: ";Y$(I):PRINT"PUBLISHER: ";P$(I)
640 PRINT:INPUT"FOR ANOTHER CORRECTION TYPE 1; ELSE TYPE 0";X
650 IFX=1THENCLS:GOTO570ELSECLS:GOTO110
660 REM *****SAVE A FILE*****
670 INPUT"PREPARE CASSETTE (RECORD), WHEN READY HIT <ENTER>";X
680 PRINT:PRINT"DATA IS NOW BEING COPIED..."
690 PRINT#-1,P1
700 FORI=1TOP1:PRINT#-1,T$(I),A$(I),C$(I),V$(I),N$(I),Y$(I),P$(I):NEXT
710 PRINT:PRINT"COMPLETE -- NOTE TAPE LOCATION PLEASE --":PRINT
720 INPUT"TO RETURN TO MENU, HIT <ENTER>";X:CLS:GOTO110
730 REM *****LOAD A FILE*****
740 INPUT"PREPARE CASSETTE (PLAY), WHEN READY HIT <ENTER>";X
750 PRINT:PRINT"DATA IS NOW BEING INPUT..."
760 INPUT#-1,P1
770 FORI=1TOP1:INPUT#-1,T$(I),A$(I),C$(I),V$(I),N$(I),Y$(I),P$(I):NEXT
780 PRINT:INPUT"DATA INPUT COMPLETE. TO SEE MENU, HIT <ENTER>";X:CLS:GOTO110
790 REM *****VERIFY A FILE*****
800 INPUT"TITLE FOR SEARCH";T$:CLS:IFT$=""THEN830
810 FORI=1TOP1:IFT$=T$(I)THENCLS:PRINT"FILE FOUND --":GOTO840
820 NEXT
830 PRINT:PRINT"FILE NOT FOUND --":PRINT:GOTO950
840 PRINT:PRINT"ITEM:";I
850 PRINT"TITLE: ";T$(I)
860 PRINT"AUTHOR: ";A$(I)
870 PRINT"CLASSIFICATION: ";C$(I)
880 PRINT"VOLUME: ";V$(I)
890 PRINT"NUMBER: ";N$(I)
900 PRINT"YEAR OF PUBLICATION: ";Y$(I)
910 PRINT"PUBLISHER: ";P$(I)
920 PRINT:INPUT"WOULD YOU LIKE THE FILE PRINTED (Y/N)";X$:CLS
930 IFX$="Y"THENPRINT"PRINTING FILE NOW...":LPRINT:LPRINT"ITEM:";I:LPRINT"TITLE:
 ";T$(I):LPRINT"AUTHOR: ";A$(I):LPRINT"CLASSIFICATION: ";C$(I):LPRINT"VOLUME: ";
V$(I):LPRINT"NUMBER: ";N$(I):LPRINT"YEAR OF PUBLICATION: ";Y$(I):LPRINT"PUBLISHE
R: ";P$(I):LPRINT
940 IFX$="Y"THENPRINT:PRINT"COMPLETE."
950 PRINT:INPUT"PRESS 1 TO REPEAT, OR 0 TO RETURN TO MENU";X:CLS
960 IFX=1THEN800ELSEGOTO110
970 REM *****PRINT A FILE*****
980 INPUT"PREPARE PRINTER (PAPER), THEN PRESS <ENTER>";X:CLS
990 PRINT"PRINTING NOW...":PRINT
1000 FORI=1TOP1:IFT$(I)="Q"THEN1110
1010 LPRINT"ITEM:";I
1020 LPRINT"TITLE: ";T$(I)
1030 LPRINT"AUTHOR: ";A$(I)
1040 LPRINT"CLASSIFICATION: ";C$(I)
1050 LPRINT"VOLUME: ";V$(I)
1060 LPRINT"NUMBER: ";N$(I)
1070 LPRINT"YEAR OF PUBLICATION: ";Y$(I)
1080 LPRINT"PUBLISHER: ";P$(I)
1090 LPRINT:LPRINT
1100 NEXT
1110 LPRINT"NUMBER OF ITEMS:";I-1:PRINT
1120 PRINT"PRINTING COMPLETE.":PRINT
1130 INPUT"PRESS 1 TO REPEAT, 0 TO RETURN TO MENU";X:CLS
1140 IFX=1THEN980
1150 IFX=0THEN110
1160 REM *****HELP*****
1170 PRINTTAB(30)"HELP":PRINT
1180 PRINT"CREATE A FILE:
```

Basic for Birdwatchers

PART TWO

BONUS offer
BASICally free!



After his 'Gentle Introduction to Forms Design' last month, Les Bell gets right into using those functions in his creation of a telephone directory program. Despite the length of the listings, he subtitles it 'Designing a Simple Directory'.

PART VIII

A TELEPHONE directory isn't at all like a mailing list.

With a mailing list, you generally want to proceed sequentially through the file, using either all or a selected number of the entries. With a telephone directory, on the other hand, you generally want to look up just one entry, and you don't want to waste time doing it.

Wouldn't it be terrific if there was a way of just looking at a name, and going straight to the right part of the file?

Unfortunately, such a method doesn't really exist, but there is a technique which comes close. This is called **hashing**, and it is often used in BASIC interpreters, assemblers and similar language processors to provide fast look-up of variables in a table. We're going to apply the idea to this telephone directory to make look-up really fast.

Hashing is basically a way of applying a simple mathematical process to a **key**, in order to yield the ordinal position of the corresponding entry in a table or file. By 'key' we mean the field of information which we are going to use to retrieve data: in this case, a surname.

The process goes like this: looking at every second letter along the length of the name, we convert it to ASCII and add it to a running total, which we keep doubling. We then divide the result by the number of records in the file, and use the remainder as the position in the file; that is, the record number.

A suitable piece of code to do this might be:

```
10 K=0
20 FOR I=1 TO LEN(N$) STEP 2
30 K=2*K+ASC(MID$(N$,I,1))
40 NEXT I
50 K=K-FS*INT(K/FS)
60 IF K=0 THEN K=1
70 RETURN
```

Having arrived at this record number, our job is not yet completed, however.

Avoiding Those Collisions . . .

A little thought will show that more than one name can still reduce to the same record number. And, of course, we might have two entries with the same name. For this reason, we have to design a **collision avoidance** strategy.

Before writing a new record into place, we read back the contents of the record to see whether there is already a name in place. If there is, then we just go on to the next record and try again.

Eventually, as the file gets very full, this hashing strategy will lose ground as we spend more and more time sequentially searching for the next record, but in the meantime we're ahead of the game.

Let's go ahead and write the program:

```
100 REM  ** RANDOM ACCESS TELEPHONE FILER **
110 REM  ** WRITTEN IN MBASIC V 5.2 **
120 REM  ** 5/3/82 **
130
```

Next we define the functions we'll need for screen handling, as well as a couple of miscellaneous constants:

```
140 REM    INITIALIZATION SECTION
150
160 DEF FNGXY$(X,Y)=CHR$(27)+"="
    +CHR$(Y+31)+CHR$(X+31)
170 DEF FNHT$(A$)=CHR$(27)+")"
    +A$+CHR$(27)+"("
180 DEF FNLN$(L)=STRING$(L,95)
190 HOME$=CHR$(30)
200 CLS$=CHR$(27)+CHR$(26)
210 FS=250:     ' FILE SIZE, ADJUST IF YOU WANT
220 TL%=100:    ' TIME DELAY
```

Next, we start the program off by asking for the file to work on. The program automatically supplies the suffix .TDR, and if no filename is given, uses the default TELE.TDR. Then we field the buffer for the name and address information:

```
230 PRINT CLS$
240 INPUT "Telephone directory file";F$
250 IF F$="" THEN F$="TELE"
260 OPEN "R",#1,F$+".TDR"
270 FIELD #1,20 AS FM$,20 AS FC$,30 AS
    FA1$,20 AS FA2$,4 AS FPC$,15 AS
    FTEL$,19 AS FCT$
280
```

Having initialised the program, we're back with our old friend the menu. This time, however, we avoid the need to type Return after making a selection, through the use of the INKEY$ function. Your BASIC may not have this or the WHILE function, so you can replace this piece of code with a standard input statement. An alternative to the WHILE construction might be:

```
400 A$ = INKEY$
410 IF A$ < "1" OR A$ > "7" THEN 400
420 REM CONTINUE
```

Notice also that we are now inputting a string, not a numeric variable, and must convert it to decimal by using the ASC() function and then subtracting 48 (ASC(0)).


```
290 REM      *** DISPLAY MENU ***
300 :
310 PRINT CLS$
320 PRINT "1 - Add name"
330 PRINT '2 - Delete name"
340 PRINT "3 - Create directory file"
350 PRINT '4 - Find name"
360 PRINT "5 - Find comment"
370 PRINT "6 - List file to CON:"
380 PRINT "7 - Quit and return to CP/M"
390 PRINT: PRINT "Enter choice:",
400 A$ = INKEY$
410 WHILE A$<"1" OR A$ > "7"
420   A$ = INKEY$
430 WEND
440 ON ASC(A$)-48 GOTO 520,1310,920,
    1550,1790,1090,480
450 :
```

Exiting MBASIC is easy:

```
460 REM      *** EXIT MBASIC ***
470 :
480 PRINT CLS$: CLOSE: SYSTEM
490 :
```

Adding a name to the file is quite simple. First we get all the details for the record:

```
500 REM  ** ROUTINE TO ADD A NAME TO FILE **
510 :
520 PRINT CLS$;"Add name to file ";FOR
    I%=1 TO TL%: NEXT I%
530 PRINT CLS$
540 PRINT FNGXY$(1,3);FNHT$("Surname      : ");
    FNLN$(20)
550 PRINT FNHT$("First Name   : ");FNLN$(20)
560 PRINT FNHT$("Street       : ");FNLN$(30)
570 PRINT FNHT$("Town/City    : ");FNLN$(20)
580 PRINT FNHT$("Postcode     : ");FNLN$(4)
590 PRINT FNHT$("Telephone    : ");FNLN$(15)
600 PRINT FNHT$("Comment      : ");FNLN$(19)
610 PRINT FNGXY$(13,3);:INPUT N$
620 PRINT FNGXY$(13,3);": ";N$;
    SPACE$(20-LEN(N$))
630 PRINT FNGXY$(13,4);:INPUT C$
640 PRINT FNGXY$(13,4);": ";C$;
    SPACE$(20-LEN(C$))
650 PRINT FNGXY$(13,5);:INPUT A1$
660 PRINT FNGXY$(13,5);": ";A1$;
    SPACE$(30-LEN(A1$))
670 PRINT FNGXY$(13,6);:INPUT A2$
680 PRINT FNGXY$(13,6);": ";A2$;
    SPACE$(20-LEN(A2$))
690 PRINT FNGXY$(13,7);:INPUT PC$
700 PRINT FNGXY$(13,7);": ";PC$;
    SPACE$(16)
710 PRINT FNGXY$(13,8);:INPUT TEL$
720 PRINT FNGXY$(13,8);": ";TEL$;
    SPACE$(15-LEN(TEL$))
730 PRINT FNGXY$(13,9);:INPUT CT$
740 PRINT FNGXY$(13,9);": ";CT$;
    SPACE$(19-LEN(CT$))
```

This is simply the screen-handling code developed last month. Next we calculate the hash key; this is used so often it's a separate subroutine at the back of the program:

```
750 REM CALCULATE HASH KEY
760 GOSUB 2040
```

Here's the subroutine; it should look familiar:

```
2020 REM  ** SUBROUTINE TO CALCULATE HASH KEY **
2030 .
2040 K=0
2050 FOR I=1 TO LEN(N$) STEP 2
2060 K=2*K+ASC(MID$(N$,I,1))
2070 NEXT I
2080 K=K-FS*INT(K/FS)
2090 IF K=0 THEN K=1
2100 RETURN
2110 :
```

Next we take a look at the record we reckon is our target. If the first character of the name is a space, then the record is empty, and we're free to write into it. Otherwise, we just push on to the next:

```
770 GET #1,K:   ' LINE 780 IS COLLISION AVOIDANCE
780 IF LEFT$(FM$,1) <> " " AND
    LEFT$(FM$,1) <> ";" THEN K=K+1:GOTO 770
790 REM    *** WRITE RECORD TO DISK ***
800 LSET FM$ = N$
810 LSET FC$ = C$
820 LSET FA1$ = A1$
830 LSET FA2$ = A2$
840 LSET FPC$ = PC$
850 LSET FTEL$ = TEL$
860 LSET FCT$ = CT$
870 PUT #1,K
880 GOTO 310
890 :
```

Actually, in the code above we also check whether the first character of the name field is a semicolon (;). The reason for that will be seen when we talk about deleting a record.

We mentioned that if the first character of the name field of the target record is a space, then it's okay to write over. But how did the space get there in the first place? Blank disks under CP/M, for example, contain E5H characters, not spaces; and if they've been written over before by another program there's no telling what may be there.

The answer is that we create the file in advance, and write spaces into the appropriate places. We already had to know the file size in advance for the hash calculation anyway, so we may as well create the file; it can't grow afterwards. Here's the routine that does that:

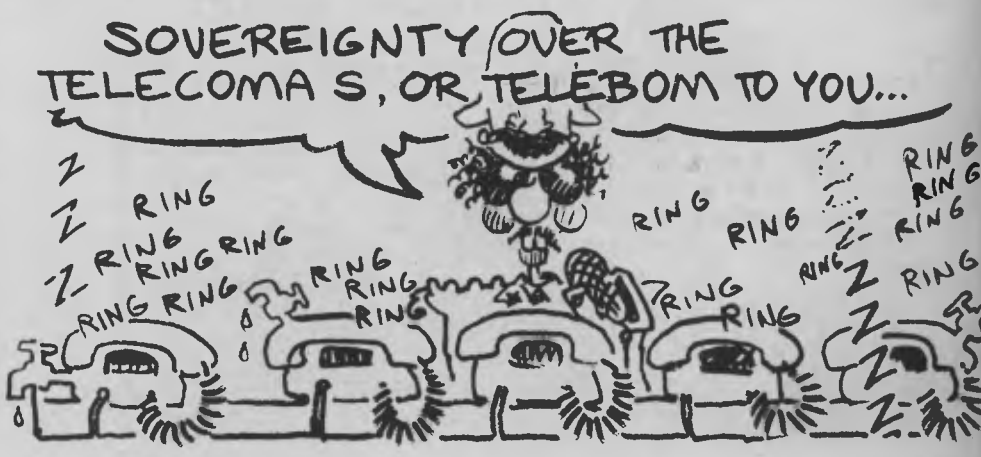
```
900 REM  ** CREATE EMPTY DIRECTORY FILE **
910 :
920 PRINT CLS$
930 CLOSE
940 PRINT "THIS WILL COMPLETELY OVERWRITE
    ANY EXISTING FILE: OK(Y/N)";
950 GOSUB 2130
960 IF A$ <> "Y" AND A$ <> "y" THEN 310
970 INPUT "Name of file to create";F$
980 OPEN "R",1,F$+".TDR"
990 FIELD #1,20 AS FM$,20 AS FC$,30 AS
    FA1$,20 AS FA2$,4 AS FPC$,15 AS
    FTEL$,19 AS FCT$
1000 LSET FM$=" "
1010 FOR I=1 TO FS
1020   PUT 1,I
1030   PRINT "*";
1040 NEXT I
1050 GOTO 310
1060 :
```

There's nothing particularly tricky about it. Note the use of a subroutine to get in a 'Y' or 'y' answer, again using the INKEY$ function so no carriage return is required. Here's the subroutine:

```
2120 REM      *** SUBROUTINE TO RETURN Y/N
                  RESPONSE IN A$ ***
2130 A$ = INKEY$
2140 WHILE A$ <> "Y" AND A$ <> "y"
    AND A$ <> "N" AND A$ <> "n"
2150   A$ = INKEY$
2160 WEND
2170 RETURN
```

Again, nothing particularly tricky, so let's press on with a routine to read the file and list it on the console device.

This is just like a sequential read, except some of the records we read will be empty, and so we should not print them out. That's why, in line 1110, there's a check for an empty record and conditional jump to line 1260 (the NEXT part of the FOR loop). Notice there's some more pretty formatting on the screen — heck, if you've paid for it you might as well use it!



```
1070 REM     *** LIST FILE TO CON: ***
1080 '
1090 FOR I=1 TO FS
1100 GET #1,I
1110 IF LEFT$(FM$,1)=" " OR LEFT$(FM$,1)
     = ";" THEN 1260
1120 PRINT CLS$;I
1130 PRINT FNGXY$(1,3);FNHT$
     ("Surname      : ");FM$
1140 PRINT FNHT$("First Name   : ");FC$
1150 PRINT FNHT$("Street       : ");FA1$
1160 PRINT FNHT$("Town/City    : ");FA2$
1170 PRINT FNHT$("Postcode     : ");FPC$
1180 PRINT FNHT$("Telephone    : ");FTEL$
1190 PRINT FNHT$("Comment      : ");FCT$
1200 PRINT FNGXY$(40,24);: PRINT "Hit
     space bar to hold, ESC to quit";
1210 FOR I%=1 TO TL%
1220 A$=INKEY$: IF LEN(A$) = 0 THEN 1250
1230 IF A$ = " " THEN I% = 1
1240 IF A$ = CHR$(27) THEN 310
1250 NEXT I%
1260 NEXT I
1270 GOTO 310
1280 '
```

Line 1200 above is interesting: because this is going to the screen, not the printer, we scroll quickly, but allow the user to hold everything by hitting the space bar, or alternatively to quit by hitting the Escape key. This section of code also incorporates a time delay to allow the user to get in before the computer's gone on to the next record.

Of course, there will be occasions when we want to delete a name from the file, so we must provide a subroutine to do this. A simple method would be to confirm the record being accessed is the one we want to delete, and then write a space into the name field. However, this approach suffers from a problem.

Our collision-avoidance scheme means a record may be located several records after its hash-computed position. If the record in the hash-computed position is deleted by this method, when the find name routine reads that record it will conclude it is empty and display a 'not found' message, without checking the following record.

To get around this, we mark a deleted record with a semicolon, so the name search routine knows to check the next record, and keep checking until the name is found or a blank record is read.

```
1290 REM    *** ROUTINE TO DELETE NAME ***
1300 '
1310 PRINT CLS$;"Delete name from file"
1320 PRINT FNGXY$(1,5);:INPUT "Name to
     delete";N$
1330 REM CALCULATE HASH KEY
1340 GOSUB 2040
1350 GET #1,K
1360 IF LEFT$(FM$,1) = ";" THEN
     K=K+1:GOTO 1350
1370 IF LEFT$(FM$,1)=" " THEN PRINT
     CLS$;"Not found":FOR I% = 1 TO
     TL%:NEXT I%:GOTO 310
1380 PRINT CLS$
1390 PRINT FNGXY$(1,3);FNHT$
     ("Surname      : ");FM$
1400 PRINT FNHT$("First Name   : ");FC$
1410 PRINT FNHT$("Street       : ");FA1$
1420 PRINT FNHT$("Town/City    : ");FA2$
1430 PRINT FNHT$("Postcode     : ");FPC$
1440 PRINT FNHT$("Telephone    : ");FTEL$
1450 PRINT FNHT$("Comment      : ");FCT$
1460 PRINT FNGXY$(40,24);"Delete (Y/N)";
1470 GOSUB 2130
1480 IF A$ <> "Y" AND A$ <> "y" THEN
     K=K+1:GOTO 1350
1490 LSET FM$ = ";"
1500 PUT #1,K
1510 GOTO 310
1520 '
```

Finding the entry for a particular name is really just a matter of hashing the name and reading forward from that point until either the name is found or a blank record is read:

```
1530 REM     *** ROUTINE TO FIND NAME ***
1540 '
1550 PRINT CLS$;"Search file for name"
1560 PRINT FNGXY$(1,5);:INPUT "Name to
     find";N$
1570 REM     *** CALCULATE HASH KEY ***
1580 GOSUB 2040
1590 GET #1,K
1600 IF LEFT$(FM$,1) = ";" THEN
     K=K+1:GOTO 1590
1610 IF LEFT$(FM$,1)=" " THEN PRINT
     CLS$;"Not found":FOR N=1 TO 300:
     NEXT N: GOTO 310
1620 PRINT FNGXY$(1,3);FNHT$
     ("Surname      : ");FM$
1630 PRINT FNHT$("First Name   : ");FC$
1640 PRINT FNHT$("Street       : ");FA1$
1650 PRINT FNHT$("Town/City    : ");FA2$
1660 PRINT FNHT$("Postcode     : ");FPC$
1670 PRINT FNHT$("Telephone    : ");FTEL$
1680 PRINT FNHT$("Comment      : ");FCT$
1690 PRINT FNGXY$(40,24);"Hit space to
     continue, ESC to quit";
1700 A$ = INKEY$
1710 WHILE A$ <> " " AND A$ <> CHR$(27)
1720   A$ = INKEY$
1730 WEND
1740 IF A$ = " " THEN K=K+1:GOTO 1590
1750 GOTO 310
1760 '
```

Finding a comment cannot be done by hashing, as file position depends upon the name, not the comment. Consequently, comments must be found by a sequential search, ignoring empty or deleted records:

```
1770 REM     *** FIND COMMENT ***
1780 '
1790 PRINT CLS$; "Find comment"
1800 PRINT FNGXY$(1,5);:INPUT "Comment
     to search for";CT$
1810 FOR I=1 TO FS
1820 GET #1,I
1830 IF LEFT$(FM$,1) = " " OR LEFT$(FM$,1)
     = ";" THEN I=I+1: GOTO 1820
1840 IF LEFT$(FCT$,LEN(CT$)) <> CT$ THEN 1990
1850 PRINT CLS$;
1860 PRINT FNGXY$(1,3);FNHT$
     ("Surname      : ");FM$
1870 PRINT FNHT$("First Name   : ");FC$
1880 PRINT FNHT$("Street       : ");FA1$
1890 PRINT FNHT$("Town/City    : ");FA2$
1900 PRINT FNHT$("Postcode     : ");FPC$
1910 PRINT FNHT$("Telephone    : ");FTEL$
1920 PRINT FNHT$("Comment      : ");FCT$
1930 PRINT FNGXY$(40,24);: PRINT "Hit
     space bar to hold, ESC to quit";
1940 FOR I%=1 TO TL%
1950 A$=INKEY$: IF LEN(A$) = 0 THEN 1980
1960 IF A$ = " " THEN I% = 1
1970 IF A$ = CHR$(27) THEN 310
1980 NEXT I%
1990 NEXT I
2000 GOTO 310
2010 '
```

That completes our first telephone directory program. It provides surprisingly fast look-up of a name, and reliable operation. However, there are a few points that should be noted.

Firstly, the hashing algorithm used is very simple, and could be improved greatly. For example, it uses only every second letter of the name, and is intolerant of spelling mistakes. During my tests of this program I also noticed the names were tending to cluster in the first half of the file, but perhaps the names I used were not a representative sample.

This program could be used as a 'test bed' for other hashing methods simply by modifying the hash subroutine. Remember, though, the program cannot access a file created with another hash method.

Another point is that the file is not in alphabetical order. This is okay as long as you know a name exactly, but if you remember only that 'it starts with a B', there is no way to predict, even roughly, where in the file it is stored.

Finally, to assist you in keying in the program, here it is in its entirety: □

```
100 REM     *** RANDOM ACCESS TELEPHONE FILER ***
110 REM     *** WRITTEN IN MBASIC V 5.2 ***
120 REM     *** 5/3/82 ***
130 '
140 REM     INITIALIZATION SECTION
150 '
160 DEF FNGXY$(X,Y)=CHR$(27)+"="+CHR$(Y+31)+CHR$(X+31)
170 DEF FNHT$(A$)=CHR$(27)+")"+A$+CHR$(27)+"("
180 DEF FNLN$(L)=STRING$(L,95)
190 HOME$=CHR$(30)
200 CLS$=CHR$(27)+CHR$(26)
210 FS=250:              ' FILE SIZE, ADJUST IF YOU WANT
220 TL%=100:             ' TIME DELAY
230 PRINT CLS$
240 INPUT "Telephone directory file";F$
250 IF F$="" THEN F$="TELE"
260 OPEN "R",#1,F$+".TDR"
270 FIELD #1,20 AS FM$,20 AS FC$,30 AS FA1$,20 AS FA2$,4 AS
    FPC$,15 AS FTEL$,19 AS FCT$
280 '
290 REM     *** DISPLAY MENU ***
300 '
310 PRINT CLS$
320 PRINT "1 - Add name"
330 PRINT "2 - Delete name"
340 PRINT "3 - Create directory file"
350 PRINT "4 - Find name"
360 PRINT "5 - Find comment"
370 PRINT "6 - List file to CON:"
380 PRINT "7 - Quit and return to CP/M"
390 PRINT: PRINT "Enter choice:"
400 A$ = INKEY$
410 WHILE A$<"1" OR A$ > "7"
420   A$ = INKEY$
430 WEND
440 ON ASC(A$)-48 GOTO 520,1310,920,1550,1790,1090,480
450 '
460 REM     *** EXIT MBASIC ***
470 '
480 PRINT CLS$: CLOSE: SYSTEM
490 '
500 REM     *** ROUTINE TO ADD A NAME TO FILE ***
```

```
510 '
520 PRINT CLS$;"Add name to file ":FOR I%=1 TO TL%: NEXT I%
530 PRINT CLS$
540 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FNLN$(20)
550 PRINT FNHT$("First Name   : ");FNLN$(20)
560 PRINT FNHT$("Street       : ");FNLN$(30)
570 PRINT FNHT$("Town/City    : ");FNLN$(20)
580 PRINT FNHT$("Postcode     : ");FNLN$(4)
590 PRINT FNHT$("Telephone    : ");FNLN$(15)
600 PRINT FNHT$("Comment      : ");FNLN$(19)
610 PRINT FNGXY$(13,3);:INPUT N$
620 PRINT FNGXY$(13,3);": ";N$;SPACE$(20-LEN(N$))
630 PRINT FNGXY$(13,4);:INPUT C$
640 PRINT FNGXY$(13,4);": ";C$;SPACE$(20-LEN(C$))
650 PRINT FNGXY$(13,5);:INPUT A1$
660 PRINT FNGXY$(13,5);": ";A1$;SPACE$(30-LEN(A1$))
670 PRINT FNGXY$(13,6);:INPUT A2$
680 PRINT FNGXY$(13,6);": ";A2$;SPACE$(20-LEN(A2$))
690 PRINT FNGXY$(13,7);:INPUT PC$
700 PRINT FNGXY$(13,7);": ";PC$;SPACE$(16)
710 PRINT FNGXY$(13,8);:INPUT TEL$
720 PRINT FNGXY$(13,8);": ";TEL$;SPACE$(15-LEN(TEL$))
730 PRINT FNGXY$(13,9);:INPUT CT$
740 PRINT FNGXY$(13,9);": ";CT$;SPACE$(19-LEN(CT$))
750 REM CALCULATE HASH KEY
760 GOSUB 2040
770 GET #1,K:              ' LINE 780 IS COLLISION AVOIDANCE
780 IF LEFT$(FM$,1) <> " " AND LEFT$(FM$,1) <> ";" THEN
    K=K+1:GOTO 770
790 REM    *** WRITE RECORD TO DISK ***
800 LSET FM$ = N$
810 LSET FC$ = C$
820 LSET FA1$ = A1$
830 LSET FA2$ = A2$
840 LSET FPC$ = PC$
850 LSET FTEL$ = TEL$
860 LSET FCT$ = CT$
870 PUT #1,K
880 GOTO 310
890 '
900 REM    *** CREATE EMPTY DIRECTORY FILE ***
910 '
920 PRINT CLS$
930 CLOSE
940 PRINT "THIS WILL COMPLETELY OVERWRITE ANY EXISTING
    FILE: OK(Y/N)";
950 GOSUB 2130
960 IF A$ <> "Y" AND A$ <> "y" THEN 310
970 INPUT "Name of file to create";F$
980 OPEN "R",1,F$+".TDR"
990 FIELD #1,20 AS FM$,20 AS FC$,30 AS FA1$,20 AS FA2$,4 AS
    FPC$,15 AS FTEL$,19 AS FCT$
1000 LSET FM$=" "
1010 FOR I=1 TO FS
1020   PUT 1,I
1030 PRINT "*";
1040 NEXT I
1050 GOTO 310
1060 '
1070 REM    *** LIST FILE TO CON: ***
1080 '
1090 FOR I=1 TO FS
1100 GET #1,I
1110 IF LEFT$(FM$,1)=" " OR LEFT$(FM$,1) = ";" THEN 1260
1120 PRINT CLS$;I
1130 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FM$
1140 PRINT FNHT$("First Name   : ");FC$
1150 PRINT FNHT$("Street       : ");FA1$
1160 PRINT FNHT$("Town/City    : ");FA2$
1170 PRINT FNHT$("Postcode     : ");FPC$
1180 PRINT FNHT$("Telephone    : ");FTEL$
1190 PRINT FNHT$("Comment      : ");FCT$
1200 PRINT FNGXY$(40,24);: PRINT "Hit space bar to hold, ESC
    to quit";
1210 FOR I%=1 TO TL%
1220 A$=INKEY$: IF LEN(A$) = 0 THEN 1250
1230 IF A$ = " " THEN I% = 1
1240 IF A$ = CHR$(27) THEN 310
1250 NEXT I%
1260 NEXT I
1270 GOTO 310
1280 '
1290 REM    *** ROUTINE TO DELETE NAME FROM FILE ***
1300 '
1310 PRINT CLS$;"Delete name from file"
1320 PRINT FNGXY$(1,5);:INPUT "Name to delete";N$
1330 REM CALCULATE HASH KEY
1340 GOSUB 2040
1350 GET #1,K
1360 IF LEFT$(FM$,1) = ',' THEN K=K+1:GOTO 1350
1370 IF LEFT$(FM$,1)=" " THEN PRINT CLS$;"Not found":FOR I%
    = 1 TO TL%:NEXT I%:GOTO 310
1380 PRINT CLS$
1390 PRINT FNGXY$(1,3);FNHT$("Surname      ");FM$
1400 PRINT FNHT$("First Name   ");FC$
1410 PRINT FNHT$("Street       ");FA1$
1420 PRINT FNHT$("Town/City    ");FA2$
1430 PRINT FNHT$("Postcode     ");FPC$
1440 PRINT FNHT$("Telephone    ");FTEL$
1450 PRINT FNHT$("Comment      ");FCT$
1460 PRINT FNGXY$(40,24);"Delete (Y/N)";
1470 GOSUB 2130
1480 IF A$ <> "Y" AND A$ <> 'y' THEN K=K+1:GOTO 1350
1490 LSET FM$ = ","
1500 PUT #1,K
1510 GOTO 310
1520 '
1530 REM    *** ROUTINE TO FIND NAME ***
1540 '
1550 PRINT CLS$;"Search file for name"
1560 PRINT FNGXY$(1,5);:INPUT "Name to find";N$
1570 REM    *** CALCULATE HASH KEY ***
1580 GOSUB 2040
1590 GET #1,K
1600 IF LEFT$(FM$,1) = "," THEN K=K+1:GOTO 1590
1610 IF LEFT$(FM$,1)=" " THEN PRINT CLS$;"Not found":FOR
    N=1 TO 300:NEXT N: GOTO 310
1620 PRINT FNGXY$(1,3);FNHT$("Surname      ");FM$
1630 PRINT FNHT$("First Name   ");FC$
1640 PRINT FNHT$("Street       ");FA1$
1650 PRINT FNHT$("Town/City    ");FA2$
1660 PRINT FNHT$("Postcode     ");FPC$
1670 PRINT FNHT$("Telephone    ");FTEL$
1680 PRINT FNHT$("Comment      ");FCT$
1690 PRINT FNGXY$(40,24);"Hit space to continue,
    ESC to quit";
1700 A$ = INKEY$
1710 WHILE A$ <> " " AND A$ <> CHR$(27)
1720   A$ = INKEY$
1730 WEND
1740 IF A$ = " " THEN K=K+1:GOTO 1590
1750 GOTO 310
1760 '
1770 REM      *** FIND COMMENT ***
1780 '
1790 PRINT CLS$; "Find comment"
1800 PRINT FNGXY$(1,5);:INPUT "Comment to search for";CT$
1810 FOR I=1 TO FS
1820 GET #1,I
1830 IF LEFT$(FM$,1) = " " OR LEFT$(FM$,1) = ";" THEN I=I+1:
    GOTO 1820
1840 IF LEFT$(FCT$,LEN(CT$)) <> CT$ THEN 1990
1850 PRINT CLS$;
1860 PRINT FNGXY$(1,3);FNHT$("Surname      ");FM$
1870 PRINT FNHT$("First Name   ");FC$
1880 PRINT FNHT$("Street       ");FA1$
1890 PRINT FNHT$("Town/City    ");FA2$
1900 PRINT FNHT$("Postcode     ");FPC$
1910 PRINT FNHT$("Telephone    ");FTEL$
1920 PRINT FNHT$("Comment      ");FCT$
1930 PRINT FNGXY$(40,24);: PRINT "Hit space bar to hold,
    ESC to quit";
1940 FOR I%=1 TO TL%
1950 A$=INKEY$: IF LEN(A$) = 0 THEN 1980
1960 IF A$ = " " THEN I% = 1
1970 IF A$ = CHR$(27) THEN 310
1980 NEXT I%
1990 NEXT I
2000 GOTO 310
2010 '
2020 REM    *** SUBROUTINE TO CALCULATE HASH KEY ***
2030 '
2040 K=0
2050 FOR I=1 TO LEN(N$) STEP 2
2060 K=2*K+ASC(MID$(N$,I,1))
2070 NEXT I
2080 K=K-FS*INT(K/FS)
2090 IF K=0 THEN K=1
2100 RETURN
2110 '
2120 REM      *** SUBROUTINE TO RETURN Y/N RESPONSE IN A$ ***
2130 A$ = INKEY$
2140 WHILE A$ <> "Y" AND A$ <> 'y' AND A$ <> "N" AND A$ <> 'n'
2150   A$ = INKEY$
2160 WEND
2170 RETURN
```

Notes

your computer

tutorial

PART IX

Les Bell develops the searching theme with some speedier and more useful routines — binary searches.

WE'VE SEEN how hashing can be used to speed up searches — now it's time to look for some other techniques to speed them up and make them more useful.

Prime among the possibilities is a technique known as binary searching. It's easiest to approach this type of search from an intuitive basis, so we'll go right back to the everyday concepts of searching.

The easiest form of search is the sequential search. To illustrate this, imagine you have a pile of magazines, in no particular order, and you are searching for the November 1981 issue of *Your Computer*.

Start At The Top

The easiest way to do this is to start at the top of the pile and work your way down, checking to see if each magazine is the one you want. This is the simplest form of sequential search, and as far as that particular problem is concerned, it's about the only one.

Now, imagine that instead of a pile of magazines you have a binder containing the magazines in sequence. Your approach to the problem will be different. You will open the binder somewhere in the middle, and check to see if the issue you are looking at is later or earlier than the one you want.

If it is later, you'll move towards the front of the binder. If it's too early, you'll move towards the back. Then you repeat the process. This is, believe it or not, a rough form of binary search.

Opening your November 1981 copy of *Your Computer* to page 28 will involve you in another form of binary search: open to the centre, that's page 50, no, too high, flick back a bit, 24, that's too low, forward a bit — got it!

We can take this analogy one step further: on the lower right of page 28 is a program which invites the player to guess a number between 1 and 100 inclusive. Try it now and see if you can come up with a strategy to minimise the number of turns you need to get the 'hidden number'.

Solid Thinking . . .

By now, you should have quite a good intuitive 'feel' for what a binary search is, so it's time to make our thinking a bit more concrete.

To do this, we'll write out an algorithm for binary search, and then write a program to perform it. Here's the algorithm:

1. Set our upper limit, **u**, to 100, and the lower limit, **l**, to 1.

2. Check for consistency: if l is greater than u, something's wrong, and we're not able to find the number. Otherwise, our best guess for the number, **g**, is g = INT(1 + u)/2.

3. Now compare (the computer does this for us in the game). If the computer's number, **i**, is less than our guess (i is less than g) then adjust upper limit, u = g — 1, and go to step 2. If i is greater than g, then adjust lower limit: l = i + 1, and go to step 2. If i = g then the algorithm has found us the right answer.

The whole procedure is quite simple and easy to follow (if a computer can do it . . .). The test for inconsistency in step 2 really indicates that one of the clues your opponent has given you is wrong, since otherwise, for this simple case, the algorithm is *guaranteed* to give you the right answer eventually.

When searching through a table of names, on the other hand, if the lower limit is greater than the upper limit, it indicates the name we are looking for is not in the table.

I said above that this algorithm is *guaranteed* to give the right answer eventually, but how eventual is eventually?

In playing around with the game above, you should have been able to get your average down to under 7 moves. The log to the base 2 of 100 is 6.64 — the algorithm will *always* get the answer in seven moves or less (if you don't cheat on it!).

Here's the algorithm coded up in BASIC:

```
100 REM      *** PROGRAM TO GUESS A NUMBER ***
110 REM      *** WRITTEN IN MBASIC V 5.2   ***
120 :
130 L = 1: U = 100: C = 0
140 IF U < L THEN PRINT "I give up. You've confused me!": END
150 G = (L + U) \ 2
160 PRINT "My guess is";G
170 C = C + 1
180 INPUT "Am I too high (H) or low (L) or right (R)";A$
190 IF A$ = "H" OR A$ = "h" THEN U = G - 1: GOTO 140
200 IF A$ = "L" OR A$ = "l" THEN L = G + 1: GOTO 140
210 PRINT "I got it in";C;"goes!"
220 INPUT "Try again";A$
230 IF A$ <> 'Y' AND A$ <> 'y" THEN END
240 GOTO 130
```

...THIS MONTH, LES BELL DEVELOPS...
..& WE SEARCH FOR A HASHED UP THEME

...AND SO, BACK AT SUNNY BELL ESTATE...

L is the lower limit, U is the upper, C counts the number of turns and G is the computer's guess. Hmmm . . . what's that backslash in line 150?

BASIC usually works with real numbers, complete with fractional parts. In this case, we want the average of the two limits to be a whole number, an integer. The backslash will perform an integer division, so that 101 divided by 2 using it would equal 50, or more confusingly, 1 divided by 2 would equal 0 (think, what's INT(1/2)?).

The advantages of the backslash division are that it's more convenient when you know you want an integer result, and it's also faster when working only with integers.

As we've seen earlier, we can tell BASIC our variables are integers by sticking a % sign onto them, so that I is real, while I% is an integer. Conveniently, BASIC will treat these two as separate variables and not confuse them.

A simpler way to make whole groups of variables integers is to use Microsoft BASIC's DEFINT statement. With this statement at the top of a program, there's no need for lots of messy %s.

The statement 'DEFINT I — N' means any variable names beginning with those letters should be taken as integers, unless overridden by other specific type declaration characters ($, ! and #). This is particularly useful for us old FORTRAN programmers, since in FORTRAN all variable names starting in I — N are automatically taken as integers (which is, incidentally, the reason why I, J and N are so often used for loop counters).

A similar statement, DEFDBL, will declare groups of variables to be double precision, while the statement 'DEFSTR A,L,Q' declares variables with those initials to be strings. There is also a DEFSNG statement, but it's not often seen.

Indexing For Speed

In our earlier attempts at a mailing list program, we sorted the entire file in memory, and found we were rapidly running out of space. We can use the concept of indexing, introduced earlier, to get out of that bind, and provide much greater speed at the same time.

In the previous example of indexing, rather than exchange all the various array elements which made up a record, we simply exchanged an index variable which pointed to them. We can use the same technique to save us having to read in every element of a file to be sorted. We'll simply set up two parallel arrays, one containing the surnames (the keys to sort on), and the other the position of the record in the file.

The array of keys and indexes can be stored as a separate sequential file, to be read in at the beginning of a session.

Using this technique, here's a much improved telephone directory program:

```
100 REM      *** INDEXED TELEPHONE FILE ***
110 REM      *** WRITTEN IN MBASIC 5.2 ***
120 REM      *** BY LES BELL, 6/15/82 ***
130 :
140 REM     INITIALIZATION SECTION
150 :
160 DEFINT I - N
170 DEF FNGXY$(X,Y)=CHR$(27)+"="+CHR$(Y+31)+CHR$(X+31)
180 DEF FNHT$(A$)=CHR$(27)+")"+A$+CHR$(27)+"("
190 DEF FNLN$(L)=STRING$(L,95)
200 HOME$=CHR$(30)
210 CLS$=CHR$(27)+CHR$(26)
220 DIM N$(256), K(256)
230 TL%=100:                          TIME DELAY
240 PRINT CLS$
250 INPUT "Telephone directory file";F$
260 IF F$="" THEN F$="INTELE"
270 :
```

After initialising the various functions, we can go ahead and read in the sequential file containing the indexes:

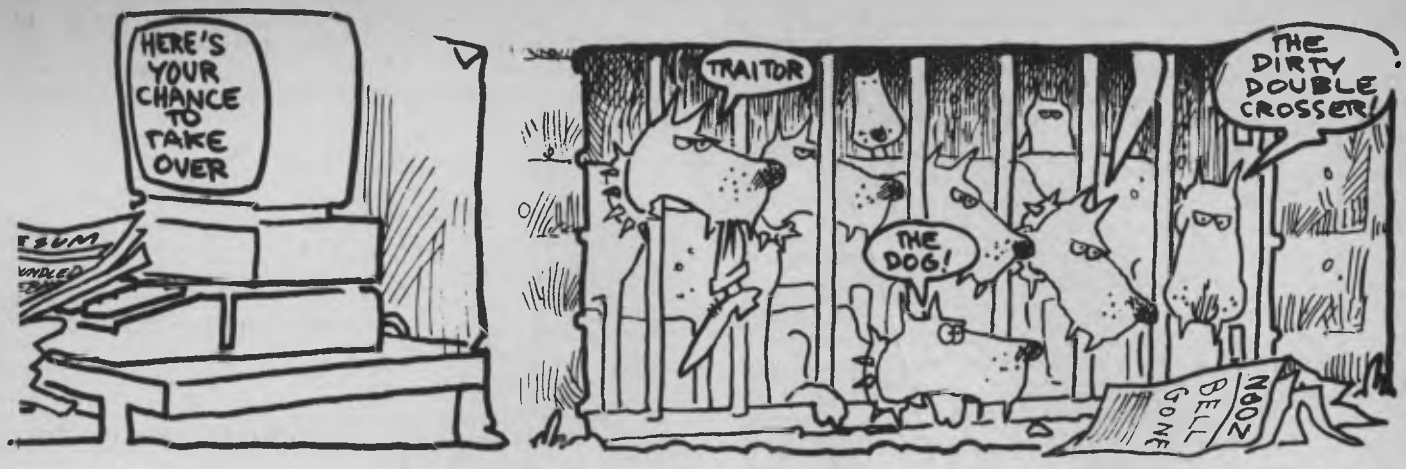
```
280 REM     *** READ INDEX FILE ***
290 :
300 ON ERROR GOTO 570
310 OPEN "I",#1,F$+".IND"
320 N=1
330 IF EOF(1) THEN CLOSE 1: GOTO 360
340 INPUT#1,N$(N),K(N)
350 N = N + 1: GOTO 330
360 PRINT: PRINT N-1;"Records in file"
370 OPEN "R",#2,F$+".TDR"
380 FIELD #2,20 AS FM$,20 AS FC$,30 AS FA1$,20 AS FA2$,4 AS
    FPC$,15 AS FTEL$,19 AS FCT$
390 :
```

The menu section is virtually the same as in the preceding chapter:

```
400 REM      *** DISPLAY MENU ***
410 :
420 PRINT CLS$
430 PRINT "1 - Add name"
440 PRINT "2 - Delete name"
450 PRINT "3 - Find name"
460 PRINT "4 - Find comment"
470 PRINT "5 - List file to CON:"
480 PRINT "6 - Pack and Sort index"
490 PRINT "7 - Quit and return to CP/M"
500 PRINT: PRINT "Enter choice:";
510 A$ = INKEY$
520 WHILE A$<"1" OR A$ > "7"
530   A$ = INKEY$
540 WEND
550 ON ASC(A$)-48 GOTO 720,1810,1310,2350,1110,1640,630
560 :
570 IF ERR=53 THEN CLOSE: PRINT "File does not exist - creating
    one.": N=1: RESUME 370
580 PRINT "Error";ERR;"in line";ERL: STOP
590 :
```

Before exiting, the updated and sorted index file should be written out to file. The subroutine at 1660 sorts the index array into ASCII order, while the subroutine at 2150 compresses the data file to save space.

```
600 REM      *** EXIT MBASIC ***
610 :
620 REM WRITE INDEX FILE
630 GOSUB 1660: GOSUB 2150: REM SORT INDICES AND PACK FILE
640 OPEN "O",#1,F$+".IND"
650 FOR I=1 TO N-1: IF K(I) = 0 THEN 670
660 WRITE#1,N$(I),K(I)
670 NEXT I
680 PRINT CLS$: CLOSE: END
690 :
```



If a name has been deleted, then the file should be packed before any more are added. If DELFLG is set, a name has been deleted, and the file is automatically sorted and packed.

```
700 REM      *** ROUTINE TO ADD A NAME TO FILE ***
710 :
720 IF DELFLG = 1 THEN GOSUB 1660: GOSUB 2150
730 PRINT CLS$;"Add name to file ":FOR I=1 TO TL%: NEXT I
740 PRINT CLS$
750 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FNLN$(20)
760 PRINT FNHT$("First Name  : ");FNLN$(20)
770 PRINT FNHT$("Street      : ");FNLN$(30)
780 PRINT FNHT$("Town/City   : ");FNLN$(20)
790 PRINT FNHT$("Postcode    : ");FNLN$(4)
800 PRINT FNHT$("Telephone   : ");FNLN$(15)
810 PRINT FNHT$("Comment     : ");FNLN$(19)
820 PRINT FNGXY$(13,3);:INPUT N$
830 IF N$ = "" THEN 420
840 PRINT FNGXY$(13,3);": ";N$;SPACE$(20-LEN(N$))
850 PRINT FNGXY$(13,4);:INPUT C$
860 PRINT FNGXY$(13,4);": ";C$;SPACE$(20-LEN(C$))
870 PRINT FNGXY$(13,5);:INPUT A1$
880 PRINT FNGXY$(13,5);": ";A1$;SPACE$(30-LEN(A1$))
890 PRINT FNGXY$(13,6);:INPUT A2$
900 PRINT FNGXY$(13,6);": ";A2$;SPACE$(20-LEN(A2$))
910 PRINT FNGXY$(13,7);:INPUT PC$
920 PRINT FNGXY$(13,7);": ";PC$;SPACE$(16)
930 PRINT FNGXY$(13,8);:INPUT TEL$
940 PRINT FNGXY$(13,8);": ";TEL$;SPACE$(15-LEN(TEL$))
950 PRINT FNGXY$(13,9);:INPUT CT$
960 PRINT FNGXY$(13,9);": ";CT$;SPACE$(19-LEN(CT$))
970 REM    *** WRITE RECORD TO DISK ***
980 LSET FM$ = N$
990 LSET FC$ = C$
1000 LSET FA1$ = A1$
1010 LSET FA2$ = A2$
1020 LSET FPC$ = PC$
1030 LSET FTEL$ = TEL$
1040 LSET FCT$ = CT$
1050 PUT #2,N
1060 N$(N) = N$: K(N) = N
1070 N = N + 1
1080 GOTO 720
1090 :
```

In the 'list file' routine, records are retrieved in key sequence. The pause routine works in exactly the same way as the one in the 'hashing' example.

```
1100 REM      *** LIST FILE TO CON: ***
1110 FOR I = 1 TO N-1
1120 IF K(I) = 0 THEN 1280
1130 GET #2,K(I)
1140 PRINT CLS$;I
1150 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FM$
1160 PRINT FNHT$("First Name  : ");FC$
1170 PRINT FNHT$("Street      : ");FA1$
1180 PRINT FNHT$("Town/City   : ");FA2$
1190 PRINT FNHT$("Postcode    : ");FPC$
1200 PRINT FNHT$("Telephone   : ");FTEL$
1210 PRINT FNHT$("Comment     : ");FCT$
1220 PRINT FNGXY$(40,24);: PRINT "Hit space bar to hold, ESC to
     quit";
1230 FOR J=1 TO TL%
1240 A$=INKEY$: IF LEN(A$) = 0 THEN 1270
1250 IF A$ = " " THEN J = 1
1260 IF A$ = CHR$(27) THEN 420
1270 NEXT J
1280 NEXT I
1290 GOTO 420
1300 :
```

This section is the actual binary search, followed by a section to read in the record from the data file and display it.

```
1310 REM    *** ROUTINE TO FIND NAME ***
1320 :
1330 PRINT CLS$;"Search file for name"
1340 PRINT FNGXY$(1,5);:INPUT "Name to find";N$
1350 REM    *** BINARY SEARCH ON N$(N) ***
1360 L = 1: U = N - 1: 'SET UPPER AND LOWER BOUNDARIES
1370 IF U < L THEN 1570
1380 I = (U + L) \ 2
1390 IF N$ < N$(I) THEN U = I - 1: GOTO 1370
1400 IF N$ > N$(I) THEN L = I + 1: GOTO 1370
1410 GET #2,K(I)
1420 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FM$
1430 PRINT FNHT$("First Name  : ");FC$
1440 PRINT FNHT$("Street      : ");FA1$
1450 PRINT FNHT$("Town/City   : ");FA2$
1460 PRINT FNHT$("Postcode    : ");FPC$
1470 PRINT FNHT$("Telephone   : ");FTEL$
1480 PRINT FNHT$("Comment     : ");FCT$
1490 PRINT FNGXY$(40,24);"Hit space to continue, ESC to quit";
1500 A$ = INKEY$
1510 WHILE A$ <> " " AND A$ <> CHR$(27)
1520   A$ = INKEY$
1530 WEND
1540 IF A$ = " " THEN I = I + 1:IF I < N THEN 1410
1550 GOTO 420
1560 :
1570 REM      *** UNSUCCESSFUL ***
1580 :
1590 PRINT CLS$;"Not found";
1600 FOR I = 1 TO TL%:NEXT I
1610 GOTO 420
```

This is a standard Shellsort on the name field. In line 1710, the SWAP statements can be replaced by appropriate GOSUBs. The sort does not use indexing itself; there is actually not much point, since BASIC uses indexes internally to allocate string storage.

```
1620 REM      *** SORT INDEX ARRAY ***
1630 :
1640 GOSUB 1660: GOSUB 2150: GOTO 420
1650 REM      *** SORT SUBROUTINE ***
1660 PRINT CLS$;"Sorting index. Please wait"
1670 M = (N-1)/2
1680 L = N - M - 1
```


```
1690 FOR J = 1 TO L
1700  FOR I = J TO 1 STEP -M
1710    IF N$(I) > N$(I+1) THEN SWAP N$(I), N$(I+1): SWAP K(I),
                                                          K(I+1)
1720     PRINT ".";
1730  NEXT I
1740 NEXT J
1750 M = M \ 2
1760 IF M <> 0 THEN 1680
1770 RETURN
1780 :
```

Deletion is achieved by doing a binary search on a name to locate it, then simply setting the index of a name to zero; there can't be a zeroth record in a file.

```
1790 REM    *** ROUTINE TO DELETE NAME FROM FILE ***
1800 :
1810 PRINT CLS$;"Delete name from file"
1820 PRINT FNGXY$(1,5);:INPUT "Name to delete";N$
1830 REM    *** BINARY SEARCH ON N$(N) ***
1840 L = 1: U = N - 1: 'SET UPPER AND LOWER BOUNDARIES
1850 IF U < L THEN 1570
1860 I = (U + L) \ 2
1870 IF N$ < N$(I) THEN U = I - 1: GOTO 1850
1880 IF N$ > N$(I) THEN L = I + 1: GOTO 1850
1890 GET #2,K(I)
1900 IF LEFT$(FM$,1) = ";" THEN K=K+1:GOTO 1320
1910 IF LEFT$(FM$,1)=" " THEN PRINT CLS$;"Not found":FOR J = 1 TO
     TL%:NEXT J:GOTO 420
1920 PRINT CLS$
1930 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FM$
1940 PRINT FNHT$("First Name  : ");FC$
1950 PRINT FNHT$("Street      : ");FA1$
1960 PRINT FNHT$("Town/City   : ");FA2$
1970 PRINT FNHT$("Postcode    : ");FPC$
1980 PRINT FNHT$("Telephone   : ");FTEL$
1990 PRINT FNHT$("Comment     : ");FCT$
2000 PRINT FNGXY$(40,24);"Delete (Y/N)";
2010 GOSUB 2070
2020 IF A$ <> "Y" AND A$ <> "y" THEN I = I + 1:GOTO 1890
2030 K(I) = 0: DELFLG = 1
2040 GOTO 420
2050 :
2060 REM     *** SUBROUTINE TO RETURN Y/N RESPONSE IN A$ ***
2070 A$ = INKEY$
2080 WHILE A$ <> "Y" AND A$ <> "y" AND A$ <> "N" AND A$ <> "n"
2090   A$ = INKEY$
2100 WEND
2110 RETURN
2120 :
```

The pack routine simply checks to see if a record has a corresponding index, and if it has, writes it back out. Because deleted records are not rewritten, the file is gradually compacted.

```
2130 REM     *** PACK RANDOM FILE ***
2140 :
2150 PRINT CLS$;"Packing data file.';
2160 D = 0
2170 FOR S = 1 TO LOF(2)
2180 T$=SPACE$(20)
2190 GET#2,S
2200 N$ = FM$
2210 L=1: U=N-1
2220 IF U<L THEN 2300
2230 I = (U + L) \ 2
2240 LSET T$ = N$(I)
2250 IF N$ < T$ THEN U = I - 1: GOTO 2220
2260 IF N$ > T$ THEN L = I + 1: GOTO 2220
2270 IF K(I) = 0 THEN 2300
2280 D = D + 1
2290 PUT#2,D:K(I) = D:PRINT ".";
2300 NEXT S
2310 DELFLG = 0
2320 RETURN
```

The 'find comment' routine is a straightforward sequential search.

```
2330 REM     *** FIND COMMENT ***
2340 :
2350 PRINT CLS$; "Find comment"
2360 PRINT FNGXY$(1,5);:INPUT "Comment to search for";CT$
2370 FOR I=1 TO LOF(2)
2380 IF K(I) = 0 THEN 2550
2390 GET #2,K(I)
2400 IF LEFT$(FCT$,LEN(CT$)) <> CT$ THEN 2550
2410 PRINT CLS$;
2420 PRINT FNGXY$(1,3);FNHT$("Surname      : ");FM$
2430 PRINT FNHT$("First Name  : ");FC$
2440 PRINT FNHT$("Street      : ");FA1$
2450 PRINT FNHT$("Town/City   : ");FA2$
2460 PRINT FNHT$("Postcode    : ");FPC$
2470 PRINT FNHT$("Telephone   : ");FTEL$
2480 PRINT FNHT$("Comment     : ");FCT$
2490 PRINT FNGXY$(40,24);: PRINT "Hit space bar t0 hold,
     ESC to quit";
2500 FOR J=1 TO TL%
2510 A$=INKEY$: IF LEN(A$) = 0 THEN 2540
2520 IF A$ = " " THEN J = 1
2530 IF A$ = CHR$(27) THEN 420
2540 NEXT J
2550 NEXT I
2560 GOTO 420
```

This method of storage allocation is still not particularly efficient, particularly in its reclamation of space occupied by deleted records. Next, we shall go on to look at linked lists and binary trees. □

your computer tutorial

PART X

In the quest for ever more efficient means of storage, Les Bell introduces linked lists and binary trees.

SO FAR, in our search for efficient means of disk storage, we have looked at straight (linear) lists, sorted lists, indexed lists and a variety of access methods such as hashing and binary searching. All of these work quite well in certain applications, but they each have drawbacks.

However, considerably more powerful techniques are still available to us (there's more to this computer science than meets the eye!). These include various kinds of more refined dynamic data structures, such as linked lists and the several varieties of trees. The basic key to understanding these is the idea of the linked list.

In a linked list, each record (or node) contains at least one extra field; this contains information about where to find the next record. The information depends on the particular implementation and computer.

For example, in a linked list which is maintained completely in memory, the link pointer may contain an address, while a linked list which forms part of a disk operating system may contain track and sector numbers.

Let's look at a linked list in memory. To choose an example near to our hearts, we'll examine the way a typical BASIC interpreter stores the lines you type into it.

Typically, the BASIC interpreter lives at the bottom end of memory, extending up for, say, 16 Kbytes or so. At the top end of memory is the microprocessor's stack. In between is a space of 24 Kbytes or so which must hold your program, all variables including strings, and disk buffers.

As you can imagine, some sophisticated techniques are used to get the best out of that memory space.

Now let's think about the problems the BASIC interpreter encounters as you type in your program. Each line is numbered, and if you've been good and written your program out on paper first, then you'll type them out in order without any mistakes. Storing such a program internally is a cinch — just a straight sequential list will do the job.

However, BASIC is rather more accommodating than that, and allows lines to be entered in any order. What would you do if a line was to be inserted into a linear list? Push down all the following lines, character by character, as the new line is typed in? If you do, you'll find your typing speed will be very slow as you enter a line at the beginning of a long program. In fact, some word processors suffer from this very problem.

Linked Lists To The Rescue

Similar problems arise when replacing a line or editing it to make it either shorter or longer. There has to be a better way. And there is — linked lists to the rescue!

Suppose we store our lines in the following way: the first part of a line is the line number, stored as an integer. Next comes the address of the next line in memory, also stored as an integer. Third, we store the line itself, either as text or in some compressed form. This is shown diagramatically in Figure 1.

Here we have a five-line BASIC program stored in memory, as the interpreter sees it. The interpreter has an internal memory location which knows the location of the first line.

Usually, after you type NEW, this will always be in the same location, but if you normally start your programs at line 100, then later add a line 95, this will change (think about it).

Thereafter, each line actually contains the address of the following one, rather like a thread linking them all together. Finally, the last line of the program will have a link value of zero, to tell the interpreter it is the last (a BASIC line could never be placed at location 0).

On drawings of lists, a link to zero is always shown as the electrical 'earth' symbol.

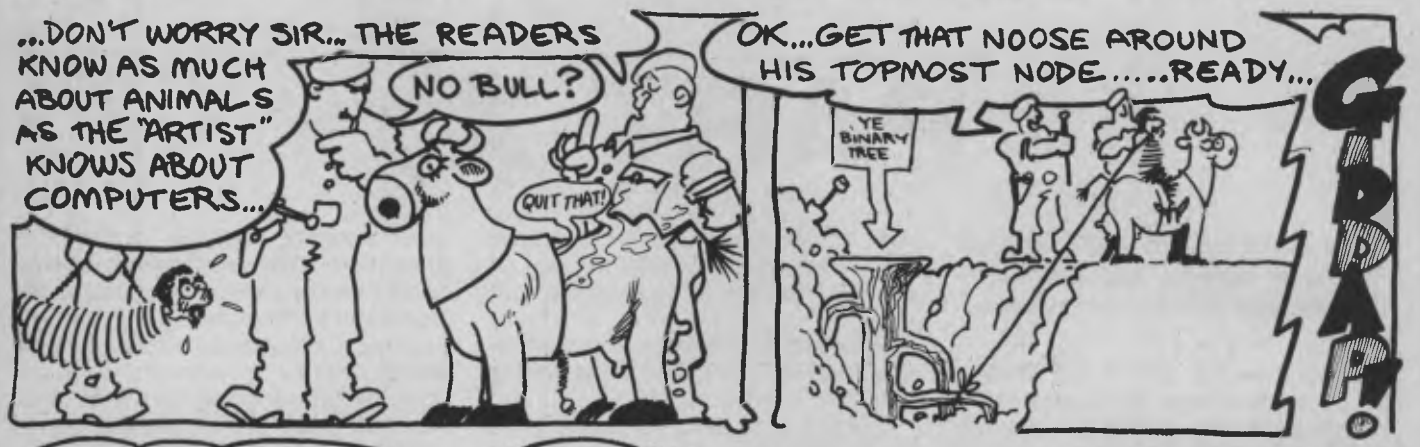
Now, adding a line onto the end of the program is very easy. We simply insert it somewhere (anywhere within reason) in memory, with a link field of zero, and change the link field of the old last line to contain the address of the new one (see Figure 2).

Inserting into a linked list is almost as easy. First we look at the line before the insertion point, and store its link value into the new line. Then we set its link to point to the new line, and that's it. The result is shown in Figure 3.

Now, in the figures so far, I've shown the lists as proceeding in an orderly manner down the page. If the program lines are typed in sequentially, that's the way the list will grow in memory. Note, though, that the lines will be 'butted up' tightly against each other with no room between them for a line to be inserted.

This means a line will normally be placed at the end of the list, but linked in


...THIS MONTH IN THE QUEST FOR.... AH... ...SOMETHING.., ..EFFICIENTLY STORED LES BELL HAS HIS LISTS LINKED... UGH..
SUH! WE'VE LOCATED A BINARY TREE & EXCAVATED DOWN TO ITS HIGHEST LIMBS... SUH!
SNAP!
OF COURSE... BINARY TREES GROW UPSIDE DOWN...
KLIK!
RIGHTO! BRING ON THE HORSE!...
HORSE?
...OF COURSE! THAT'S HOW THEY LINCH 'EM IN THE FLICKS!


...DON'T WORRY SIR... THE READERS KNOW AS MUCH ABOUT ANIMALS AS THE "ARTIST" KNOWS ABOUT COMPUTERS...
NO BULL?
QUIT THAT!
OK...GET THAT NOOSE AROUND HIS TOPMOST NODE.....READY...
YE BINARY TREE
GRRAP!


..IT DIDN'T WORK!..HE'S SUPPOSED T'GO UP!
MAYBE HE HAS A DISK BUFFER, SUH!
OK! LET'S DO IT AGAIN!
HELP!
HELP?
YARP! YARP!
YOING!
..AT THIS MOMENT...
TIRANT! TIRRAA!
PITOOTLE! TOOTLE! TOOT!
WHAT'S THAT?..SUH?
MY GOD!... IT... IT'S THE.....


HOORAY! SAVED BY THE CAVALRY!..
:CHOKE:
PAKOOT! PTOOT!
TWANG!...
THANKS FELLOWS... ...A TRULY GALAANT GESTURE..
OFFIS IDIOT
...WELL..UH...NOT REALLY...WE... ER...NEED YOUR COLLECTION OF GARBAGE...SORRY... GARBAGE COLLECTION...TO...AH.. MAKE OUR STUFF LOOK GOOD!
YEH... A VALUABLE CONTRIBUTION...
YEH
J. KURT

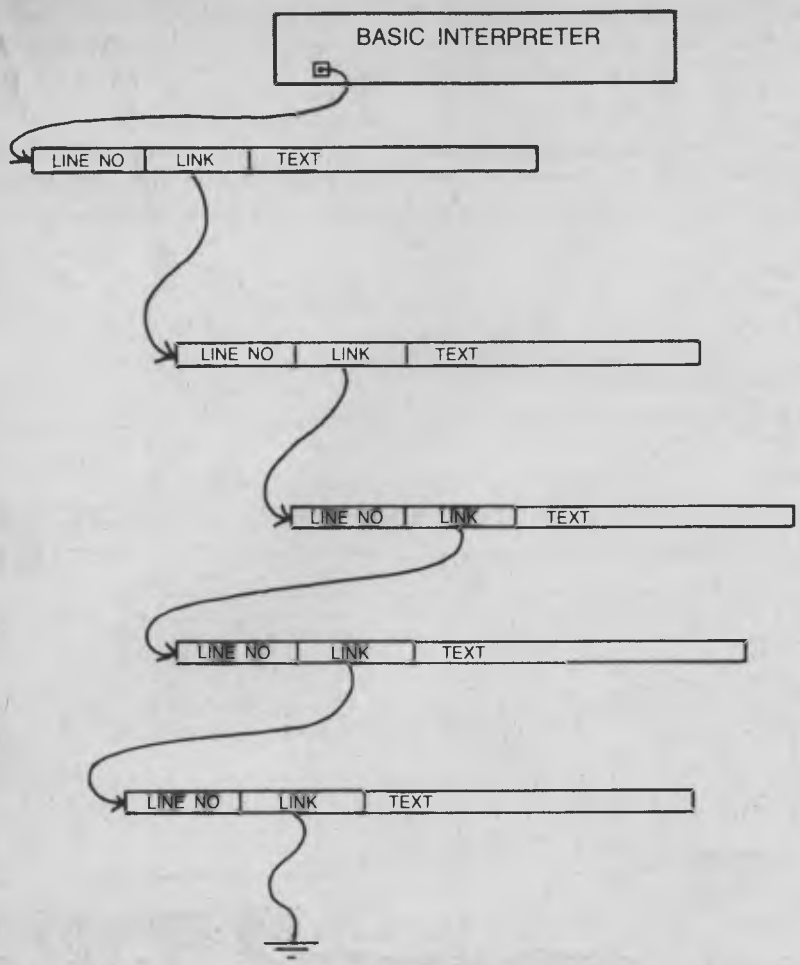


Figure 1. Basic program stored as a linked list.

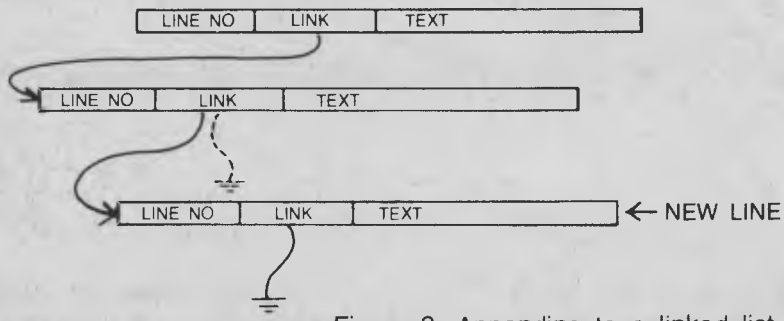


Figure 2. Appending to a linked list.

in exactly the same way. Although it is physically located at the end of the list, when the interpreter executes or lists the program by tracing its way along the links, the line will appear in its correct position. See Figure 4 for a graphic representation of this.

Deleting a node from a linked list is straightforward too; it's the reverse of insertion. We look at the node preceding the one to be deleted, and copy the link from the one to be deleted into its predecessor (see Figure 5). That's it.

Of course, it leaves a 'hole' in memory where the line used to be; this will be wasted space unless we do something about it. The answer is to grab the space back by appending it onto another list, consisting of deleted lines, and known as the 'free list'.

From now on, if a line is to be inserted, we can quickly check down the free list to find a space which will accommodate it. If one is found, we put the line into it and delete it from the free list, inserting it into the program list.

Of course, lines will not usually be exactly the same length as the spaces they occupy, leaving a few bytes spare, and as a program grows in memory, so will the free list. The free list will also consist of progressively smaller and smaller, and consequently less usable, spaces.

Eventually, the machine runs out of space, and something has to be done about it.

Collecting The Garbage

The answer is garbage collection. Without the aid of any Glad bags, a program called the garbage collector runs down the free list collecting up the spaces, and at the same time packing up the program lines to eliminate the spaces between them.

This repacks the program more tightly and collects all the itty-bitty spaces into one usable lump.

By this stage it should come as no surprise to you to learn that BASIC stores its strings in exactly the same way. As you concatenate, delete and otherwise work with strings, they are moved around on a linked list, and there is an associated free list.

If you're running out of string space, the garbage collector will come along and reshuffle everything into a tighter configuration.

This is why storing machine code programs as strings and then using the VARPTR function to access them can sometimes cause you grief; the garbage collector is quite likely to arbitrarily shift your program out of the way and put something else in its place.

Incidentally, for those who think garbage collection and linked lists are 'big machine' techniques, the HP-41C pocket calculator uses just this method to cram programs into memory, which is why it can sometimes down tools and display

'PACKING' or 'WORKING' for 20 seconds or so. Garbage collection is a slow process on any computer.

Putting The Concept To Work

We could quite easily apply the idea of linked lists to a mailing list or similar program. When FIELDing up a record, we would merely have to provide an extra field for the link. After reading the first record of the file we can then carry on by putting the link field into a variable and then doing a GET using that variable to index into the file.

By repeating the process, we can read through the file in alphabetical order. Inserting records into the file is quite easy, and only requires a few random reads and writes, so it's quite quick.

The problem arises when we try to randomly access the file. There's just no way it can be done! The records aren't in consecutive order, and there's no way hashing or binary search will get us near the record we want. So for applications where fast random access is required, count linked lists out.

On the other hand, you can't rule linked lists out totally, since there is no reason why you can't maintain a table of extra links into the middle of the list; say, 25 extra links, one for each letter of the alphabet. Then you can perform a sequential search on just a section of the list — something you can get away with on small lists.

Other advantages of linked lists: they make it easy to join lists together or break one apart; common information can be shared (for example, two people with different names can share one address); clever schemes with multiple links and tables of links can be constructed.

As an example of the last, consider the case in a line-oriented text editor, where you may want to look backwards through a text. In this case, an extra link field can be added, which gives the address of the preceding line, as well as the successor. Now sequential access is possible in both directions.

The idea of doing tricks with links leads on naturally to the subject of trees. So far, all the data structures we've discussed have been linear; that is, they have one beginning and one end. Trees don't work that way.

Suppose we define a record for a person whose surname is Michaels, and we make this the first record in a file. We can always access the first record by just reading the file. Suppose we then define two link fields, each of which leads further into the file (obviously) and one of which is for names lexicographically less than our first record, and the other for names greater than it.

We then follow down to the 'left', to the names starting with letters before M, and

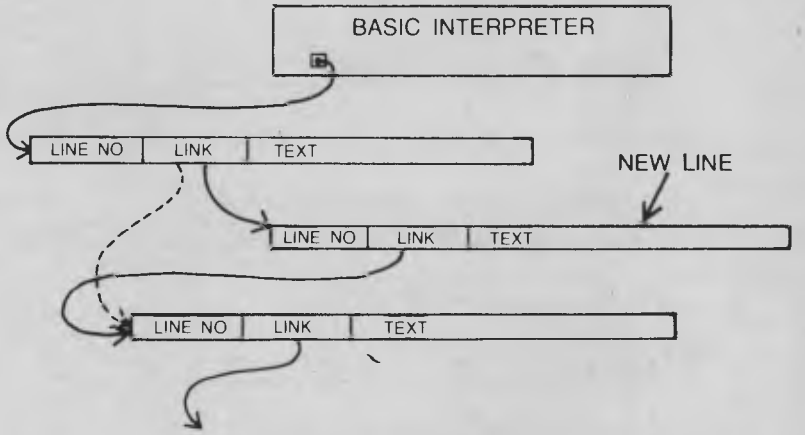


Figure 3. Inserting into a linked list.

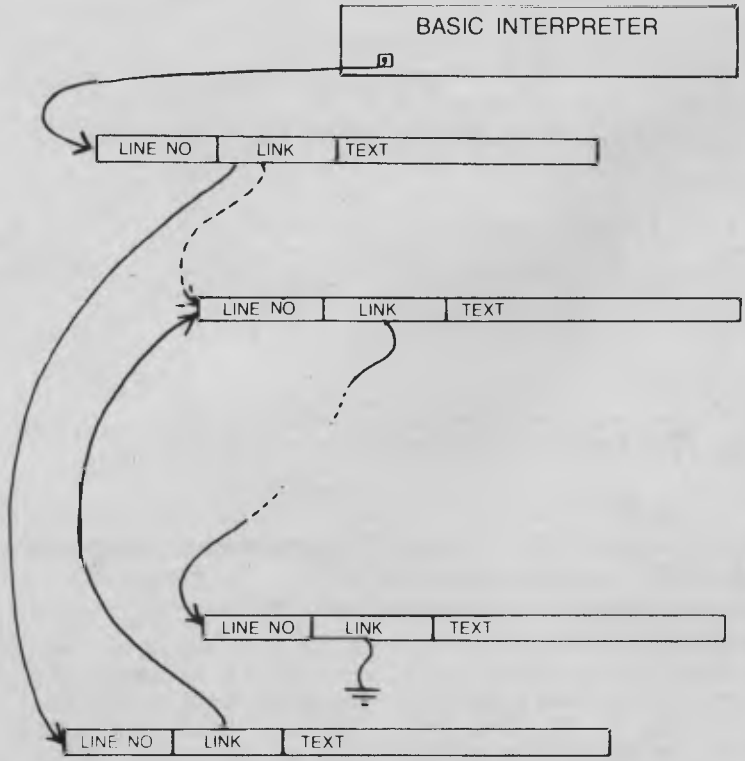


Figure 4. A more realistic view of insertion into a linked list.

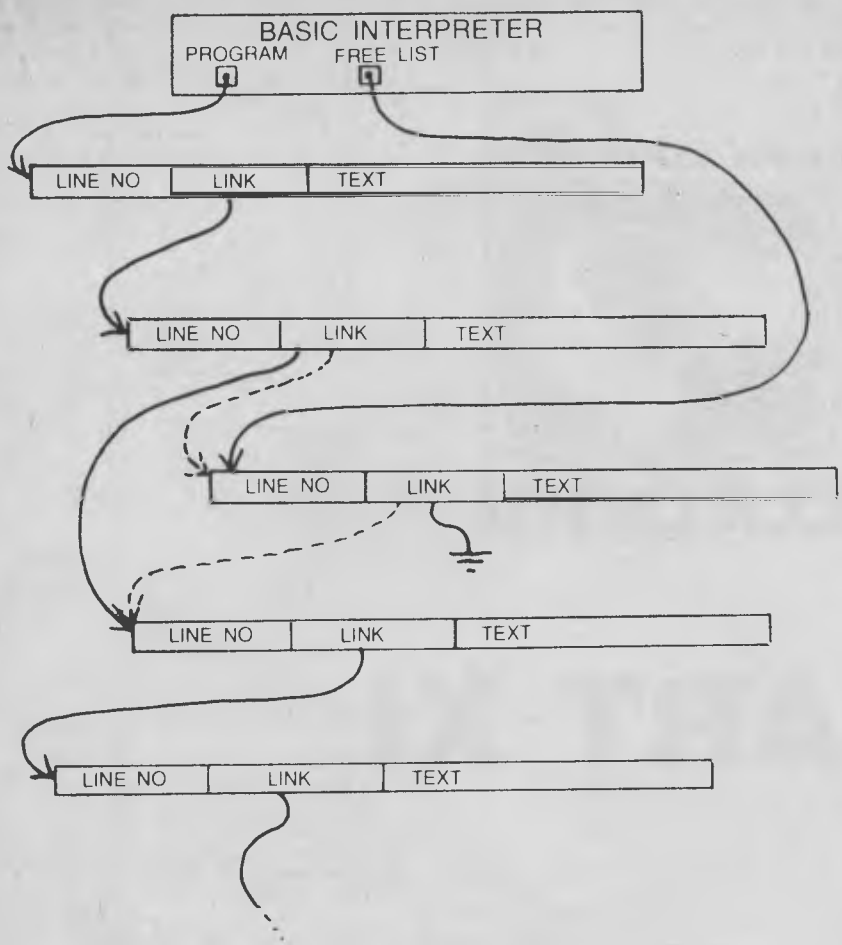


Figure 5. Deletion of a line from a linked list.

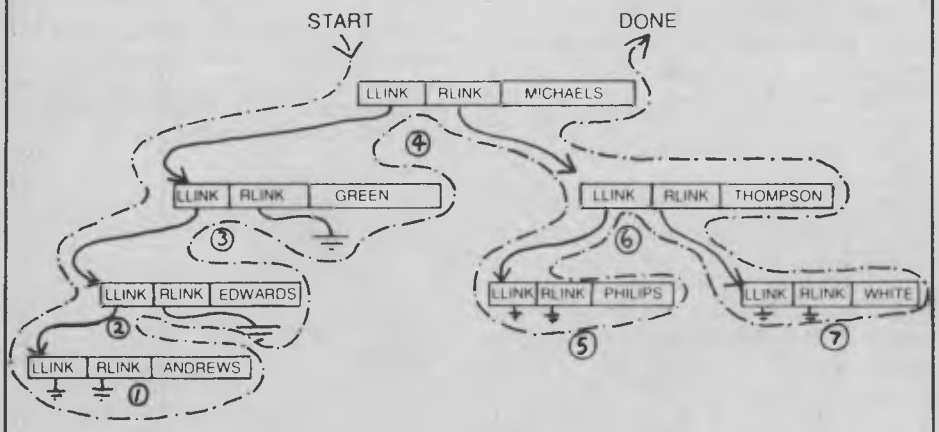


Figure 6. A simple binary tree of names.

TRAVERSAL PATH

find this takes us to a node for a Mr Green. Now taking the 'right' link, we wind up with Mr Johnson. At this stage, the right node is zero, so we now know that Mr Lessing, for whom we were searching, is not on file. Why?

Look at Figure 6. This shows a simple binary tree for a few names and addresses. If you think back to our earlier discussion on binary searching, you will see a certain similarity between that technique and searching a binary tree.

Notice, from the drawing, that binary trees grow upside down. The topmost node, that for Michaels, is known as the root node, and the nodes below it are known as sons (or daughters, if you feel that way). Two nodes with the same parent are known as brothers, sisters or siblings, depending on your preference.

The left link points to a son which has a lexicographic value less than the parent, while the right link points to a son of greater (or equal) lexicographic value.

Now, how could one get an alphabetic listing of such a data structure? This is known as *traversing* the tree, and is really quite a simple process (though it probably gave its discoverer a few sleepless nights).

The process begins with the root node. Start at the left link of the node. If there is a son, move down to it. If there is not, print the contents of the node, and then move to the right link. If there is a son there, go to it. Otherwise, climb back up (down?) the branch that brought you there.

Repeat this process for every node visited, and the result will be an alphabetic listing! The process is shown diagramatically in Figure 6. Basically it involves climbing down the left side of every link and up the right side, printing each node's contents as you pass across its underside between the left and right links. This sounds complicated but is actually quite simple.

Unfortunately, this is the kind of thing BASIC does not shine at; other languages do it much better. However, in the next instalment we'll tackle the job of growing a binary tree, traversing it and even pruning it. □

your computer

tutorial

PART XI

We've always thought Les was a bit of an animal, but even we were surprised to find that he was only artificially intelligent: a member of the 'artificial intelligentsia' . . . ?

HAVING discussed such lowly applications as maintaining mailing lists, phone lists and other mundane subjects, it's time for a little glamour — artificial intelligence. In the last section, we introduced linked lists and trees, and now we'll actually grow a tree.

Many readers will be familiar with the well-known game of 'Animal', which asks the human questions about the animal he or she has in mind, so the computer will eventually guess it, or give up.

Here is a version of that program which maintains the information about the animals as a tree structure on a disk. This allows the tree to grow and grow to a considerable size, while memory-bound versions are stuck at quite a small size.

The program is quite slow in comparison with the memory-based versions, but its main time-consuming loop is in fact occupied stripping nulls from a long string. If this is shortened (and you should know how to do this by now!), the program can be roughly doubled in speed.

Here we go with the actual program:

```
100 REM   *** ANIMAL ***
110 REM   *** WRITTEN IN MBASIC BY LES BELL ***
120 REM   *** 9/21/82 ***
130 PRINT "'GUESS THE ANIMAL'"
140 PRINT "YOU THINK OF AN ANIMAL AND THE
150 PRINT "COMPUTER WILL TRY TO GUESS IT."
160 PRINT
```

The first job that has to be done is to open the file which the program will operate on. We will assume the file already exists from previous runs of the game, and later we will show a program which can be used to create a 'starter' file.

Each record of the file will contain only three fields: a text field containing either a question or the name of an animal (DQ$), and two fields containing the record numbers to jump to in the case of either a yes or no response to the question.

We can tell whether the text field contains a question or animal by examining the values in the other two fields; a question must jump somewhere, but an animal name will be accompanied by two zeros, as these are terminal nodes of the tree.

```
170 OPEN "R",1,"B:ANIMAL.DAT"
180 FIELD #1,124 AS DQ$,2 AS DY$,2 AS DN$
190 N=LOF(1)
```

Once the file has been opened, the game can begin. The first thing is to wait until the player has thought of an animal; alternatively, by replying 'LIST' to this question, the player can display a list of the animals known to the program.

The game begins by opening the file and reading, then asking, the first question:

```
200 INPUT "ARE YOU THINKING OF AN ANIMAL";A$
210 IF A$="LIST" THEN 700
215 IF A$="END" THEN CLOSE: END
220 IF LEFT$(A$,1)<>"Y" THEN 200
230 K=1
240 GET #1,K
250 GOSUB 530 : REM ASK QUESTION
```

The subroutine starts by calling yet another subroutine to strip off the blanks which fill out the question (or animal name) to the full length of the field (124 bytes). It then prints the question, and inputs the reply. If the reply is 'yes', it moves the file pointer (K) to the 'yes' daughter node of the tree; if the reply is 'no', then it goes to the 'no' node.

```
530 REM   SUBROUTINE TO PRINT QUESTIONS
540 GOSUB 640 : REM STRIP SPACES
550 PRINT LEFT$(Q$,C);
560 INPUT C$
570 C$=LEFT$(C$,1)
580 IF C$<>"Y" AND C$<>"N" THEN 550
590 IF C$ = "Y" THEN K = CVI(DY$) :
    REM MOVE TO NEXT RECORD
600 IF C$ = "N" THEN K = CVI(DN$)
610 GET #1,K : REM GET IT
620 RETURN
```

Next the program examines the node pointers in the new node; if the 'yes' node pointer is zero, then this is an animal name, otherwise it can just go back and ask this question in the same way as the last one.

If the node contains an animal name, the program prints the first part of the "Is it a " message, then strips off the redun-


GUESS THE ANIMAL...
IS THIS A NEW ~~BOK~~ PLOT BY LES..ER... MASSA BELL TO GRAB THE REINS OF Y.C.P IT'S PRETTY WELL SELF EXPLANATORY..OOK OOH

dant spaces and prints the animal name too. Then it waits for the player's reply.

```
260 IF CVI(DY$) <> 0 THEN 240 : 'ASK
    ANOTHER QUESTION
270 GOSUB 640 : REM STRIP OFF SPACES
    FROM FIELDED STRING
280 PRINT "IS IT A ";LEFT$(DQ$,C);
290 INPUT A$
300 A$=LEFT$(A$,1)
```

If the first character of the reply is a 'Y', then the machine guessed correctly, and it goes back to start the main loop again. Otherwise, it asks for a question to distinguish between its guess and the player's choice of animal, together with an answer to that question.

```
310 IF A$="Y" THEN PRINT "ANOTHER
    ANIMAL?": GOTO 200
320 INPUT "THE ANIMAL YOU WERE THINKING
    OF WAS A ";AN$
330 PRINT 'PLEASE TYPE IN A QUESTION
    THAT WOULD DISTINGUISH A"
340 PRINT AN$;" FROM A ";
350 GOSUB 640
360 PRINT LEFT$(DQ$,C);
370 INPUT QU$
380 PRINT "FOR A ";AN$;" THE ANSWER WOULD BE ";
390 INPUT A$
400 A$=LEFT$(A$,1):IF A$<>"Y" AND
    A$<>"N" THEN 380
```

Now comes the real meat of the program. At this stage a new node must be inserted into the tree. Figure 1 shows how this is done; the code does not show it well at all! The whole procedure is quite tricky, and I do confess that although I wrote it, I'm not entirely sure I understand it myself!

This is not as complex as the conventional insertion into a linked list, since we are replacing a terminal node, and not one further up the tree. The first step is to save the old animal's name (the one the computer guessed) into a temporary variable. It will be replaced by the question which distinguishes it from the newly entered animal name:

```
410 GOSUB 640
420 D$ = LEFT$(DQ$,C) : REM SAVE ANIMAL NAME
430 LSET DQ$ = QU$ : REM MOVE QUESTION
    INTO RECORD
```

Next we set up pointers to two new records just beyond the current last record. If the distinguishing question is answered in the negative (that is, not just 'yes') then we swap over the two pointers.

```
440 X1 = N + 2: X2 = N + 1:
    IF A$ = "N" THEN SWAP X1,X2
```

Next we store the two pointers into the record, and write it to disk.

```
450 LSET DY$ = MKI$(X1):LSET DN$ = MKI$(X2)
460 PUT #1,K : REM WRITE QUESTION RECORD
```

Now we retrieve the old animal name, and store it, with zero pointers, into one of the two new records.

```
470 LSET DQ$ = D$:LSET DY$ = MKI$(0):
    LSET DN$ = MKI$(0)
480 PUT #1,N+1 : REM WRITE 1st ANIMAL RECORD
```

Then we do the same thing for the new animal to be added to the file.

```
490 LSET DQ$ = AN$
500 PUT #1,N+2 : REM WRITE 2nd ANIMAL RECORD
```

Finally, we increment the file length variable, and go round the main loop again.

```
510 N = N + 2
520 GOTO 200
```

Here's the subroutine which eliminates the spaces that pad out the text field in the buffer. It starts at the end of the buffer and heads backwards until it comes to the first non-space character:

```
630 REM SUBROUTINE TO ELIMINATE
    PADDING SPACES
640 C = LEN(DQ$)
650 WHILE MID$(DQ$,C,1) = " "
660   C = C - 1
670 WEND
680 RETURN
```

To finish up, here's the routine which lists the animals. It simply starts at the beginning of the file and lists every record which has zero link pointers (those with non-zero links are questions, remember?).

```
690 REM   *** ROUTINE TO LIST ANIMALS
700 PRINT: PRINT "ANIMALS I ALREADY KNOW ARE:"
710 J=0: I=1
720 WHILE I <= LOF(1)
730   GET #1,I:I = I + 1
740   IF CVI(DY$) <> 0 THEN 730
750   PRINT TAB(12*J);
760   GOSUB 640
770   PRINT LEFT$(DQ$,C);
780   J=J+1: IF J>6 THEN J=0: PRINT
790 WEND
800 PRINT
810 PRINT
820 GOTO 200
830 END
```

For those who like to key in programs from a whole master, here's the original:

```
100 REM     *** ANIMAL ***
110 REM     *** WRITTEN IN MBASIC BY LES BELL ***
120 REM     *** 9/21/82 ***
130 PRINT "'GUESS THE ANIMAL'"
140 PRINT "YOU THINK OF AN ANIMAL AND THE
150 PRINT "COMPUTER WILL TRY TO GUESS IT."
160 PRINT
170 OPEN "R",1,"B:ANIMAL.DAT"
180 FIELD #1,124 AS DQ$,2 AS DY$,2 AS DN$
190 N=LOF(1)
200 INPUT "ARE YOU THINKING OF AN ANIMAL";A$
210 IF A$="LIST" THEN 700
215 IF A$="END" THEN CLOSE: END
220 IF LEFT$(A$,1)<>"Y" THEN 200
230 K=1
240 GET #1,K
250 GOSUB 530 : REM ASK QUESTION
260 IF CVI(DY$) <> 0 THEN 240 : 'ASK ANOTHER QUESTION
270 GOSUB 640 : REM STRIP OFF SPACES FROM FIELDED STRING
280 PRINT "IS IT A ";LEFT$(DQ$,C);
290 INPUT A$
300 A$=LEFT$(A$,1)
310 IF A$="Y" THEN PRINT "ANOTHER ANIMAL?": GOTO 200
320 INPUT "THE ANIMAL YOU WERE THINKING OF WAS A ";AN$
330 PRINT "PLEASE TYPE IN A QUESTION THAT WOULD DISTINGUISH A
340 PRINT AN$;" FROM A ";
350 GOSUB 640
360 PRINT LEFT$(DQ$,C);
370 INPUT QU$
380 PRINT "FOR A ";AN$;" THE ANSWER WOULD BE ";
390 INPUT A$
400 A$=LEFT$(A$,1):IF A$<>'Y' AND A$<>"N" THEN 380
410 GOSUB 640
420 D$ = LEFT$(DQ$,C) : REM SAVE ANIMAL NAME
430 LSET DQ$ = QU$ : REM MOVE QUESTION INTO RECORD
440 X1 = N + 2: X2 = N + 1: IF A$ = "N" THEN SWAP X1,X2
450 LSET DY$ = MKI$(X1):LSET DN$ = MKI$(X2)
460 PUT #1,K : REM WRITE QUESTION RECORD
470 LSET DQ$ = D$:LSET DY$ = MKI$(0): LSET DN$ = MKI$(0)
480 PUT #1,N+1 : REM WRITE FIRST ANIMAL RECORD
490 LSET DQ$ = AN$
500 PUT #1,N+2 : REM WRITE SECOND ANIMAL RECORD
510 N = N + 2
520 GOTO 200
530 REM   SUBROUTINE TO PRINT QUESTIONS
540 GOSUB 640 : REM STRIP SPACES
550 PRINT LEFT$(DQ$,C);
560 INPUT C$
570 C$=LEFT$(C$,1)
580 IF C$<>'Y" AND C$<>"N" THEN 550
```

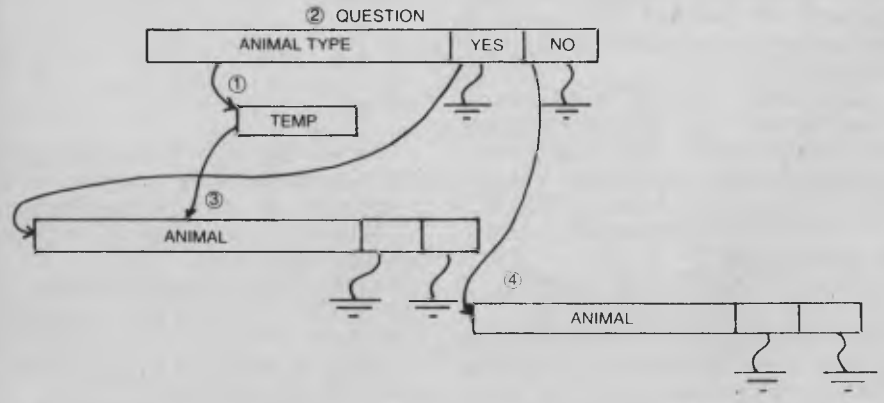
```
590 IF C$ = "Y" THEN K = CVI(DY$) : REM MOVE TO NEXT RECORD
600 IF C$ = "N" THEN K = CVI(DN$)
610 GET #1,K : REM GET IT
620 RETURN
630 REM SUBROUTINE TO ELIMINATE PADDING SPACES
640 C = LEN(DQ$)
650 WHILE MID$(DQ$,C,1) = " "
660   C = C - 1
670 WEND
680 RETURN
690 REM    *** ROUTINE TO LIST ANIMALS
700 PRINT: PRINT "ANIMALS I ALREADY KNOW ARE:"
710 J=0: I=1
720 WHILE I <= LOF(1)
730   GET #1,I:I = I + 1
740   IF CVI(DY$) <> 0 THEN 730
750   PRINT TAB(12*J);
760   GOSUB 640
770   PRINT LEFT$(DQ$,C);
780   J=J+1: IF J>6 THEN J=0: PRINT
790 WEND
800 PRINT
810 PRINT
820 GOTO 200
830 END
```

As mentioned above, this is a simple example of an artificial intelligence program, although it is certainly not very smart. Much more sophisticated programs, based on similar concepts of 'decision trees' but with the added ability to deal with 'fuzzy logic' and probabilities, are being developed to assist humans in decision-making, particularly in sciences like geology.

One last thing (before I forget): here's the program to create the 'starter' file:

```
100 OPEN "R",1,"B:ANIMAL.DAT"
110 FIELD #1,124 AS DQ$,2 AS DY$,2 AS DN$
120 FOR I= 1 TO 3
130 READ Q$,Y,N
140 LSET DY$=MKI$(Y):LSET DN$=MKI$(N)
150 LSET DQ$ = Q$
160 PUT #1,I
170 NEXT I
180 DATA "DOES IT SWIM",2,3
190 DATA "GOLDFISH",0,0
200 DATA "BUDGIE",0,0
```

It's pretty well self-explanatory. □



① MOVE ANIMAL NAME TO TEMPORARY STORAGE.
② REPLACE WITH QUESTION AND SET POINTERS TO LAST TWO RECORDS OF FILE, REVERSING POINTERS IF NECESSARY.
③ MOVE ANIMAL INTO NEW RECORD, SET POINTERS TO ZERO.
④ MOVE NEW ANIMAL INTO LAST RECORD, SET POINTERS TO ZERO.

Figure 1.

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PART XII

Les continues his Odyssey through the wilderness of BASIC with a look at various miscellaneous functions . . .

BACK WHEN we were working with screen-handling functions, you may have noticed the MID$ function hidden in there with no explanation. Well, here's the explanation.

BASIC offers several functions which assist in string handling. We've already seen how strings can be joined together (concatenated) by the '+' operator, so that, for example:

PRINT "The quick br"+"own fox"

will print: *The quick brown fox*.

On the other hand, how can you take strings apart? This can be achieved using the functions LEFT$, RIGHT$ and MID$.

Let's take as an example the string A$ = "The quick brown fox". The function LEFT$, as its name implies, will return the left part of the string, so the line:

210 B$ = LEFT$(A$, 7)

will set B$ equal to the seven leftmost characters in A$; in other words, "The qui".

The function RIGHT$ does a similar thing, except at the right end of the string. So RIGHT$(A$,7) is the string "own fox".

MID$ is a bit more complex. Its purpose is to extract a substring from the middle of a string. For example, MID$(A$,4,7) will move an imaginary 'pointer' to the fourth character in the string, and then extract the next seven characters. In this case, it will return the string "quick b".

More succinctly, the function MID$(A$,X,Y) will return a string of Y characters, extracted from string A$ starting at position X.

Now all these functions are useful as long as you know exactly at what positions you are going to carve a string up. Unfortunately, text input is made up of words of varying lengths, and so we cannot assume that spaces, for example, will always be in the same positions — unless we are using an artificially structured language, for example.

This is why some languages, like COBOL, expect certain information in certain positions on punched cards. (It's because the compilers that operate on the input programs are a bit simple-minded, poor things.)

Fortunately, BASIC is a bit smarter than that, and most BASIC interpreters will have a function which can find the position of a given character or string in another larger string. In Microsoft BASIC, this is the INSTR function, which comes in two flavours.

The simple INSTR looks like this:

X = INSTR(A$,"fox")

and will set X equal to 17, since that's the position of the first character of the string "fox". It starts searching the string at the first character, and then finds the first occurrence of the string it's looking for. If it finds the string, it returns its position; if it doesn't, it returns zero.

What would happen with a string like "The quick brown fox jumped over the slow brown fox"? Using the simple version of INSTR to find the string "fox", it would never find the second occurrence of the string. Obviously, we need something a bit smarter.

The smart version of INSTR looks like this:

X = INSTR(Y,A$,"fox")

Now, with Y set equal to zero or one, the search will start at the beginning of the string, and it will find the first occurrence of the word "fox".

However, with Y set to any other number, the search will start with the 'Yth' character. If Y is greater than 17, it will find the second occurrence of the string.

Therefore, to find all occurrences of a pattern in a string, you need a loop that will look like this:

```
200 I = INSTR(A$,B$)
210 do something with I, A$ and B$
220 I = INSTR(I+1,A$,B$)
230 IF I <> 0 THEN 210
```

That will keep looping round and round until it has found every occurrence of B$ in the string A$. You can use this technique to count the number of words in a line and similar tricks.

To help with figuring out the values for LEFT$, RIGHT$ and MID$, one particularly useful function is LEN. This returns the length of a string, so that, for example, LEN("The quick") is 9.

One useful trick that can be performed with these string-handling functions is to dissect names. Generally, a file of names and addresses would be indexed on surnames, and so we have hitherto written our file manipulation programs to explicitly ask for the surname before the christian name.


This month, in the wilderness...
OK... WE ALL KNOW HOW TO CONCATENATE STRINGS...
...ON THE OTHER...PAW.... HOW CAN YOU TAKE THEM APART..?
...THIS CAN BE ACHIEVED USING THE FUNCTIONS LEFT$...
...RIGHT$.... AND MID$...ER.. AH..THANK YOU, ELVIS
...HARDLY MICROSOFT EH? EH...HEH HEH HEH...AH... LITTLE "IN" JOKE...HEH HEH...
OOK OOK!
WHOOP WHOOP
SNORT
HOOT
WHINNY!
HOOT
...ANYHOW...A USEFUL TRICK IS DISSECTING CHRISTIAN NAMES FROM SURNAMES...AND..
HEY!...THE LABORATORY RATS LIBERATION FRONT OBJECT TO THAT FILTHY WORD...
...AND SO...WE OFF!
CHRISTIANS...?! WHERE?..
...INCIDENTALLY, COM.DEC.(COME DECEMBER) ISSUE, WE'LL HAVE SOME LOGIC...
...AND SOME CHRISTIANS!
NO! NO! NOT ME! HIM!
©B.J.AKHURST.82.3

```
100 INPUT "Input a name";N$          'obvious by now, I hope
110 P1 = INSTR(N$," ")               'find the first space
120 P2 = INSTR(P1,N$,".")            'then the dot after it
130 C$ = LEFT$(N$,P1-1)              'extract the first name
140 IF P2 = 0 THEN 180               'is there an initial?
150 S$=RIGHT$(N$, LEN(N$)-P2-1)      'yes, extract surname
160 I$ = MID$(N$,P1,4)               ' then initial
170 GOTO 200                         'and jump to print line
180 S$ = RIGHT$(N$,LEN(N$)-P1)       'no initial, get surname
190 I$ = " "                         'and set initial to blank
200 PRINT N$,S$;", ";C$;I$           'print the result
210 GOTO 100
```

However, people generally write names down christian name first, then initial, then surname. Being able to take a name written in this form and extract the surname is a useful trick: here it is.

In this program N$ is the full name as it is input, C$ is the christian name, I$ the initial and S$ the surname. It works by looking for the first space which will follow the christian name, then looking from that point forward for the full stop which indicates an initial, and then stripping off the surname which must follow.

There are several other useful miscellaneous functions for handling strings. SPACE$(X), for example, will return a string of X spaces. A similar function, SPC(X), will print X spaces on the terminal or screen.

Similar to SPACE$ is STRING$(X,Y). This function will return a string X characters long, consisting of the ASCII character Y repeated X times. So, STRING$(5,43) would be "+++++". If the second argument to the function is itself a string, then the function will just use the first character. So STRING$(5,"(A)") will be "(((((", *not* "(A)(A)(A)(A)(A)".

To convert a numeric variable into a string can be useful on occasions — for example, to take apart a part number which is constructed on some logical basis such as department numbers, and so on.

This is achieved by the function STR$(X), which will return a string representing the number X. Of course, the same thing can often be achieved by dividing by 10 or multiples of 10 and using the INT function, but this is quicker and more elegant. If you've got it, flaunt it!

The reverse function is available — VAL(A$) will convert A$ into a numeric variable. As it does it, it will strip leading spaces, redundant plus signs and the like.

As you probably know, characters inside the computer are maintained in the ASCII (American Standard Code for Information Interchange) code. Characters can be converted to and from this code using two more functions, and this can be very useful on occasions. For example, how do you print a quote symbol (")?

The most transportable way to do it is to look up its value in the ASCII code and then convert that into a string using the CHR$ function. So, PRINT CHR$(34) will print a quote. If you want to see all the characters which can be displayed by your terminal or computer, you can usually write a small program to output all the possible ASCII codes.

```
10 FOR I = 1 TO 127
20 PRINT CHR$(I)<30 NEXT I
```

In all probability, the results will turn your screen crazy, and may even send some terminals into self-test mode (which will generally display all the characters anyway!).

If this happens to you, change line 10 to FOR I = 32 TO 127 (which removes the control characters from 1 to 32), which should be less disastrous. If your computer has chunky graphics, you may be able to see those by changing line 10 to FOR I = 1 TO 255, but the same *caveat* applies.

The reverse function is ASC(A$) which returns the ASCII code for the first character of A$. So ASC("ABCDE") is 65.

PEEKing And POKEing

While BASIC was originally intended for writing simple applications programs, typically in engineering work, it has increasingly been pressed into use for what is called systems programming: that is, programs which are intended to function as part of the operating system of the computer.

This has primarily come about because on some machines BASIC is the only language and there is no operating system.

Systems programming typically involves dealing directly with memory locations, and so microcomputer BASICs provide a statement and a function to assist with this. The function POKE X,Y will place the integer value Y (in the range 0 to 255) into memory location X.

The PEEK function does the reverse. The statement Y = PEEK(X) reads the contents of location X and assigns it to the variable Y.

Now, while PEEKing is fine and dandy most of the time, POKEing is fraught with hazards. Your BASIC interpreter looks after certain locations in memory and uses it for its own purposes, and the results of POKEing many locations in memory are unpredictable to say the least. You could accidentally alter part of the BASIC interpreter, causing disastrous results.

PEEKing is generally safe, although there is one potential danger in systems like the TRS-80 which use memory-mapped I/O (in other words, what you think are memory locations are in fact I/O ports). In such systems, reading a memory location can alter the machine's status, causing errors.

In general, though, you can use PEEK to examine memory and find out how your system makes use of its memory. Here's a short program which displays the contents of memory from E000 hexadecimal to F000 hex:

```
10 FOR N=&HE000 TO &HF000
15 IF N/16-N\16=0 THEN PRINT:
   PRINT HEX$(N);"    ";
17 IF PEEK(N) < 16 THEN PRINT "0";
20 PRINT HEX$(PEEK(N));" ";
30 NEXT N
```

Despite its length, this program illustrates several new points. First, notice in line 10 that Microsoft BASIC will accept hexadecimal constants in the form &Hxxxx. Octal constants are okay too, and they have the prefix &O or just &. So &O377 is really 255.

The first part of line 15 is used to check whether N is divisible by 16. The first division is a real number division, while the second one is an integer division. Subtracting one from the other leaves the remainder from the real division, and only if this is zero is N a multiple of 16.

If it is a multiple of 16 then we print a carriage return and linefeed, then print out the hexadecimal value of N — the address being examined.

The function HEX$ converts the value of integer N into a string representing its hex value. If N is less than 16, HEX$(N) will be a single digit, as the function suppresses leading zeros. So in line 17 we check to see whether the memory location being examined is less than 16, and if it is, we supply a zero to keep the dump listing even.

Line 20 prints the hex value of memory location N, followed by a space, and line 30 goes round the loop again.

With suitable modification, you can use this program to have a look into your own computer. Here's a suggestion for a modification: check to see whether the location being PEEKed contains a printable ASCII value, and if it does, print that character using CHR$(PEEK(N)). This will make areas of text in memory easy to spot, and you can find the keyword tables inside your BASIC interpreter, as well as error messages, and so on.

Next, on to logic and error handling. □

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PART XIII

Les continues his bash into BASIC with a look at logic . . .

WE ALL know computers are logical beasts at heart — they can't even add two numbers together, but instead fudge an answer with a bit of ANDing and ORing. Now, in a high-level language like BASIC, you don't have to worry about all that, you just write X = Y + Z and the BASIC interpreter does the rest.

Nonetheless, there will be times when you will want to do some logical things, and BASIC does provide some ways for you to do it. First, let's examine what logic is all about.

Logic was invented by the ancient Greeks, and really consists of a set of rules for manipulating and combining statements to make other statements about which we know the truth or falsehood. Basically, there are only about four rules we need to know for what is called combinational logic.

The rules we will use were discovered by an Irish mathematician of the last century called George Boole, and for that reason, they are called Boolean arithmetic.

Firstly, computers know nothing about true and false; they operate internally on zeros and ones. Therefore, what we have to do is define true and false in terms of ones and zeros. Many languages define false as zero and true as one, and this is typically used in assemblers with conditional assembly, macro processors and the like.

Be aware, however, that some languages, notably Pascal, have special variables which can take on the values of true and false (although internally, we're still back to 0 and 1).

The first rule of logic is the NOT rule, which says how the NOT operator works. This simply says that NOT true equals false and NOT false equals true. That seems perfectly simple, and compatible with our everyday experience. Not so simple for the computer.

The computer will perform the NOT operation on every bit which makes up a number — in other words taking the one's complement of the number. In 16-bit binary arithmetic, which is how the computer does its logic, NOT 0 is not 1; instead it is 0FFFF hex, which in two's complement arithmetic is –1. So now we know that NOT 0 is –1, and NOT –1 is 0. So our symbols for true and false must be 0 and –1.

Which one is true and which is false? In fact, false is 0 and true is –1. Actually, when the NOT operator is not involved, the computer will interpret 0 as false and any non-zero number as true. However, if you intend to use the NOT operator, you must make sure you use the right values, as NOT 1 is –2, which is not false. Gee, this gets confusing.

The easiest way to keep yourself straight is to start your programs with the assignments:

```
100 FALSE = 0
110 TRUE = NOT FALSE
```

so that FALSE = 0 and TRUE will be assigned the value of –1 or whatever your computer thinks TRUE should be.

The next rule relates two statements via the AND operator. If A is true and B is true, then A AND B is true, otherwise it is false. So if either A or B or both are false, then A AND B is false too.

This is usually shown in what is called a truth table:

A	B	A AND B
false	false	false
false	true	false
true	false	false
true	true	true

Figure 1. AND Truth Table.

So we see that A AND B is only true if A and B are both true.

The next operator is called OR, and performs a similar function, except that A OR B is true if either A or B or both are true. Here's the truth table:

A	B	A OR B
false	false	false
false	true	true
true	false	true
true	true	true

Figure 2. OR Truth Table.

Finally, there's an operator called XOR (exclusive OR). A XOR B is true only when A or B is true, but not both. In other words, and this is a more useful way of looking at it, if A and B are the same A XOR B will be false, but if they are different, A XOR B will be true. Here's the truth table:

A	B	A XOR B
false	false	false
false	true	true
true	false	true
true	true	false

Figure 3. XOR Truth Table.


OK...THIS MONTH...LOGIC & ERROR HANDLING...
...WITH THE HELP OF MY TWO IRISH MATHEMATICIAN FRIENDS...RIGHT?
ROIGHT
ROIGHT
BOINARY LOGIC...
...TO BE LOGICAL IS TO BE BELIEVABLE...RIGHT?
ROIGHT
ROIGHT ENOUGH
& IF YOU WERE RIGHT ALL THE TIME, YOU'D BE ABSOLUTELY LOGICAL!...RIGHT?
...& THEN EVERYONE WOULD BELIEVE IN YOU 'CAUSE YOU'RE NEVER WRONG & THIS WOULD GIVE YOU POWER!...RIGHT?
...GOOD!..HEH HEH...LISTEN TO THIS...THE 1ST RULE OF LOGIC SAYS THAT NOT TRUE IS FALSE... ...& NOT FALSE'S TRUE!...RIGHT?
ROIGHT
ROIGHT
...ER... ...ROIGHT..
ROIGHT!
ROIGHT!
SO!...IF NOT FALSE IS TRUE & YOU NEVER USE NOT TRUE, YOU'RE NOT WRONG & YOU NEED NEVER BE WRONG BECAUSE YOU'RE RIGHT!..RIGHT?
NOW!...HERE'S MY INFALLIBLE PLAN FOR COMPLETE POWER!
...GREMLINS?..WE GO TO 'YOUR COMPUTER' AS GREMLINS?... ...HMM...
ROIGHT! ROIGHT!
ROIGHT AN' ALL!
OIK!*
SNAP
* IRISH FOR 'EEK'
..YEAH...YOU CAN REWRITE HE TRUTH-TABLE PROGRAM SPILL COFFEE ON THE KEYBOARD...
...STUFF THE MEMORY DRIVE... ...HIDE THE STICKY TAPE...
OI'VE GOT ME MAGNET READY
BEGORRAH! IS THAT WHUT YER CALL IT?
URGENT DELIVERY 4C
Merry Christmas to Your Computer
...THIS..THIS IS...ILLOGICAL & UNBELIEVABLE...WHAT KIND OF OPERATIONS WILL (MASSA) LES BELL PERFORM WHEN HE GETS HIS HANDS ON PUBLISHER WHELAN'S LOGICAL EXPRESS--IONS....WAIT WITH BAITED BREATH, ON TENTERHOOKS, IN ANXIOUS EXPECTATION & AVID ANTICIPATION FOR A MERRY CHRISTMAS & HAPPY NEW YEAR!
©B.J.AHURST.82..

Now, how does all this translate into useful programming techniques? First here's the NOT operator, applied to different values:

```
10 A = 0:PRINT A,NOT A
20 A = 1:PRINT A,NOT A
30 A =-1:PRINT A,NOT A
```

When you run this program, you see that NOT works okay for 0 and –1, but not for 1, which is why it's better to use –1 for true. However, 1 will still work for true for the other functions, as this short program will show:

```
10 PRINT "A","B","A AND B","A OR B","A XOR B"
20 FOR A = 0 TO 1
30 FOR B = 0 TO 1
40 PRINT A,B,A AND B, A OR B, A XOR B
50 NEXT B
60 NEXT A
```

When run, this program will generate the truth tables for the remaining operators. As long as the NOT operator is not involved, you're quite safe using 1 for true.

Here's a more 'correct' version of the program:

```
10 FALSE = 0
20 TRUE = NOT FALSE
30 PRINT "A","B","A AND B", "A OR B","A XOR B"
40 FOR A = FALSE TO TRUE STEP -1
50 FOR B = FALSE TO TRUE STEP -1
60 PRINT A,B,A AND B,A OR B, A XOR B
70 NEXT B
80 NEXT A
```

In this case, true is defined as NOT false. Note also that as true is less than false, the FOR statements must have the STEP —1 option to work, otherwise nothing will happen.

Now, all this is leading to the way the IF statement works. Previously we've only used it in tests for equality and similar ways:

100 IF X = 0 THEN 240

What the IF statement does is evaluate the conditional expression which immediately follows the IF. If it is true the rest of the statement is executed, otherwise execution continues with the next statement, or the ELSE clause if there is one.

The trick is that it's perfectly feasible to use a Boolean expression or a variable as the conditional expression. So:

130 IF A THEN 240 ELSE 270

will jump to 240 if A is true, or 270 if it is false. You can also say:

130 IF A AND B THEN 240 ELSE 270

which will jump to 240 if both A and B are true and 270 otherwise.

This allows the construction of programs like the following section of code for a hypothetical computer-based burglar alarm:

```
260 IF TIME > 20 THEN NITIME = TRUE


730 WINDOW = INP(PORT)
740 IF WINDOW AND NITIME THEN GOSUB 1200
    REM WARN OF OPEN WINDOW
```

This will warn of an open window after 8 pm (20:00 hours). All kinds of operations are possible using logical expressions. As an example, you might try rewriting the truth-table program to print 'true' and 'false' instead of 0 and –1. □

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PART XIV

A tidy printout is the goal of almost every programmer; it makes programs so much nicer to use. In this part of the series, Les Bell introduces Microsoft BASIC's PRINT USING statement . . .

MANY BUSINESS programmers will quote one of the principal virtues of COBOL as being its ability to format neatly output so the columns all line up, there are commas between three-digit groups and so on. If that's all that's keeping COBOL alive, then BASIC will soon knock it off its pedestal, as this chapter will show.

Microsoft BASIC, as described in this series, offers an extension of its PRINT statement called PRINT USING, which gives the programmer almost complete control over the way results will be printed. It can be used to print two types of data: numeric and string.

The basic format of the PRINT USING statement is:

PRINT USING (format string);
(expression list).

Note the format string can be either a string constant enclosed in quotes, or a string variable, such as A$. The expression list is formed in just the same way as a standard PRINT statement.

Numeric Data

The major application of PRINT USING is in printing numbers, primarily in commercial reports, and as we shall see, its features are oriented to this area.

The way PRINT USING works is that the format string specifies a field format using a special set of characters. To take the simplest example, the '#' symbol indicates a numeric position. So, for example:

```
PRINT USING "###.##";23.477
```

will produce the result 23.48.

If the number to be printed has fewer digits than there are numeric positions, then the number will be right-justified (that is, pushed to the right) and preceded by spaces as necessary.

The decimal point character inserts the point at the appropriate position. If there is a numeric position in front of the decimal point, it will always be filled, with a zero if necessary. Digits after the decimal point will be rounded if necessary, as shown above.

Accountants traditionally represent negative balances with a minus sign at the right-hand end of a number, while the scientific/mathematical world puts it at the left. With PRINT USING, either format can be used.

If no action is specified, BASIC will put a minus sign at the beginning of a number as usual. However, if a minus sign is placed at the right end of the formatting string, then negative numbers will be printed with a trailing minus sign. Positive numbers are unmodified. For example:

```
PRINT USING "###.##-  ";345.23,-234.12,.678
345.23   234.12-    0.68-
```

Notice also in this example that the format string contained spaces which were also reproduced in the output.

If the sign is always required to be shown, a '+' sign can be placed at either end of the format string. In this case, positive numbers will be printed with a '+' sign at the appropriate end, and negative numbers with a '-'. An example:

```
PRINT USING "+###.##  ";72.37,4.712,-20.05
 +72.37    +4.71   -20.05
```

When people write numbers down, they commonly separate the digits before the decimal point into groups of three separated by commas. PRINT USING can do that too. A comma before the decimal point will perform digit grouping into threes, but note that a comma at the end of the format string will be taken literally as a comma.

```
PRINT USING "#######.##";6543210.98
6,543,210.98
```

In the printing of financial reports, most of the numbers printed will be dollar values, and it would be nice to have '$' signs printed at the beginning of each number.

No problem: a double dollar sign at the beginning of the format string stands for two character positions, one of which will be occupied by a dollar sign when printed:

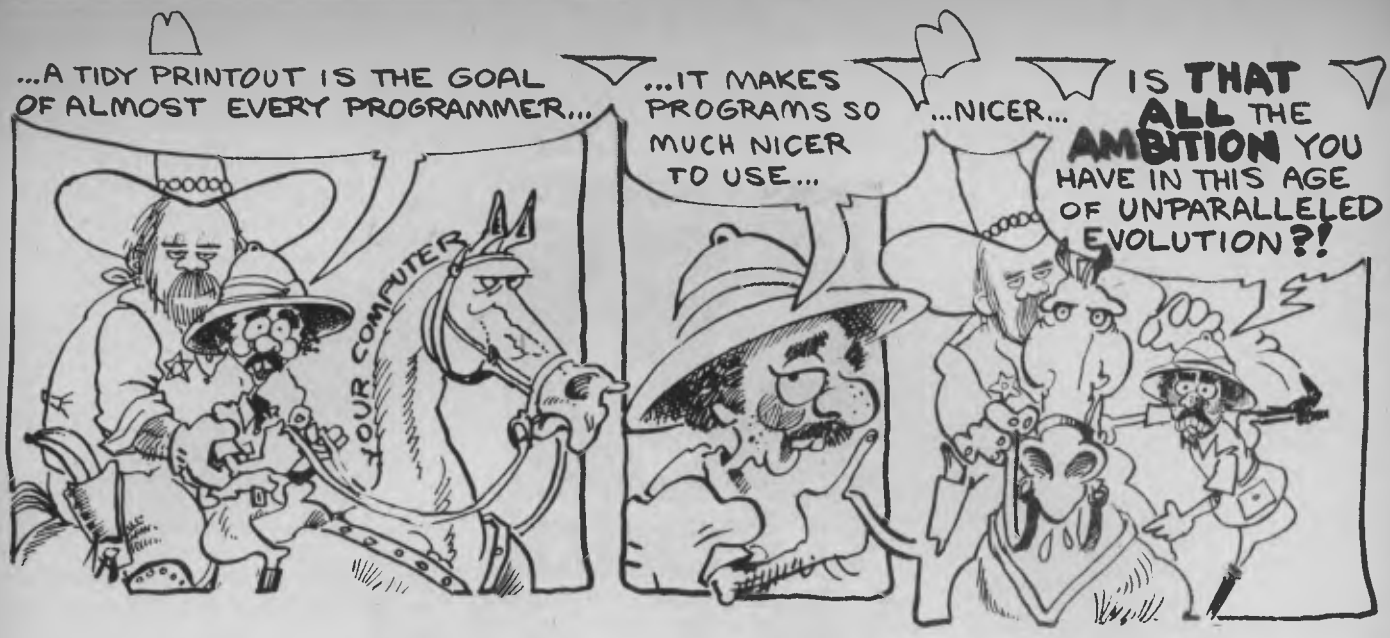
```
PRINT USING "$$#######,.##-  ";452339.37,230120.45,-128792.04
$452,339.37   $230,120.45   $128,792.04-
```

A common requirement is to do cheque printing, and here certain precautions must be taken to prevent fraudulent alteration of cheques.

A double asterisk will cause leading asterisks to be printed before a number, so there is no room for additional digits:

```
PRINT USING "**##,.##-  ";23.45,-.6,16
**23.45   ***0.6-   **16.00
```

In the same fashion as the double dollar sign, the asterisks stand for character positions.



These two formats can be combined into the '**$' format:

```
PRINT USING "***$####.##";
*****$23.45    $230.120.45

                  ";23.45,230120.45,2390.00
                   **$2,390.00
```

In case you are wondering, '$$*' has no meaning as a format string, and will be ignored by your BASIC.

For scientific types who want to force every number printed into exponential or scientific notation, a series of four carets (up-arrows) after the digit position characters forces E-format. The four carets allow room for 'E+dd' to be printed:

```
PRINT USING "+#.##^^^^";123.45
+1.23E+02

PRINT USING "+.####^^^^";123.45
+.1235E+03
```

If you require one of these formatting characters such as the up-arrow to be output as part of a numeric field, it can be printed using the underscore character as an escape. So:

```
PRINT USING "_###";24
#24
```

Overflow of the field length is possible, in which case BASIC will print the number as best it can, preceded by a per cent symbol.

String Fields

String field lengths can be specified using a very simple format: a format string consisting of backslash, **n** spaces and another backslash specifies that n+2 characters from the string will be printed.

If there are not enough characters to fill the field, the string will be left-justified and padded with spaces to the right. For example:

```
5 A$ = "HELLO THERE"
10 PRINT USING "\   \";A$
20 PRINT USING "\     \";A$
30 PRINT USING "\       \";A$
40 PRINT USING "\         \";A$
50 PRINT USING "\           \";A$
RUN
HELL
HELLO
HELLO TH
HELLO THER
HELLO THERE
Ok
```

To print only the first character of a string, use the format string '!'. For example:

```
PRINT USING "!";"Now is the time"
N
```

Finally, in some situations, you might want to output a variable-length string field through a PRINT USING statement. To do this, use the format string '&'. Here's an example:

```
PRINT USING "&","Now is the time"
Now is the time
```

PRINT USING can also be used to print to disk files; just use:

```
PRINT#n USING <format string>;<expression list>
```

□

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tutorial

PART XV

As we draw to the end of this course in BASIC programming, Les Bell turns his attention to error handling and debugging . . .

WE ALL make mistakez from time to time; yours truly is no exception — I do things like inputting silly values into programs by accident and then wondering why the program just collapsed into a quivering heap.

This month, we'll learn how to avoid such disasters.

When I was but a little boy, learning programming for the third time at university, we engineers used to use a fair-sized time-sharing mainframe. It used to be a favourite game of spotty little first-year wimps to try and crash the system. While the system was armoured against such facile ploys as dividing by zero there were other ways of bringing the system to a halt and thereby losing everybody's work.

With a single-user microcomputer, there's no need to armour-plate your programs against other users, but it is still advisable to try to make your programs as foolproof as possible. In any program, there are all kinds of ways invalid data can be input or somehow be derived during a run, giving rise to any of a number of curious error messages from the BASIC interpreter or, if you're unlucky, total silence or even a scrambled disk file.

Microsoft BASIC, the most common variant, has 39 or even more error messages. These can range from a terse '?SN' issued by the smaller versions of the language to the slightly more comprehensible messages of the extended and disk versions. What this means is that there are 39 or so things that can go wrong while your program is running, and it may be that your operator will be confronted by a cryptic error message.

Wouldn't it be better to have the computer 'trap' that error and either attempt to do something sensible to correct it or explain the situation to the operator in a rather more (dare I say it?) 'user-friendly' way? MBASIC provides a way to do that using the ON ERROR statement.

This takes the form ON ERROR GOTO xxxx, and enables error trapping. After this statement has been executed, any error will cause a jump to the specified line, which should be the first line of an error routine. Error trapping can be disabled using the statement ON ERROR GOTO 0, which will cause MBASIC to issue its standard error messages.

The error-handling routine may perform several different functions. The first thing most routines will have to do is identify the error type, which is stored in a 'reserved' variable named ERR. The line number at which the error occurred is also stored, in the variable ERL.

Once the error has been identified, an attempt can be made to recover from it or, alternatively, the program can be aborted. If recovery is attempted, normal operation is resumed with the RESUME statement. This takes several forms. RESUME will resume execution at the statement which caused the error, while RESUME NEXT will resume at the following line. RESUME xxxx will resume at line xxxx.

Examples

A common mathematical problem is finding the roots of a quadratic equation; that is, an equation of the form:

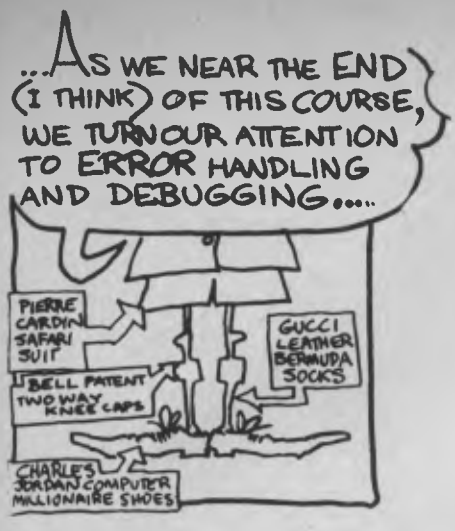
$$ax^2 + bx + c = 0$$

There are several possible results: either the two roots will be real, and possibly equal, or they will be imaginary. The formula for finding the roots is:

```
R1, R2 = (-B +/- SQR(B*B-4*A*C))/(2*A)
```

If B * B — 4 * A * C is negative, then the roots are imaginary; the problem is that we will be attempting to find the square root of a negative quantity and BASIC will normally respond with an 'Illegal Function Call' error message.

The obvious thing to do is to test before performing the square root calculation to find if the argument is negative and jump to the appropriate routine, but for the sake of demonstrating error handling we'll do it differently. We'll go ahead and try to take the square root, trapping



the error if the argument is negative and then jumping to the imaginary root routine.

Here's one way to do it:

```
100 REM      *** QUADRATIC ROOT FINDER ***
110 REM      *** WRITTEN IN MBASIC 5.2 ***
120 REM      *** 2/10/83, LES BELL     ***
130 REM
140 PRINT TAB(16);"Quadratic Equation Solver"
150 PRINT: PRINT:
160 INPUT "A";A
170 INPUT "B";B
180 INPUT "C";C
190 ON ERROR GOTO 1000
200 D = SQR(B*B-4*A*C)
210 R1 = (-B + D)/ (2 * A)
220 R2 = (-B - D)/(2 * A)
230 PRINT:PRINT:PRINT "Root 1 is ";R1
240 PRINT "Root 2 is ";R2
250 END
1000 PRINT:PRINT:PRINT "Imaginary Roots"
1010 R1 = -B/(2*A)
1020 I1 = SQR(ABS(B*B-4*A*C))/(2 * A)
1030 PRINT "Roots = ";R1;" +/- i";I1
1040 END
```

This program will calculate the roots of a quadratic equation, given the values of a, b and c. It's a little unconventional, but does demonstrate the operation of the ON ERROR GOTO statement in line 190. The routine at 1000 takes care of the case where the roots are imaginary.

Another use of ON ERROR GOTO is in file handling. Occasionally it will happen that a file does not exist or a disk may be full, and rather than a cryptic message, an error-handling routine can offer the operator the chance to recover from the error.

Here's an example where a file is opened for input (this is only a program segment, but it makes the point):

```
130 INPUT "File Name";A$
140 ON ERRDR GOTO 3000
150 OPEN "I",1,A$
160 INPUT#1,C$,N
.
.
3000 IF ERR = 53 AND ERL = 150 THEN GOTO 3100
.
.
3100 PRINT "File does not exist!";CHR$(7)
3110 INPUT "Try another";A$
3120 RESUME
```

Line 140 sets up the address of the error handler, and line 150 tries to open the file. If the file is not found (error 53) control is passed to line 3000, which tests for that particular error using the ERR and ERL variables and then jumps to 3100.

This is the error handler proper, which offers the operator the opportunity to enter another filename. The RESUME statement transfers control back to the statement at which the error occurred, to try again.

Tracing Program Flow

Often when a program is executing you may have no idea of what it's actually doing. However, Microsoft BASIC provides a very useful facility for tracing your program as it executes.

The TRON statement turns the trace option on, and from then on the line number will be printed (inside square brackets) as each line is encountered by the interpreter. TROFF disables the tracing. Both statements may be entered from the keyboard in the usual way, or they may be used as executable statements inside a program, to enable tracing of a section only of a program.

Here's an example of TRON at work — in this case tracing the quadratic root finder above:

```
BASIC-80 Rev. 5.2
[CP/M Version]
Copyright 1977, 78, 79, 80 (C) by Microsoft
Created: 14-Jul-80
15430 Bytes free
Ok
LOAD "QUAD"
Ok
TRON
Ok
RUN
[100][110][120][130][140]
                Quadratic Equation Solver
[150]

[160]A? 1
[170]B? 4
[180]C? 4
[190][200][210][220][230]

Root 1 is -2
[240]Root 2 is -2
[250]
Ok
RUN
[100][110][120][130][140]
                Quadratic Equation Solver
[150]

[160]A? 1
[170]B? 1
[180]C? 1
[190][200][1000]

Imaginary Roots
[1010][1020][1030]Roots = -.5  +/- 1.866025
[1040]
Ok
SYSTEM
```

Notice that even REM statements show up in the trace, as do all the other PRINT, INPUT and LET statements. You can clearly see in the second run how the program jumps to line 1000 after line 200, because it can't calculate the square root of a negative number.

Similarly, I used this facility to trace the operation of the file-opening program segment above. Here's what it looked like:

```
BASIC-80 Rev. 5.2
[CP/M Version]
Copyright 1977, 78, 79, 80 (C) by Microsoft
Created: 14-Jul-80
15430 Bytes free
Ok
LOAD "ERR"
Ok
TRON
Ok
RUN
[130]File Name? FRED
[140][150][3000][3100]File does not exist!/
[3110]Try another? GROT
[3120][150][3000][3100]File does not exist!/
[3110]Try another? ^C
Break in 3110
Ok
SYSTEM
```

The other major debugging technique used in BASIC is inserting PRINT statements throughout a program to print the values of variables as loops are processed and so on. For example, in the quadratic root finder, the value of the intermediate variable D could help in debugging.

In the case of the sort routines we worked on earlier, the index pointers and other loop variables would be helpful — and in fact this technique, combined with TRON, was exactly how I debugged those programs.

This brings us to the end of this introduction to BASIC — I'll round off with a look at CBASIC and North Star BASIC, the two other major BASIC variants. □

your computer

tutorial

PART XVI

Les Bell wraps up his series on BASIC with a comparison between Microsoft BASIC and CBASIC . . .

UP TILL NOW, all the examples in this series have been written in Microsoft's MBASIC, probably the most common variant of BASIC on microcomputers. However, the reader should be aware there are many other versions of BASIC available. In this article, I will look at one of them — CBASIC 2 — and briefly mention others.

CBASIC 2 was one of a line of programs which started when Gordon Eubanks wrote a BASIC compiler during his student days at the Naval Postgraduate School in Monterey, California. That compiler, BASIC-E, was written in PL/M, the Intel high-level language, and is now in the public domain. The complete source code for BASIC-E is in the CP/M User Group library, and anyone who has a PL/M compiler can customise it to his or her heart's content.

What makes BASIC-E and CBASIC fundamentally different from MBASIC is that the former are compiled languages. MBASIC is interpreted — in other words, you type your program into the interpreter, which stores it, and that is what actually runs (I know, I'm ignoring BASCOM).

CBASIC programs, on the other hand, are entered into a file using a text editor such as ED or Wordstar in non-document mode. The CBASIC compiler is then invoked by typing 'CBAS2 progname', and it reads in the source code and produces an output file called progname.INT (for intermediate).

Then, by typing CRUN2 progname, the intermediate code file is loaded and executed. Note the compiler produces pseudo-code (that is, machine code for an imaginary machine) which is then interpreted by the run-time package, CRUN2.COM.

Because only pseudo-code need be distributed, and not source code, CBASIC has long been popular with authors of commercial software. Compilation has another advantage for authors: the addition of comments makes no difference to the size of the resultant object code, so liberal use of REMs is quite justifiable!

CBASIC has another appealing feature for authors of business programs: all CBASIC arithmetic is done using 14-digit floating-point decimal numbers. This means there are no rounding errors in conventional arithmetic, as happens in BASICs which use floating-point binary numbers. No fractions of cents can be siphoned off into the programmer's account, as has happened in some computer installations!

Looking at a CBASIC program, the first thing the reader will notice is the comparative absence of line numbers. Because the user can insert lines at any point using a text editor, line numbers are not required for editing purposes. They are, however, still required as the targets of GOTO, GOSUB, and the like. However, they need not be in sequence, and they can consist of any decimal numbers — including fractional parts or even exponents! But be aware that 123 is a different line number from 1.23E2.

Apart from that obvious difference, simple MBASIC and CBASIC programs will look fairly similar. The remaining differences are primarily of detail, such as the RND function not taking an argument in CBASIC. The INPUT statement does not automatically supply a '?' after a prompt, allowing the user to use ':' or '-' if he or she wants to.

PRINT statements work slightly differently: comma separation of data items breaks the print line into fields 20 characters wide, while semicolons work the same way as in MBASIC.

CBASIC is particularly good at supporting a structured programming style. For example, functions can be defined by the user in a similar way to that allowed by MBASIC, but multi-line functions are also allowed, giving the feature particular power.

In addition, CBASIC supports the WHILE/WEND construct (as do later versions of MBASIC). This is a kind of loop


...THE WRAP UP....
UNTIL NOW, DEAR FRIENDS, WE'VE HAD THIS SERIES AS OUR COMMON BOND...
...NOW, AT SWEET XVI ...THE END, FINAL... ...FINISHED...COMPLETE ...SAD...
...ONE DAY, HOWEVER, WE EACH MAY LOOK BACK & SAY, "BASIC HAS LIVED ON IN ME, ...I HAVE BORNE IT STILL... ...STILL BORNE, SO TO SPEAK..."
...WE ARE HERE, DRAWN TOGETHER (ARTIST'S LAST PUN) TO PAY OUR 'LAST RESPECTS' TO OUR VALUED FRIEND..
ENDING A PROFITABLE RELATIONSHIP...
PLEASE, DON'T BE AFRAID TO LET YOUR FEELINGS SHOW...
VALUED..?
PROFITABLE?
PROFITABLE?
PROFITABLE?
SIDCHROME SPANNER?!
PROFITABLE?
PROFITABLE?
*GIRAFFES AREN'T GOOD LISTENERS
AND SO.....
THE LOOT'S IN THE COFFIN
WHERE'S OUR SHARE OF THE PROFITS?!
PIRATE!
BAD FELLOW
CAD!
BOUNDER!
MY TURN NEXT!
BLAGGARD!
SWOIN!
R.I.P.
©BJ.AKHRT83.....

(similar to FOR/NEXT) which relies on repeated testing of a condition, rather than repeating a specified number of times.

The basic logic is this: WHILE a particular condition exists, every statement down to WEND will be done, and then control will pass back to the WHILE to test for the condition again. If the condition is not met, execution continues after the WEND.

Note that this means it is quite possible for the condition to fail the first time the WHILE is encountered, so that the body of the WHILE is never executed. Thus we will often have to ensure variables being tested have sensible values before the WHILE.

Listing 1 shows an example of a simple CBASIC program. This is a version of the simple guessing game developed back at the beginning of this series. By dint of some rearrangement, I have managed to dispense with line numbers altogether, using two WHILE loops to control the program flow.

```
REM   Guessing Game Version 2.1
REM   Programmed in CBASIC-2
REM   3/3/83
REM   Execute an INPUT before RANDOMIZE
    INPUT "Hi, there, what's your name?";NAME$
    PRINT "OK ";NAME$;", do you want to play a guessing game";
REM PLAY$ controls the outer loop using WHILE - no GOTO
    INPUT PLAY$
REM The RANDOMIZE statement uses your delay in answering \
    the INPUT PLAY$ statement to seed the random number \
    generator.
    RANDOMIZE
REM We're only interested in the first char. of PLAY$ being \
    "Y" or "y"
    WHILE UCASE$(LEFT$(PLAY$,1)) = "Y"
        NUMBER = INT(99*RND+1)
        PRINT "I'm thinking of a number between 1 and 100"
        PRINT "You've got to try to guess it."
        INPUT "What's your guess?";GUESS
        WHILE GUESS NE NUMBER
            IF GUESS > NUMBER THEN PRINT "Too high"
            IF GUESS < NUMBER THEN PRINT "Too low"
            INPUT "What's your guess?";GUESS
        WEND
        PRINT "You've got it, ";NAME$;"!!!"
        INPUT "Play again?";PLAY$
    WEND
    END
```

File Handling

The major difference between the two BASICs comes in the area of file handling, where no standards exist. CBASIC deals with two types of data files: sequential and relative. Sequential files are not opened specifically for input or output; they are just opened. This means a CBASIC sequential file can be appended to by reading up to the end and then writing to it, a trick which is not permitted by MBASIC (and there are good and sufficient reasons for that).

The open statement can best be illustrated by a comprehensive example:

```
200 OPEN "B:SALES.DAT" AS 3:\
        "B:RCV.DAT" RECL 128 BUFF 4 AS 4
```

This will open file B:SALES.DAT for sequential input/output as file 3, and B:RCV.DAT for relative (random) I/O with a record length of 128 and buffer of four sectors (512 bytes) length, as file 4.

The FILE statement will open a file or automatically create one if it does not exist, and will assign the lowest available file number. The CREATE statement, of course, will create a file.

File I/O is performed using the PRINT #, PRINT USING # and READ # statements. The PRINT # and PRINT USING # statements write data to disk in exactly the same way as it would appear on paper, with the exception that commas do not cause tabbing — instead, they cause commas to be inserted in the data field as data separators. Each record is ended with the CR/LF pair, which must be figured into the record length.

CBASIC's random I/O stores numeric data in ASCII format, unlike MBASIC, which uses the internal form for data. This means files are much easier to patch using a text editor, and are also easier to transfer to or from other programs.

Several CBASIC features are particularly useful in creating larger applications programs, such as accounting packages. The COMMON statement specifies which variables are common to different programs and are, therefore, preserved when control is passed between programs using the CHAIN statement.

While MBASIC uses the LPRINT statement to print on the system printer, CBASIC switches all output to the printer using the LPRINTER statement. All subsequent output will go to the printer until a CONSOLE statement is executed. The LPRINTER WIDTH 80 statement will set the printer width to 80 characters, causing CBASIC to insert automatic CR/LF pairs when required. The console width can also be varied by POKEing a memory location.

Machine language subroutines are particularly easy to use with CBASIC. The SAVEMEM statement will reserve a number of bytes at the top end of memory and will automatically load a binary file into the reserved area. The machine code routines can subsequently be accessed by the CALL statement.

CBASIC also provides some interesting functions. Most of the functions are identical or very similar to those in MBASIC, but unique functions are provided for testing the console status, and for returning the command line entered into CP/M when the program was invoked.

The overall flavour of CBASIC is very like other BASICs, with some differences in detail and particularly in areas like file handling. It's not a very good BASIC for game-playing, or for learning to program, particularly because it has to be compiled, but it is very popular for business/-commercial programming.

Incidentally, there is a fully compiled version of CBASIC, called CB-80, which is very much faster and has some very nice features, and there are also 16-bit versions of these programs for the IBM-PC and other 8086/88-based computers. I also understand there is a version of CBASIC for the PDP-11 minicomputer.

Other BASICs

While Microsoft BASIC and CBASIC are the most popular microcomputer BASICs, there are several other versions. Perhaps the best known is North Star BASIC, which follows the style of Hewlett-Packard's minicomputer BASIC.

The major area of difference between North Star and the BASICs previously discussed is string handling. There are no RIGHT$, LEFT$ and MID$ functions. Instead, a string is handled as though it is an array of characters. So, if we have:

A$ = "ABCDEFGH"

then A$(2,3) is 'BCD' — that is, the three characters starting at the second character position.

File handling is different again, but the fundamental concepts we have discussed still hold good.

Then there's BASIC/Z, a native-code compiler which is unique in having a range of data types, including 10-byte BCD integers! While this BASIC is even further away from the 'standards' we have covered, most of its unique features are additions to a standard base, and simple programs should be easily convertible. But file I/O is different again!

Applesoft is a bit different from Microsoft BASIC, but simple programs should be close enough for easy translation. It is in the file-handling area that the major differences arise. Applesoft writes command strings to the DOS as though they were console output; the only difference is that they are preceded by a Control-D. Because of this, programs which involve files (most really useful programs) will require extensive rewriting to run on the Apple.

SBASIC, from Topaz, is a compiled BASIC which is rather like CBASIC in many ways — no line numbers, for instance — but which takes the structured programming extensions to a further stage by borrowing a number of concepts from Pascal. For example, procedures are supported, and variables must be declared before use. The result is very powerful, but many programs will require extensive conversion work.

The fundamental (almost wrote basic there!) problem is that the ANSI standard for BASIC defines only a very simple language, and every manufacturer has gone its own way in defining the extensions required to support files, printing, and especially graphics.

However, there are signs of a new, better standard being developed. Digital Research is rumoured to be working on a BASIC interpreter/compiler pair, and since this company tends to do things right, hopefully that will implement the ANSI standard.

Perhaps we can look forward to a new age of standardisation in BASIC! □

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```
THIS PROCEDURE ALLOWS THE USER TO CREATE THE FILE(S) USED
IN STORING THE INFORMATION REQUIRED.

VIEW A FILE:

THIS PROCEDURE ALLOWS THE USER TO SEE THE FILE(S) EITHER JUST
CREATED OR LOADED INTO MEMORY FROM TAPE."
1190 PRINT:INPUT"TO CONTINUE PRESS 1, ELSE PRESS 0 TO RETURN TO MENU";X:CLS:IFX=
0THEN110
1200 PRINTTAB(30)"HELP":PRINT
1210 PRINT"UPDATE A FILE

THIS FUNCTION ALLOWS THE USER TO CORRECT ANY ERRORS MADE DURING
TYPING, OR, ALTERNITAVELY, IF AN UPDATE IS MADE IN THE READING
MATERIAL USED.

SAVE A FILE:

THIS PROCEDURE ALLOWS THE USER TO SAVE THE FILE(S) JUST CREATED
OR ERRORS "
1220 PRINT"JUST CORRECTED TO TAPE."
1230 PRINT:INPUT"TO CONTINUE PRESS 1, ELSE PRESS 0 TO RETURN TO MENU";X:CLS:IFX=
0THEN110
1240 PRINTTAB(30)"HELP":PRINT
1250 PRINT"LOAD A FILE:

THIS PROCEDURE ALLOWS THE USER TO CALL UP A PARTICULAR FILE

FROM THE CASSETTE-TAPE OF THEIR CHOICE.

VERIFY A FILE:

THIS FUNCTION ALLOWS THE USER TO SEARCH FOR A PARTICULAR ENTRY
WITHIN A FILE."
1260 PRINT:INPUT"TO CONTINUE PRESS 1, ELSE PRESS 0 TO RETURN TO MENU";X:CLS:IFX=
0THEN110
1270 PRINTTAB(30)"HELP":PRINT
1280 PRINT"PRINT A FILE:




HELP:

THIS FUNCTION."
1290 PRINT:INPUT"TO CONTINUE PRESS 1, ELSE PRESS 0 TO RETURN TO MENU";X:CLS:IFX=
0THEN110
1300 PRINTTAB(30)"HELP":PRINT
1310 PRINT"QUIT:

END PROGRAM."
1320 PRINT:INPUT"PRESS <ENTER> TO RETURN TO MENU";X:CLS:GOTO110
1330 REM *****QUIT*****
1340 CLEAR0:POKE16396,201:END
```

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VIC-20

FORMULA 1

This program is a racing-car game, in which you must control a car: moving it from left to right, dodging obstacles and being careful not to run into the sides. It uses up 3 Kbytes of the VIC-20's memory

Greg Hoskins
Fullarton, SA

```
0 PRINTING CHARACTERS
1 "S" HOME
2 "s" CLEAR
3 "Q" CRSR DOWN
4 "q" CRSR UP
5 "]" CRSR RIGHT
6 "←" CRSR LEFT
7 "p" BLACK
8 "E" WHITE
9 "≤" RED
10 "C" CYAN
11 "↑" PURPLE
12 "↑" GREEN
13 "←" BLUE
14 "π" YELLOW
15 "R" RVS ON
16 "r" RVS OFF
17 "←" SHIFT -(MINUS)
18 "u" SHIFT U
19 "i" SHIFT I
20 "a" SHIFT A

READY.
5 POKE36879,10:PRINT"s"
20 PRINT"Rp
                ;
30 PRINT"Rp
                ;
40 PRINT"Rp        ≤          p          ";
45 PRINT"Rp                                ;
50 PRINT"Rp   ≤                       p    ;
110 PRINT"SQQQQ]]]]]]]πRFORMULA1"
120 PRINT"SQQQQQQ]]]]πRBY: GREG HOSKINS"
121 PRINT:PRINT:PRINT
122 PRINT"E      u"
123 PRINT"      ←←ER 1 ]]]]] 1"
124 PRINT"      ←←ER] 1 1 1 1 "
125 PRINT"      ←←ER 1 1 1 1 1"
126 PRINT"      ←←ER] 1 1 1 1 "
127 PRINT"      ←←ER 1 1 1 1 1"
128 PRINT"      ←←ER] 1 1 1 1 "
129 PRINT"      ←←ER 1 1 1 1 1"
130 PRINT"      ←←ER] 1 1 1 1 "
131 PRINT"      ←←ER]] 1 1 ]]]"
132 PRINT"      ←←"
139 FORI=1TO4800
140 NEXTI
150 REM SET UP
160 POKE36879,110
161 PRINT"sE"
198 PRINT"THIS IS THE FIRST      RUSSIAN
GRAND PRIX"
199 PRINT"YOU ARE TO RACE IN     YOUR FIR
ST GRAND PRIX"
200 PRINT"& LOOK OUT FOR         OBSTACLE
S IN THE       MIDDLE OF THE TRACK & THE
SIDES"
205 PRINT
210 PRINT"THIS IS YOUR CAR   a
220 PRINT
250 PRINT
260 PRINT:PRINT:PRINT
270 INPUT"HIT RETURN TO GO ON";K$
290 PRINT"s"
300 PRINT:PRINT:PRINT"YOU CONTROL YOUR C
AR  WITH"
310 PRINT:PRINT"  πZRLEFTr  &  MRRIGHTr"
320 PRINT:PRINT:PRINT:INPUT"ERETURN TO S
TART YOUR  GAME";S$
329 POKE36879,14
330 PRINT"s"
340 FORI=7680TO7987
350 POKEI,160:POKEI+30720,6 :NEXTI
380 FORI=7988TO7997
390 POKEI,160:POKEI+30720,5 :NEXTI
420 POKE7998,105
430 POKE7998+30720,2
440 POKE7999,95
450 POKE7999+30720,2
460 FORI=8000TO8018
470 POKEI,160:POKEI+30720,5:NEXTI
500 POKE8019,105
510 POKE8019+30720,2
520 POKE8022,95
530 POKE8022+30720,2
540 FORI=8023TO8039
550 POKEI,160:POKEI+30720,5:NEXTI
580 POKE8040,105
590 POKE8040+30720,2
600 POKE8045,95
610 POKE8045+30720,2
620 FORI=8046TO8060
630 POKEI,160:POKEI+30720,5:NEXTI
660 POKE8061,105
670 POKE8061+30720,2
680 POKE8068,95
690 POKE8068+30720,2
700 FORI=8069TO8081
710 POKEI,160:POKEI+30720,5:NEXTI
740 POKE8082,105
750 POKE8082+30720,2
760 POKE8091,95
770 POKE8091+30720,2
780 FORI=8092TO8102
790 POKEI,160:POKEI+30720,5:NEXTI
820 POKE8103,105
830 POKE8103+30720,2
840 POKE8114,95
850 POKE8114+30720,2
860 FORI=8115TO8123
870 POKEI,160:POKEI+30720,5:NEXTI
900 POKE8124,105
910 POKE8124+30720,2
920 POKE8137,95
930 POKE8137+30720,2
940 FORI=8138TO8144
950 POKEI,160:POKEI+30720,5:NEXTI
980 POKE8145,105
990 POKE8145+30720,2
1000 POKE8160,95
1010 POKE8160+30720,2
1020 FORI=8161TO8165
1030 POKEI,160:POKEI+30720,5:NEXTI
1060 POKE8166,105
1070 POKE8166+30720,2
1080 POKE8183,95
1090 POKE8183+30720,2
1100 FORI=8184TO8185
1110 POKEI,160:POKEI+30720,5:NEXTI
1140 POKE8108,65
1150 POKE8108+30720,1
1151 POKE36878,15
1152 POKE36877,140
1153 SC=0
1154 B=8108
1155 M=3
1160 GOSUB1200:REMOBSTACLES
1170 GOSUB1300:REMDIRECTION
1180 GOSUB1400:REMGETKEY+MOVE CAR.
1181 POKEX-Y,160
1182 POKEX-Y+30720,0
1183 POKEQ-U,160
1184 POKEQ-U+30720,0
1190 GOSUB1500:REMMOVEOBSTACLE
1192 GOSUB1700:REM CHECK FOR CRASH
1193 IFX>8185THEN1160
1195 GOTO1170
1200 REM OBSTACLE
1210 X=INT(RND(1)*4)
1212 Q=INT(RND(1)*4)
1215 X=X+8041
1217 Q=Q+8041
1220 POKEX,81
1222 POKEQ,81
1225 POKEX+30720,7
1226 POKEQ+30720,7
1227 SC=SC+5
1228 PRINT"S]]]]]]]]]]]SCORE  ;SC
1229 IFSC>HSTHENHS=SC
1231 PRINT"S]]]HIGH ";HS
1232 RETURN
1300 REM DIRECTION
1310 Y=INT(RND(1)*3+21)
1311 U=INT(RND(1)*3+21)
1320 X=X+Y
1321 Q=Q+U
1330 RETURN
1400 REMGET KEY
1402 GETA$
1405 IFA$="Z"THEN1450
1410 IFA$="M"THEN1475
1415 RETURN
1450 POKEB,160
1455 POKEB+30720,0
1460 B=B-1
1463 POKEB,65
1464 POKEB+30720,1
1470 RETURN
1475 POKEB,160
1480 POKEB+30720,0
1485 B=B+1
1488 POKEB,65
1490 POKEB+30720,1
1495 RETURN
1500 REM MOVE OBSTACLE
1510 POKEX,81
1512 POKEQ,81
1515 POKEX+30720,7
1516 POKEQ+30720,7
1520 RETURN
1700 IFX=BTHEN1735
1705 IFQ=BTHEN1735
1710 IFB=8114THEN1735
1720 IFB=8103THEN1735
1730 RETURN
1735 M=M-1
1736 POKEB,102
1737 POKEB+30720,2
1738 B=8108
1750 POKE36877,230
1751 FORS=1TO350
1752 NEXTS
1753 POKE36878,0
1754 IFM=0THEN1768
1755 POKE36878,15
1756 POKE36877,140
1757 POKEB,65
1758 POKEB+30720,1
1767 RETURN
1768 PRINT"s":PRINT
1769 PRINT"YOU CRASHED 3 TIMES  :PRINT
1770 PRINT"YOUR SCORE WAS";SC:PRINT
1780 PRINT"]]]]]]EGAME OVER":PRINT
1790 INPUT"ANOTHER GAME(Y/N)";G$
1795 IFG$="Y"THEN150
1800 IFG$="N"THENEND
1810 GOTO1790

READY
```

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CON/ST/101

JAVELIN

As spreadsheets continue to mount in popularity, users are having to grapple with the increasing complexity of their models. Les Bell reports on a new product for the IBM PC which could ease their worries.

JAVELIN

WHEN SPREADSHEET calculators were first introduced, in the early days of Visicalc and Supercalc, most users were building relatively simple budgets and forecasts on them. However, with the advent of the macro programming facility of packages like Lotus 1-2-3, Symphony and Framework II, some users have started to construct large spreadsheets — typically over 300 Kbytes.

It's rather like the early days of programming: the first FORTRAN allowed the programmer only GOTOs, the weirdest IF statement (called the arithmetic IF) and generally did not support modern structured programming ideas. It was possible (and indeed still is, in languages like BASIC) to create the most impenetrable mass of incomprehensible program code, which even the original author could not understand, let alone update or modify.

There are spreadsheets out there in accounting land which violate all the classic tenets of program design: they are unstructured, badly planned, inelegant (in the engineering sense), undocumented, unmaintainable Gothic nightmares which also have bugs (although discovering or proving that is not so easy). The reason for this is that users are pushing the spreadsheet metaphor for model design to its limits: even with enhancements such as labels and named ranges, the spreadsheet is just not up to the job. It's a bit like trying to design a word processing program in BASIC (don't laugh, it has been done!).

Given all these models are fulfilling some useful purpose in life, and therefore ought to be made to work properly within their lifetime, where does the user look for a more powerful tool for the job? Javelin is just such a tool. This new software package combines the best features of financial modelling languages with the immediacy and interactivity of spreadsheets.

By extending the analogy of financial analysis programs to computer languages, I could say that if Lotus-type spreadsheets are equivalent to assembly language, then Javelin is the first high-level language.

What You See

When Javelin is first started up, it splits the screen into two halves, each of which contains a **view** of the central information base upon which Javelin is currently working (this is empty at first). The top two lines of the screen are called the edit line and the information line, and they are respectively where information is entered, and prompts, instructions and error messages appear.

One of the strengths of Javelin is that it 'understands' time. It knows the names of the months, and can work with time periods of days, weeks, months, quarters, years or user-defined periods (you can even make it ignore time altogether).

The major part of the top half of the screen is initially devoted to the **diagram view**, in which Javelin draws a block diagram or flowchart of the model as it is constructed. The centre of this area shows a highlighted variable name, while on the left are the variables which affect it and on the right those which depend on it. Lines link the variables and illustrate the relationships. It is possible to scroll around in this view and see other variables, tracing your way through the model.

The lower half of the screen is initially given over to a **table view**, used to enter formulae and data. Formulae for Javelin look quite different and much more informative than for most spreadsheets; for example:

Net Profit = Sales — Commissions — Salaries

Incidentally, this produces a diagram view as in Figure 1, with the formula displayed below it.

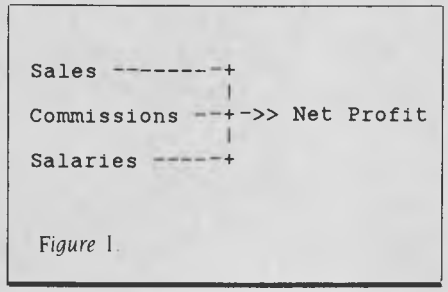

Figure 1.

After typing in a formula like this one, the next step is to enter some values for the variables. In the old days, we would simply have started with an initial sales figure and then applied a growth factor and replicated the whole lot across the screen. Javelin recognises the real world is a lot messier.

To display a table view for the sales figures, you can use the GO TO key (F5) and then type in the name of the variable you want — sales. In fact, if you cannot remember the name of the particular variable you want, or if your typing is a bit suspect (remember, Javelin encourages the use of long and meaningful variable names), then you can use Javelin's **spell** key. Just type the beginning of the variable name, then press the PC's tab key, and Javelin will complete the variable name, or display a short list of names which match what you've typed so far. By using the up and down arrow keys, you can select whichever one you want. Nice feature.

The table view for a variable shows a three-column table of values. By default, the values are at monthly intervals, starting at the current month (taken from DOS's real-time clock — what do you mean, yours always says January 1980?), but by using the /DV command (Define Variable) you can specify whatever time period you want, as well as other facts about the variable.

As you will have twigged from the above comment, Javelin has slash commands, which work in a menu-driven fashion similar to Lotus 1-2-3 (although the menu appears upside-down for some reason). Of course, the menu choices are nothing like those in 1-2-3.

In addition, you will have guessed that one of the strengths of Javelin is that it 'understands' time. It knows the names of the months, and can work with time periods of days, weeks, months, quarters, years or user-defined periods (you can even make it ignore time altogether). It can also convert time periods; for example, sales and profit might be calculated weekly, but commission paid monthly: Javelin will automatically sum each week's sales to calculate monthly commission. It can also split time periods as well as combining them.

Once values have been entered for commissions and salaries, we can switch to the table view for net profit. Initially, this will display the formula for the variable, ▶

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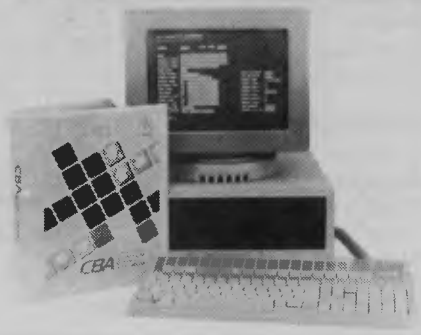

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together with the message 'NOT YET CALCULATED'. Pressing the F9 (Calc) key will display the table for this variable, with the correct values. Javelin does not waste time constantly recalculating automatically — with the size of its models, it would take too long. Whenever models are updated, therefore, it displays the CALC keyword at the bottom of the screen to indicate the model must be recalculated to obtain correct results. It also displays an asterisk beside the model filename to indicate it has been modified and not yet saved back to disk.

All-round Views

Javelin offers several other views of the information base. The **chart view** displays a variable as a bar chart, with automatic scaling and labelling of axes. The best feature of this view, however, and a unique feature of Javelin, is the ability to adjust values in the chart view. Simply highlight a bar, and use the up and down arrow keys to increase or decrease the variable's value. This view can also be used for data entry, if you don't know the exact values but know the kind of curve you expect.

The **quick graph** view is very like the chart view, except it produces a line graph. Once again, this can be adjusted dynamically and even used for data entry. The **formulas view** can be used to show all formulas in the model, or to display all the formulas upon which a particular variable depends, or those formulas which depend upon it.

The notes view allows the entry of annotations for each variable. It's probably not the ideal way to document a model (I don't know what is), but it's a damn sight better than previous spreadsheet systems have provided.

The **graph view** displays a high-resolution graph in any of a number of styles, such as line, bar, stack bar, %bar, horizontal bar, pie, and XY plot. Seven variables can be plotted simultaneously, and the graph view allows for control of scaling, labelling, legends and time limits.

The **notes view** allows the entry of annotations for each variable. It's probably not the ideal way to document a model (I don't know what is), but it's a damn sight better than previous spreadsheet systems have provided. The **errors view** displays error messages for diagnostic purposes.

Arithmetic	**SUM, AVG, MAX, MIN**
Rolling	RSUM, RAVG, RMAX, RMIN, CUM
Time series	TSUM, TAVG, TMAX, TMIN, COUNT
Sum to date	MTD, QTD, YTD
Lead, lag, etc.	NEXT, PREVIOUS, VALUE, CHANGE, PCT
Time span limits	BEGIN, END, RANGE
Number of days	MDAYS, QDAYS, YDAYS
Period conversion	DAILY, WEEKLY, MONTHLY, QUARTERLY, YEARLY
A, B	
Date comparison	BETWEEN, UNTIL, SINCE, LENGTH
Logical	IF, AND, OR, NOT
Statistical	VAR, STDEV, CORR, LN, EXP
Prediction	SLOPE, INTERCEPT, PREDICT
Trend	TREND, TRENDCORR, TRENDSLOPE, TRENDSTART
Mathematical	SQRT, ABS, MOD, INT, ROUND
Financial	NPV, PV, FV, IRR, PMT
Depreciation	DEPRSL, DEPRDECL, DEPRSOYD
Bond value	BONDPRICE, BONDYTM
Time series growth	INTERP, GROW, GROWRATE
Miscellaneous	SELECT, F

Table 1: *Javelin functions, by type.*

The **macro view** allows the definition and editing of stored keystroke sequences. At first I wasn't entirely sure of what this could be used for, since Javelin's modelling capabilities effectively remove the need for macros. But they do have their uses: more later.

Finally, there's the **worksheet view**; yes, Javelin can function like dear old 1-2-3 if it has to. The worksheet view provides the most convincing demonstration of Javelin's power: it can effectively create a spreadsheet with no data entry on the part of the user. For example, listing some variable names down the left-hand margin of the worksheet and then inserting a date at the top of a column will cause Javelin to automatically insert all the values into the right places. Pressing return a few times will insert dates and values into successive columns completely automatically; the data is already in the information base, and all Javelin has to do is extract it.

So far, so good — Javelin obviously has some smart ways of manipulating data and displaying it, and the central information base idea is a good one. But Javelin goes way beyond that.

The program is rich in functions for time calculation and time period conversion, as well as in financial functions such as bond pricing and yield to maturity, various depreciation schedules and the like. See Table 1 for full details.

Building Blocks

If these functions are not enough, it is possible to define your own, through what Javelin calls **building blocks**. Being a systems engineer by background, I would call these transfer functions or black boxes. There are five different types of building blocks: look-up table, curve, time delay, import data and roll-up.

All the building blocks accept input variables and in some way produce outputs. The look-up table building block does this by using the input variable as an index into a table and thereby selecting the appropriate output value. The curve building block is similar, except the transfer is not defined tabularly, but by drawing a graph. This is particularly useful for specifying a function like price elasticity of demand.

The time delay building block can be used to handle situations like delays between invoicing and receiving payment. However, it is more powerful than it at first appears: it does not simply apply, say, a four-week delay to its inputs; instead, a curve is defined which specifies what percentage of the input appears at the output over a time period. So, if 20 per cent of customers pay in 14 days, 50 per cent in 30 days, 20 per cent in 60 days and 10 per cent in 90 days, the building block will output 20 per cent of its input in 14 days, 50 per cent in 30 days and so on. Of course, this is not what really happens, but statistically speaking it's quite correct.

The other two building blocks are used for consolidating information from other models. The import data building block can be used to abstract data from other models, while the roll-up block organises models into a hierarchical structure, with automatic consolidation. This one requires a bit of planning!

The building block concept is powerful, providing as it does a modelling equivalent to the structured programming concept of abstraction, equivalent to subroutines or functions. It would have been nice to see a building block which could be used to mask away the details of some complex formulas, purely for purposes of abstraction. ▶

Cursor movement:	@RIGHT, @LEFT, @UP, @DOWN, @PGUP, @PGDN, @HOME, @END, @CTRLRIGHT, @CTRLLEFT, @CTRLHOME, @CTRLEND
Other keys:	@ESC, @ENTER, @SPACE, @SLASH, @INS, @DEL, @SPELL, @CTRLK, @CTRLY, @CTRLQ, @@ (at)
Function keys:	@F1, @F2, @F3, @F4, @F5, @F6, @F7, @F8, @F9, @F10
Prompt or pause:	@READ, @PAUSE, @PROMPT text
Flow of control:	@LABEL label, @JUMP label, @EXIT
Conditional macros:	@IF condition, @THEN action, @ELSE action, @ENDIF, @ERROR
User-defined menus:	@SELECT text, @CHOICE label text, @ENDSELECT

Table 2: *Javelin macro commands.*

Macros

Javelin's macros can be used in very much the same way as, say, those in Lotus 1-2-3. However, they offer considerably more power and are rather reminiscent of the FRED language in Framework.

The set of Javelin macro commands is shown in Table 2. Many are purely to provide the same functions as the function or cursor movement keys. Macros using just these functions can easily be created by capturing keystrokes while working through an example model; for example, to create a template model repeatedly, this can be done once while recording keystrokes and then repeated by invoking the macro.

However, more advanced functions are available which only make sense in a macro; for example, those which pause or prompt the user for input. Additional functions allow macros to call other macros as subroutines and to perform statements conditionally. There is even a GOTO statement, in the form of the @JUMP macro command (there goes my dream of well-structured models — most financial modellers have no idea how harmful the @JUMP is!).

Macros can be made to automatically execute on start-up. The macros look quite powerful enough to implement small applications that otherwise would be a candidate for databases such as dBase III (some misguided individuals would try to do them in Lotus 1-2-3). However, the fact that I suggest this could be done in no way implies that it *should* be done — as I just suggested, the world is full of misapplied Lotus spreadsheets, and misapplying Javelin would only compound the problem. There's no substitute for the right tools for the job.

The omission of trig functions is serious, as it reduces the capability of the package in modelling seasonal and cyclical variations in sales, although there are admittedly other ways of doing this.

Documentation

Considering the complexity of the program, the documentation is surprisingly slim. In part this is a tribute to the consistency of the Javelin user interface; in general, things just work the way you expect them to.

The manuals include an installation manual and a 'getting started' manual which includes a short tutorial. Three 'case studies' disks contain a simulation of Javelin demonstrating the use of particular features in various applications.

The major user manual is well organised with clear explanations and examples. I experienced no difficulty in getting some small models up.

Disappointments

Having an engineering background, I was disappointed to see that all the time periods and functions provided were aimed purely at the business user. With time periods such as seconds provided, plus functions such as sine, cosine and others, Javelin could be used to model not only business activities but also physical systems.

I was interested in attempting to model some oscillating spring/mass/dashpot systems, just to see how easily it could be done, but found the functions I required were not supported.

The omission of trig functions is more serious, as it reduces the capability of the package in modelling seasonal and cyclical variations in sales, although there are admittedly other ways of doing this.

Summary

Javelin is an order of magnitude better than Lotus 1-2-3, Symphony *et al* at building complex models for forecasting, project evaluation and similar purposes. The current tendency on the part of dedicated spreadsheeters to take such programs beyond their limits is of more than a little concern to corporate DP auditors, consultants and others who recognise the dangers. Javelin can, at the least, perform a valuable function by reducing the exposure of modellers to the risks associated with erroneous, faulty, or improperly constructed spreadsheet models.

The provision of time functions, the formula view, building blocks and other Javelin functions all correspond to the concepts of abstraction and structure in modern programming (which has suffered from similar problems) and should allow the modeller to ignore several sets of constraints and concentrate on the logical design and correctness of the model.

Javelin synthesises the best features of conventional minicomputer and mainframe modelling languages, PC spreadsheet programs and symbolic equation solving products such as TK!Solver. Highly recommended — it gets my vote as the top product currently on the market for financial modelling. □

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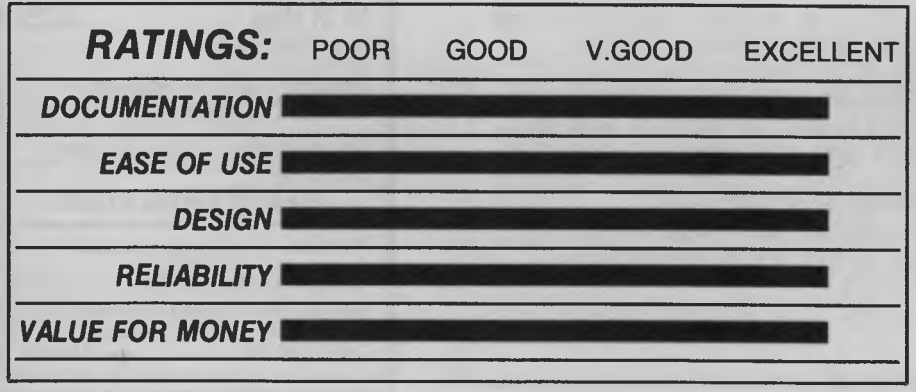

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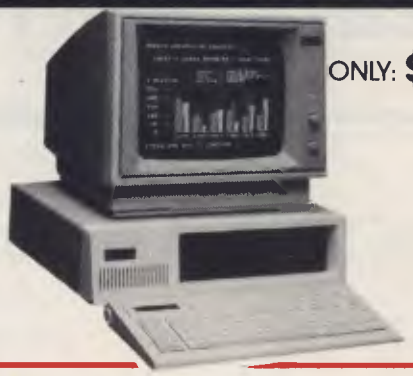

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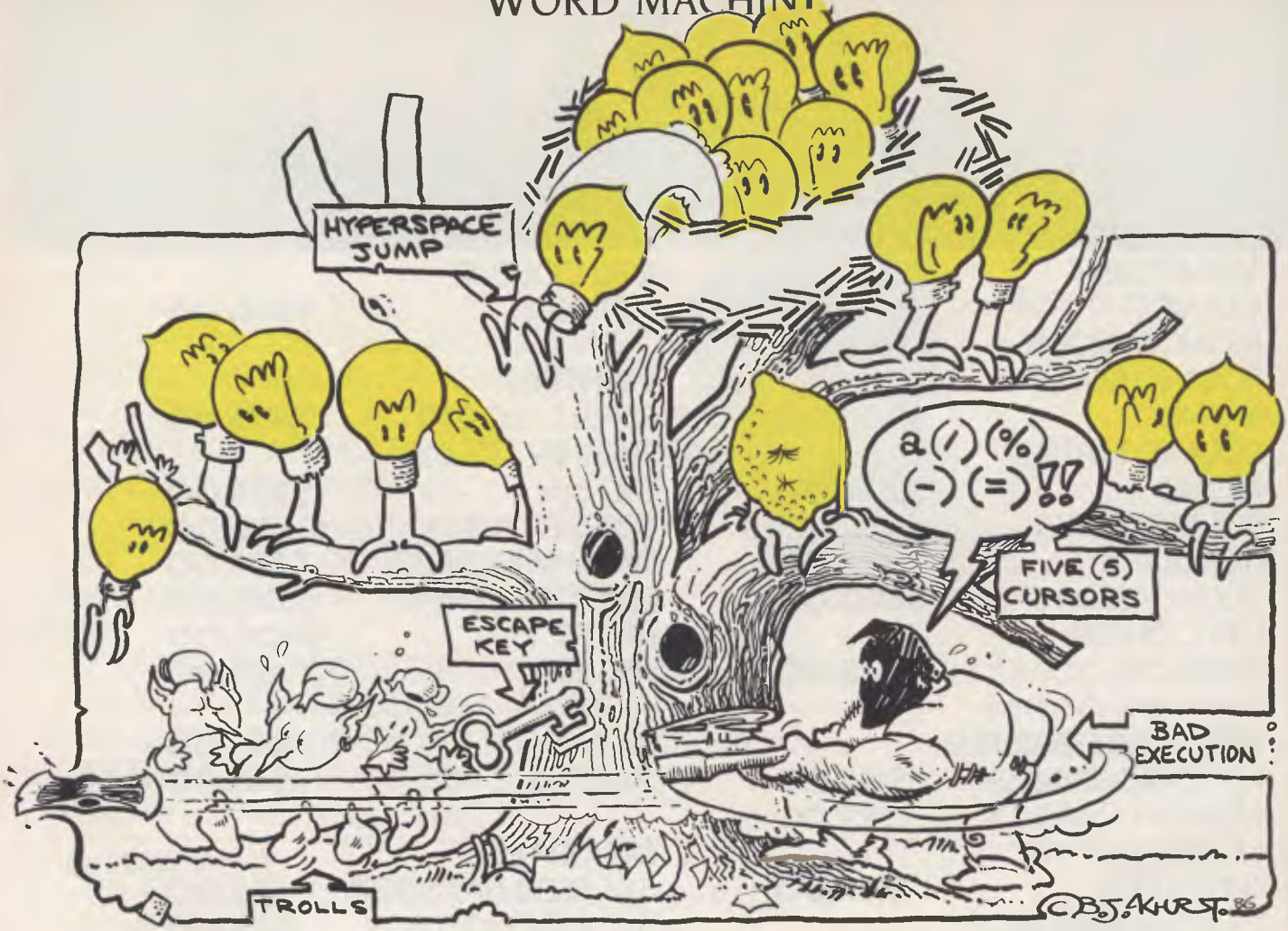

WORD MACHINE

Processing Ideas

Do you have trouble organising ideas when working on reports, essays, letters or manuscripts? The Word Machine is designed to help you order all those lightbulb flashes into a tree format for processing. Jon Fairall was impressed with the concept of the program, but found the actual execution of the idea lacking.

WORD MACHINE

RECENTLY, THE esteemed editor of *Your Computer* sidled up to me and said: "Pssst . . .wanna look at an idea processor?" Always a sucker for novel software, I jumped at the opportunity. Sometimes you turn up a gem, sometimes a lemon.

It's called the 'Word Machine', and the droll fellas at Troll Software have included a bound manual, a master disk and a demonstration copy with the package. Nothing is copy protected, so the first step is to back it up. So far so good.

The Word Machine is an *idea* processor, not a word processor, and should be used to order thoughts, organise essays and keep track of the relationships between a host of interrelating factors in complex projects.

The concept is simple: ideas are entered hierarchically on a 'tree' as lines of text, then refined and organised into a coherent whole.

A single-keystroke approach means the user can move from place to place with ease. Each 'branch' of the tree of ideas is assigned a number where it splits from the branch above, so there is a menu of choices at each level of the hierarchy. Moving down is merely a question of selecting the right number, and moving up is a matter of pressing the Escape key.

However, ideas are rarely this ordered, so Word Machine offers a number of other methods of linking thoughts together. A 'return jump' allows you to mark a spot anywhere in the text with 'X'. Hitting return will always send you to that spot, and the 'X' is repositioned in the place you left, so it's possible to jump back and forth across the document.

Another horizontal move, which allows you to put a permanent marker (in the text, to cause a jump to another branch), is grandly referred to as a 'hyperspace jump'. Selecting that branch from the menu will then cause a jump to another one. In this way you can direct ideas from one branch to another, from one level to another. At this stage the tree analogy starts to break down and you're left with a bird's nest of ideas, but that's life.

One of the problems with this sort of program is ideas may get too big for the screen and you can easily get lost. To avoid this, Troll Software has developed a window-like feature on the Apple. A window is defined as being between any lines on the screen, and as long as you keep the cursor within the window you can carry out the usual manipulations without affecting the rest of the screen. The number of windows allowed is limited only by the size of the screen, and each can be operated independently.

Is Word Machine any good? The answer is a qualified 'Yes'. A word handler is a great way of disciplining your thoughts, but the way this one is implemented it would probably be easier to do the same thing with pencil and paper.

Having come up with a good idea for a software package, Troll seems to have tripped up over some details. For instance, there are no less than five cursors, each with a different function. If you want to move about the document you use the scan cursor (represented by @); you have to change to the pen cursor (/) to be able to write; the clip cursor (%) erases and moves letters to the clipboard; the screen cursor (-) is used to set windows; and the window cursor (=) is used to move window boundaries up and down.

Bamboozled? Now consider that the machine reacts differently, depending on which cursor you're operating. For instance, it responds to the down arrow by moving the cursor down one line, but only when the scan cursor is operating. In the presence of the pen cursor a down arrow will scroll the screen; a window boundary is lowered for the window cursor; and a line is drawn from the clipboard on the screen when the clip cursor is set.

Supposedly simple manoeuvres, such as changing a word or altering a line, require the selection of three different cursors. In fact, the editing facility doesn't even include an insert function — if you want to add a word you have to retype the entire sentence.

Troll Software warns that the Word Machine is not a word processor, and no doubt argues it should not be assessed as such. However, the essence of this type of software should be the ability to chop and change, switch things around, change ideas which don't work, rewrite paragraphs, cut and paste until you have something you like. Word Machine gives you a thousand reasons not to bother.

The philosophy behind Word Machine is sound, but it's badly executed. Watch out for the remake — it should be great. □

RATINGS:	POOR	GOOD	V.GOOD	EXCELLENT
DOCUMENTATION		■■■■■■■■		
EASE OF USE		■■■		
DESIGN		■■■■■■■■		
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X-HILARATING, X-CITING, XTREE

We've rarely heard John Hepworth go into such raptures over a program as he did over Xtree, a hard disk manager that does all the fiddly things you can't do easily (or at all) with DOS. Read his paean of praise for yourselves.

GOT A hard disk? Quick — tell me *right now* what directories and subdirectories you have and what files are in them. You can't? Join the thousands of others in the same predicament. Want to run a program but can't remember its location or the syntax to invoke it? Like to copy some files to a disk and want to know if it has enough free space to fit them? Want to move files between subdirectories without copying? Want to do so many other tasks but get frustrated by DOS?

Xtree provides the answer to all these problems, and more. It is a hard disk manager for all users, and even the most computer naive will find it of use as soon as they graduate from one of those hand-holding menu systems.

Xtree is easier to use than to describe, so let's take a walk through a typical session. By the end I'm sure you'll be sending off your order for a copy.

Main Screen

Fire up Xtree from the DOS prompt manually by typing Xtree — not too hard so far. Most users will do this from their AUTOEXEC.BAT file so the program is invoked at the start of every session. A screen will appear with the Xtree logo filling the left two-thirds of the screen and a column of disk information on the right. Xtree is reading the disk directory information and building an image of it in memory. The information includes the disk drive identification letter, the free space available, the number of files on the disk and the total of their sizes, the current directory, the number of bytes in files in that directory, and the number and total size of tagged files (more on this later).

When all the information is loaded into the memory image, the left two-thirds of the screen clears, and divides horizontally into two windows (see Figure 1).

The Windows

The top left window is the directory window, containing a map of the directory structure of the disk. A cursor appears over one of the directory names. The bottom left window is the files window, with the names of the files in the directory selected by the cursor in the directory window.

In the sample screen you will notice all the files are in alphabetical order. Alternative sorts by 'extension', 'creation date/time' or 'file size' are also available. Up in the right corner of the screen you will see 'FILE *.*'. This mask selects which filenames will be shown on the screen. Xtree defaults to *.* and shows all files in the subdirectory. If the user has selected *.BAT then only files with a .BAT extension will be shown.

Pressing return jumps the cursor down to the file window; pressing it again removes the directory window, and the file window expands to fill its place. Pressing return a third time displays the directory and file windows as before, with the cursor back in the directory window.

The Directory Window

In the directory window appears a map of the screen, with lines connecting down and across from each directory to directories beneath it. At the bottom of the screen is a menu bar. In each word in the menu one letter is highlighted: pressing A for 'available' shows the available space on a selected disk. D(elete) removes the subdirectory under the cursor if it is empty. (F)ilespec allows the 'mask' for the displayed files to be changed. (L)og Disk permits a change to a different drive or a relogging of the same disk. (M)akedir is particularly useful: after pressing M, Xtree asks for the name of a subdirectory to be created, and creates it under the directory on which the cursor rests.

(P)rint allows for a listing on the printer of all tagged files, or of a list of all the possible paths on the disk, or of a diagram of the disk's directory structure. The printouts have left margins, are split into numbered pages, show the disk volume label and are dated and timed!

(R)ename will do just that for directory names — something DOS can't do. (S)howall displays all the files in any directory on the disk, sorted in selected order. The (F)ilespec mask is still active, so *.BAT will show all .BAT files in every directory.

Xtree allows a number of commands to work on multiple files, which must be tagged before the command is executed. Pressing (T)ag marks each file in the current directory which meets the current Filespec — if it is *.BAT then all .BAT files in the current directory will be marked. Control-(T)ag marks all matching files in any directory on the disk; (U)ntag and control-(U)ntag do the reverse. (V)olume allows a volume label to be placed on the disk.

E(x)ecute is beaut! It drops you back to a DOS-like environment while leaving Xtree resident. Any normal DOS command can now be run, and other programs like Lotus 1-2-3, Wordstar and so on will operate. At first I thought there would have to be a speed loss under such circumstances, but none of the benchmarks I've run shows any variation in speed with or without Xtree. After exiting the application program, hitting Enter returns to Xtree. The disk is relogged after re-entering.

Four more directory commands are available from Xtree, in conjunction with the alt key. Alt-(F)ile Display changes the files from name and extension to name/extension/attributes to name/extension/attributes/date/time. Alt-(S)ort Criteria gives the option of sorting files in the display by name of extension or size or creation date. Alt-(T)ag and alt-(U)ntag

tag or untag files whose attributes match those selected by the user.

The File Window

Hit return, and the cursor jumps from the directory window to the file window. Now a whole new set of commands is available.

(A)ttributes sets or removes the read-only, hidden, system or archive attributes from the file under the cursor. Control-(A)ttributes does the same for all tagged files in the directory. (C)opy copies the file, with a new name if desired, to any directory on any disk, while Control-(C)opy copies tagged files to another disk after making matching directories. (D)elete and control-(D)elete remove the file under the cursor or all tagged files. (F)ilespec changes the filename mask and (L)og Disk reads the directory of a selected disk.

The information includes the disk drive identification letter, the free space available, the number of files on the disk and the total of their sizes, the current directory, the number of bytes in files in that directory, and the number and total size of tagged files.

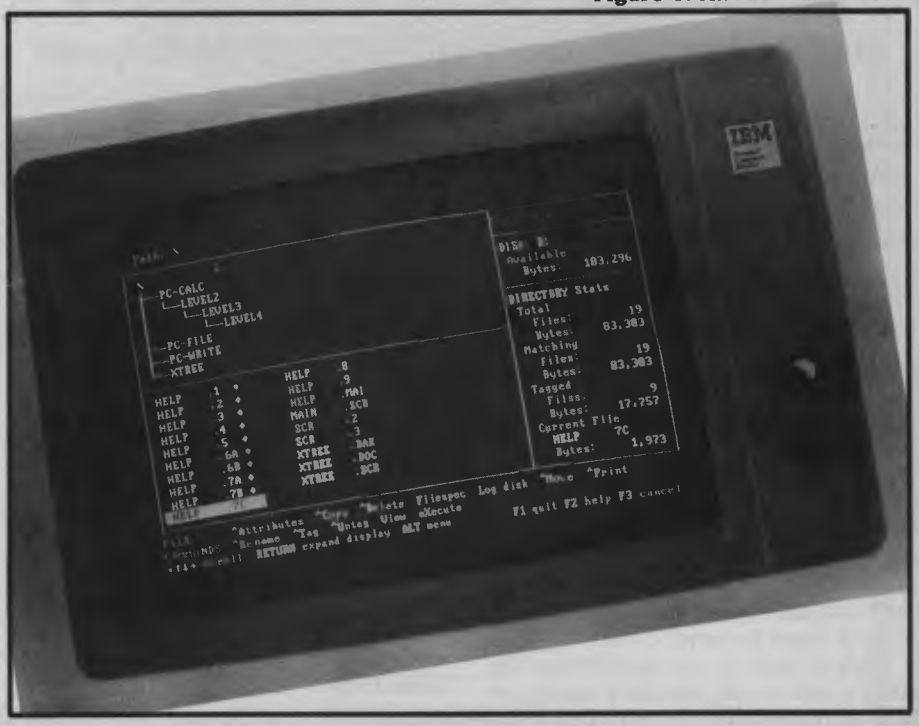
(M)ove moves a file from one directory to another without copying — only the directory information is rewritten. Control-(M)ove does the same for all tagged files. (P)rint lists the file under the cursor on the printer, and control-(P)rint lists all tagged files. (R)ename does just that for the file under the cursor or, in conjunction with control, on all tagged files. Files can be (T)agged and (U)ntagged from within the file window, and may be E(x)ecuted from the file window particularly easily.

(V)iew is especially good, allowing a browse of a file. Up to 10 markers can be set, and for the remainder of the viewing session a jump can be made straight to a marker. Pressing Home or End jumps straight to the start or end of a file. The display can be scrolled horizontally or vertically with the cursor keys, and can automatically scroll at one of nine speeds. Pressing (H)ex gives a display of the file contents in hex in the left three-quarters of the screen and a matching ASCII display on the right. Fantastic!

The Bottom Line

Xtree replaces the DOS commands like TREE, MKDIR and RMDIR, and does so on-screen with only a couple of keystrokes. Making and deleting directories is a snap. Xtree replaces a whole swag of public domain programs like Util, Volser, Move, Alter and XDIR, Cat, Browse and so on with one integrated, convenient, powerful unit. Even the price is right, at $99 recommended retail. I'm sure all PC users will buy a copy and won't ever work without it again. □

Figure 1. Xtree's main screen.



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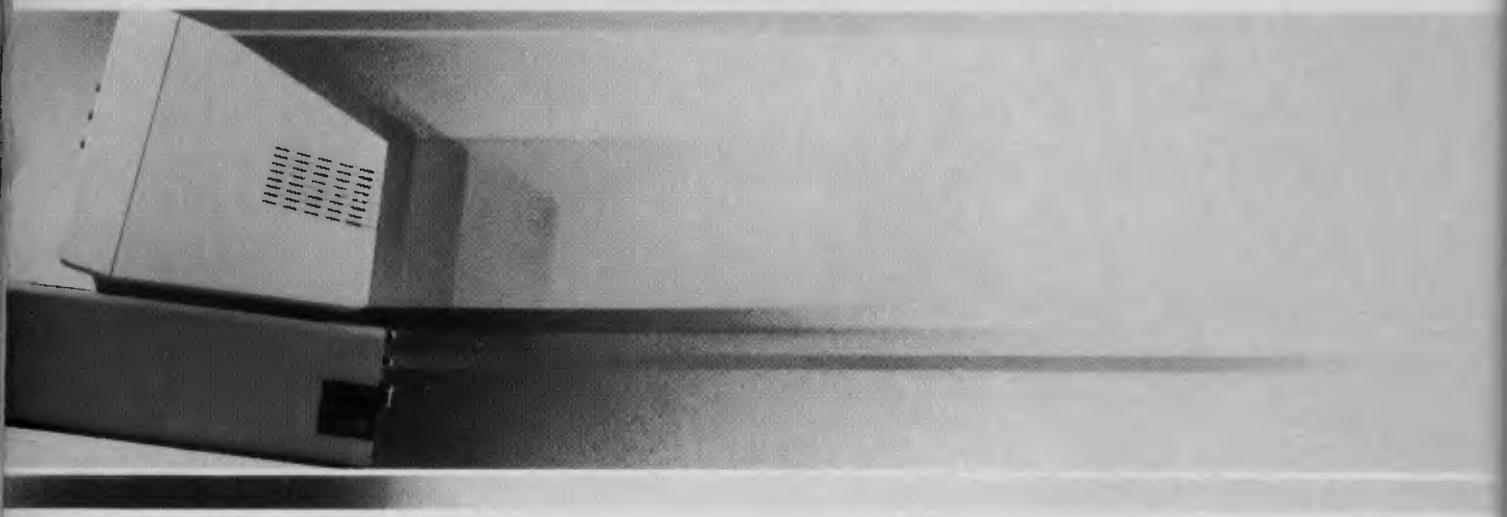

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C FOR SMARTIES
Part 8

Les continues his investigation of the C language with a look at an area where C is quite different from most other languages — string handling.

MANY PROGRAMMERS starting C for the first time, especially if they've previously used BASIC, are prone to comment about how primitive C's string handling is. Perhaps it is, at the basic level, but it's also surprisingly versatile and fast enough to be used extensively where BASIC would simply fall over.

By now you should be aware of the difference between single characters in C and strings. Single chars are stored quite frequently in integers, and single char constants have single quotes around them ('A'), while strings are stored in char arrays and string constants are surrounded by double quotes ("constant").

In other words, when you write:

```
char name[40];
```

you are actually reserving an area of memory called name, which is big enough to store 40 characters. The C compiler stores no information about this array other than where it will end up in memory — its address — which it maintains under the name 'name' (in this case).

This has two corollaries: first, if you want to store more than 40 characters at that address, the C compiler will let you go ahead and do it. C assumes you know what you're doing, and that if you want to do something that might otherwise be silly, you must have some reason for doing it.

If you do put more than 40 characters in the array name, they will overwrite whatever follows it in memory. Chances are these will be other variables in your program, and this will give rise either to some mysterious behaviour or a complete crash.

The other corollary of the way C works is that the compiler stores the address where the array will be stored under the array name (which is also 'name' in our example). In other words, the name of an array is also the address where the array is stored.

In C syntax, this equivalence is written as:

```
name = &name[0]
```

Another way of looking at it is that an array name is a pointer constant: it contains an address, just like a pointer, but that address cannot be changed. This means that in C, array names can often be substituted for pointers.

You should now understand why the gets() function is often implemented in a non-standard way by compiler writers. The standard gets() function is passed just one parameter:

```
char *gets(where)
char *where;
```

that is, the address where it is to store the input line. Note that although the parameter is a char pointer, we often pass it an array name, since they are effectively the same thing — they both contain an address. But if the input line is too long for the input buffer, it will overwrite something else, with potentially catastrophic results.

For this reason, many PC compilers implement gets() this way:

```
char *gets(where,howmuch)
char *where;
int howmuch;
```

where 'howmuch' specifies a limit on the length of the input string.

In C, strings are always terminated with ▶

a null character (ASCII value zero, often written as '\0'). In other words, if you write a statement like:

```
printf("Hi there! \n");
```

what the compiler actually stores in the program is the string

"Hi there! \n\0"

Not Rude to Point

String constants in C programs are always referred to through a pointer, so the value the printf function receives in the function call above is a pointer to the string, not the string itself. Contrast this with a language like PL/1, where the entire string is passed, usually on the stack, and you will begin to see where C's speed advantage comes from.

In other words, the value of a string constant is the address where that string is stored. Therefore constructions like the following are legal:

```
char *fred;
fred = "Hi there! \n";
```

Unlike other languages, this does not copy the characters across to a new location in storage; all it does it set the pointer fred to point to the string constant stored elsewhere in memory.

Beware of this; the declaration of a pointer to char causes the compiler to reserve storage space for a pointer, not a string of chars. The declaration for a string variable or buffer is:

```
char string[LEN];
```

which will allow the storage of most LEN characters in this buffer. It is the responsibility of the programmer to ensure he or she does not overflow the buffer and cause overwriting of whatever follows in memory. Notice the LEN characters here include the end-of-string zero character, so a buffer defined as follows:

```
char name[40];
```

can store at most a 39-character name, plus the end-of-string character. The gets() function, if it has a limit parameter 'howmuch', generally accepts up to howmuch-1 characters for the same reason.

Manipulating with Pointers

String variables are frequently manipulated with pointers, so let's look at some examples of this.

Probably the best-known function provided by the C function library is strcpy, which copies a string from one location to another. This has to be done this way, because a simple assignment cannot operate on aggregate data types like arrays, and of course a string is an array of chars.

C assumes you know what you're doing, and that if you want to do something that might otherwise be silly, you must have some reason for doing it.

The function strcpy is passed two parameters, to and from, which are pointers to the destination and source strings respectively. Here's the way this function might be written in longhand:

```
strcpy(to,from)
char *to, *from;
{
   char c;

   c = *from;
   while (c != '\0') {
      *to = c;
      to++;
      from++;
      c = *from;
   }
   *to = c;
}
```

and this is, in fact, the way one would be tempted to write it in many other languages. We copy each character into a temporary variable, and as long as it is not the EOS character, we write it out to the destination string and then increment both pointers.

In C, we would shorten this program quite considerably. In particular, check out the operation of the while condition, which also does the actual copying (remember the precedence rules here):

```
strcpy(to,from)
char *to, *from;
{
   while ((*to = *from) != '\0') {
      to++;
      from++;
   }
}
```

However, strcpy is generally defined in the following way:

```
strcpy(to,from)
char *to, *from;
{
   while (*to++ = *from++);
}
```

This is only one of many ways of writing this function; in fact, many compiler libraries, in the interests of speed, implement it as assembly language, usually using the REP string instructions of the 8086 microprocessor family.

The version of strcpy above is typical of the shorthand you will see in many C programs. The while loop has no body, since all the work is actually done in the loop control test. That expression actually copies a character from the location pointed to by 'from' and copies it to the location pointed to by 'to', then increments both pointers. The character is also used as the termination test for the loop, since it will be zero at the end of the from string, so the while test will fail.

Listing 1.

```
/* Test of strcpy function */

main()
{
    char a[40], *const;

    const = "This is a test.\n";
    strcpy(a,const);
    printf("a contains %s",a);
}
strcpy(to,from)
char *to;
char *from;
{
        while(*to++ = *from++);
}
```

As an exercise, try running Listing 1 on your machine; then try modifying it to copy between two variables. You will need to declare an input buffer — should this be of type char * or of type char []?

A more powerful version of the strcpy ▶

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function, which is provided with the Unix System V compiler and now with many microcomputer C libraries, is strncpy. This copies up to n characters from source to, destination. Listing 2 shows how Computer Innovations codes it for its compiler. This demonstrates the use of assignments as expressions in their own right, use of the , operator and some generally tight coding. It takes some minutes' study to fully understand how this function works.

Listing 2.

```
/*      copy a string into a buffer n characters in length
*/

unsigned char *strncpy(to,from,n)
unsigned char *to,*from;
unsigned n;
{
  unsigned char *cp;

  for(cp=to;n && (n--,(*cp++=*from++)););
  while(n--)*cp++=0;
  return to;
}
```

Programming Examples

1. Write the function strlen, which returns the length of a string. Its definition is as follows:

```
int strlen(string)
char *string;
```

This returns the length of the string pointed to by string. Suggestion: just count characters until you see a '0' character. I'll give you the answer later.

2. Write the function strcmp which compares two strings for equality. The definition of the function is as follows:

```
int strcmp(str1,str2)
char *str1, *str2
```

This returns:

-n if str1 is less than str2
0 if str1 is equal to str2
+n if str1 is greater than str2

Strcmp compares the two strings as far as the length of str1. That is, if str2 is longer than str1, but identical as far as the length of str1, then the two are equal. The actual value returned is not important; it should just be a negative number if str1 is less than str2, and a positive number if str1 is greater than str2. Comparison is based on the ASCII collating sequence. As an example, see Table 1.

You will have to write the function strcmp, and also construct a main function as scaffolding to test it.

Solution to the 'strlen' Exercise

Listing 3 shows one way of writing strlen, while Listing 4 gives an even shorter way of doing it.

Listing 3.

```
int strlen(string)
char *string;
{
        int i;

        i = 0;
        while(*string++ != '\0') i++;
        return i;
}
```

Listing 4.

```
int strlen(string)
char *string;
{
        int i;

        for (i = 0;*string++ != '\0';i++);
        return i;
}
```

Listing 5.

```
#define MAXSTR 80

main()
{
     char instring[MAXSTR];

     printf("Enter a string: ");
     gets(instring,MAXSTR);
     printf("\nThe length of that string is %d",strlen(instring));
}
```

Listing 6.

```
main(argc,argv)
int argc;
char **argv;
{

        printf("Length of %s is %d",argv[1],strlen(argv[1]));
}
```

Table 1.

str1	str2	Result
"ABC"	"ABC"	equal
"ABC"	"ABCDE"	equal
"ABC"	"ABB"	str1 > str2
"ABC"	"ABD"	str1 < str2
"ABC"	"ABD"	str1 > str2

You'll need a main() function to test the routine. Listings 5 and 6 give a couple of possible solutions. The second one allows you to type the word you want the length of on the command line as you run the program. It uses two parameters you haven't seen before, called argc and argv — you'll be formally introduced to them later. □

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Part 13

HOW TO WRITE A STRUCTURED PROGRAM

This month Phil Grouse takes a fresh look at a topic he started to cover earlier in this series: data structures.

SYSTEMS ANALYSTS generally recognise the equivalent importance of data analysis and process analysis. Data analysis is concerned with the forms of communications and records held by an organisation, whereas process analysis deals with what is actually done with that data.

The development of database systems over the last decade has enabled system designers to partition their activities along these same lines. Data may be analysed and maintained apart from processes, while processes may be developed to deal with data via a database management system.

We saw in an earlier article that this 'duality' of significance extends to the similarity of a process flowblock to the data blocks representing the data to be processed. The example was that of a telephone directory listing program given the required data structure of its output.

This month's article seeks to formalise the way in which we express data structures as 'data blocks' — the logical equivalent of the flowblock (which specifies processes or programs).

In flowblock notation, processes which follow one another in natural sequence are shown as a **pile** of blocks, each block representing one of the processes. Similarly, when a data structure consists of a sequence of smaller data structures, it too is shown as a pile.

An example might be a simple name and address record for a customer. The record includes the customer number and the date of last purchase. Figure 1 shows a possible representation of this record. The name of the structure is always shown at the top of the block.

Note that by assigning sequence to the blocks in this pile we are imposing a 'physical' constraint on the way in which the pile is to be stored. A further physical constraint arises from the required attributes of each of the actual data items. These attributes are commonly held in a data dictionary; the data dictionary for Figure 1 is given in Table 1. In reality, data dictionaries carry a great deal of information about data items, and are usually manipulated by a special-purpose program. Amongst information likely to be kept on each item are:

Name of data item or structure
Physical attributes
Alternative names used
Where the item is kept
The origin of the item
Uses
Volume per period of time
Access restrictions
Comments

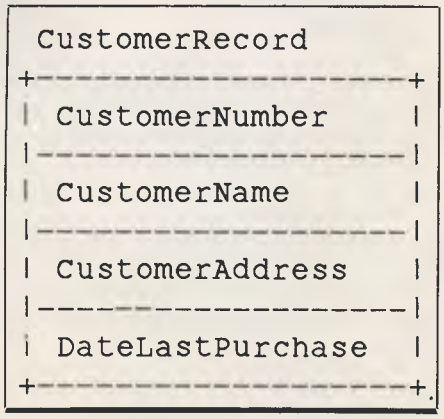

Figure 1. *A data structure for a customer record illustrating sequential structures.*

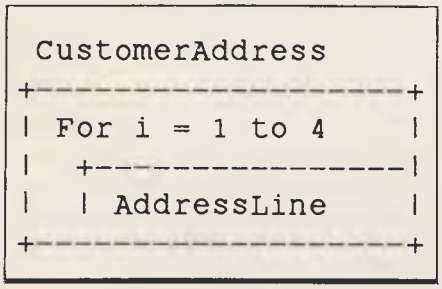

Figure 2. *The customer address is itself a data structure consisting of four lines.*

In database jargon, data 'items' are logically irreducible, and therefore may have specified physical attributes. For example, a name might be held left-justified in a field of 40 characters. The notation might be 'char(40)'. By contrast, a 'record' or 'structure' is composed of one or more 'items', and therefore has the 'attribute' of 'structure'. This means the data block of that name must be referenced to specify the structure. For example, **CustomerAddress** is a structure consisting of four separate lines, as shown in Figure 2. The item components **AddressLine** are in the data dictionary as char(30).

The data dictionary contains one record for each data structure. The records are maintained in sorted order (over the name of each structure) for ease of access. The attribute 'decimal(7)' means the customer number is a sequence of seven decimal digits, though the actual method of storage (for example, BCD or binary) would be determined by the database system in use. ▶

Data Name	Attributes
AddressLine	char(30)
CustomerAddress	Structure
CustomerName	char(30)
CustomerNumber	decimal(7)
DateLastPurchase	date

Table 1. *A simple data dictionary associated with the structures in Figures 1 and 2.*

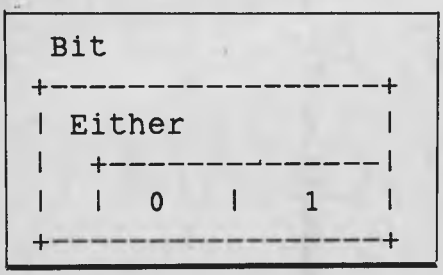

Figure 3. *The bit is either 0 or 1. The keyword 'Either' is a selection phrase.*

The attribute 'date' is a reference to a predefined commonly used structure. It has the form DDMMYY and is stored as a sequence of six decimal digits. Further, 'date' must be a valid date, so MM may not exceed 12, nor DD exceed 31. More particularly, DD may not exceed 30 when MM is 04, 06, 08 or 11. This is an example of a data item which is subject to specified editing restrictions. Similar restrictions may apply to other items, such as range checks on salaries or prices. While 'date' could be specified as a structure in its own right, it is generally regarded as a 'system-supplied' attribute.

Figure 2 illustrates a suitable notation for depicting repeated items or records; we have simply borrowed the corresponding flowblock notation.

Generally, a repeated structure uses a control phrase which gives an unambiguous directive. Since (at this stage) there is no software available for processing data blocks, the best choice is structured English. There is certainly scope for a data block translator capable of generating suitable DDL (data definition language) specifications along the lines of Stylus.

Possible repetitive control phrases could include:

Do N+1 times
Until x=0
While i>0

Similarly, we could use an extension of the flowblock IF control phrase to provide for selections or alternatives. Here some possibilities include:

Either
If byte is not null

Now let's use this notation to draw data blocks for some of the more commonly encountered data structures. The first of these is the most familiar and irreducible of all data items: the bit. This is shown in Figure 3 as simply being either a zero or a one. Being a primitive data structure specification it does not specify the contents of the bit; simply that it is either 0 or 1.

Similarly, we may define the byte to be a sequence of eight bits, as shown in Figure 4.

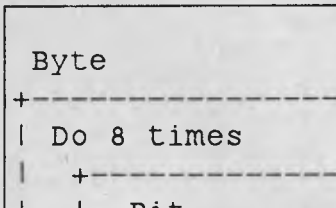

Figure 4. *The byte is defined in terms of the bit.*

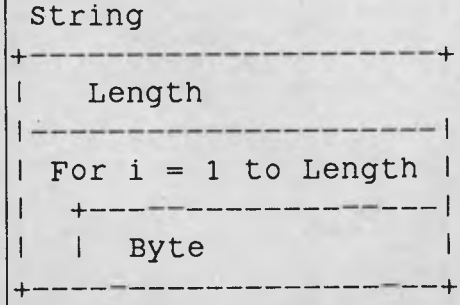

Figure 5. *The structure used by PL/I to store variable-length character strings. The variable 'i' is called a 'metavariable' because it is only part of the control construct. Contrast with the method used by C, as shown in Figure 6.*

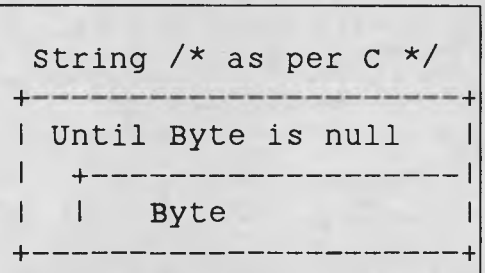

Figure 6. *String storage data structure used by the C programming language. The 'Until' test is always performed at the end of the repeated item (as is the case with the 'Until' flowblock control construct).*

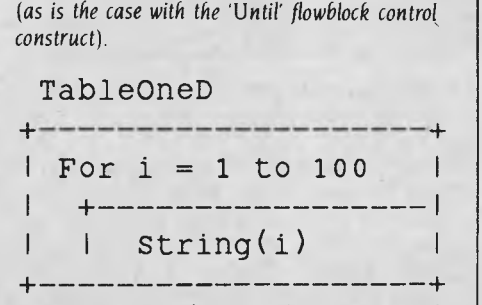

Figure 7. *A one-dimensional string array. The (i) following the String structure reference simply marks the reference number (or index) of the element.*

Byting Right Along . . .

We can now progress to structures composed of bytes: strings are a good example. In the PL/I language, variable-length character strings are stored as a sequence of bytes, preceded by a byte which contains the length of the string as a binary number (0 to 255). The Length item shown in Figure 5 would be defined in the data dictionary as a one-byte unsigned binary integer.

C programmers are more familiar with the string storage method shown in Figure 6. Here, a string consists of a sequence of bytes terminated by a 'null' byte (all zero bits). This means strings can have any length at all, but they may not include the null byte. Note that the 'null' would also be defined in a data dictionary as a byte with a specific value.

One- and two-dimensional tables are further examples of abstract data structures. They are composed of individual elements which themselves may be defined as abstract data structures. For example, a one-dimensional table of 100 strings could be expressed as shown in Figure 7, while a 20-by-30 array of strings is shown in Figure 8.

In practice, string arrays are usually stored indirectly. The elements in the array are actually addresses (or 'pointers') to the starting positions of each string. We could specify this in the data blocks of Figures 7 and 8 by prefixing the words 'pointer to' before the word 'String'. Since addresses are fixed-length entities, it is much easier to locate them given the row (and column) co-ordinates, then to follow the address to the associated string element.

As most programmers are aware, the elements of a table or array may be more complex than simple data items such as strings or numbers; array elements may be records such as the one depicted in Figure 1. The two-dimensional array of Figure 8 could also be regarded as a one-dimensional array in which the elements are also one-dimensional arrays.

At a slightly more complex level are list data structures. A list is a set of elements where each element consists of two fields, the first of which contains a pointer to the data defined by this element. The second field is a pointer to the next element in the list. The last element of the list is marked by the fact that its second field is the 'null' pointer. This structure is depicted in Figures 9a and 9b.

A special case of the unidirectional list is the 'circular list'. In this case, the **SecondPointer** of the 'tail' **Node** is the address of the 'head' **Node**. Traversing this list by following **SecondPointer** results in a circular path.

The list of Figures 9a and 9b can be traversed from its 'head' to its 'tail' just by following the **SecondPointer** values. To traverse the list in the reverse direction requires that we add another pointer to the **Node** structure, which is the address of the preceding **Node**. The **Node** at the head of the list would have a null pointer for this address. An alternative (but less efficient) method of working back to an earlier node is to start again at the head of the list and work forwards until the required **Node** is reached.

If the data structures addressed by the **DataPointer** values can also be lists as well as 'atomic' data structures, the list becomes a 'tree'.

Strictly, a tree consists of a set of nodes. The 'root' node is at the head of the list. Subsequent nodes are either 'leaves' (in which case their **SecondPointer** values are null) or pointers to the next **Node** at that level. The 'degree' of a node is the number of nodes in the tree dangling from that node.

A tree can also be implemented using nodes which contain a variable number of pointers rather than just the usual two (or three if the list is bi-directional). Logically a tree consists of a root from which stem zero or more additional trees and/or terminal nodes (or 'leaves') which contain pointers to atomic data structures. Note this is a 'recursive' definition since we ▶

```
TableTwoD
+-------------------------+
| For i = 1 to 20         |
|  +--------------------+ |
|  | For j = 1 to 30    | |
|  |  +---------------+ | |
|  |  | String(i,j)   | | |
+-------------------------+
```

Figure 8. *A two-dimensional string array with 20 rows and 30 columns.*

```
List
+-----------------------------+
| Until SecondPointer = null  |
|  +--------------------------|
|  | Node                     |
+-----------------------------+
```

Figure 9a. *Primary definition of a uni-directional list. 'SecondPointer' is defined in the 'Node' data structure (Figure 9b). The list consists of a sequence of 'Nodes'.*

```
Node
+-------------------------------+
|  DataPointer                  |
|  /* Pointer to related data */|
|-------------------------------|
|  SecondPointer                |
|  /* Pointer to next Node */   |
+-------------------------------+
```

Figure 9b. *Definition of a list node as two pointers, the first pointing to a data item, the second pointing to the next node in the list.*

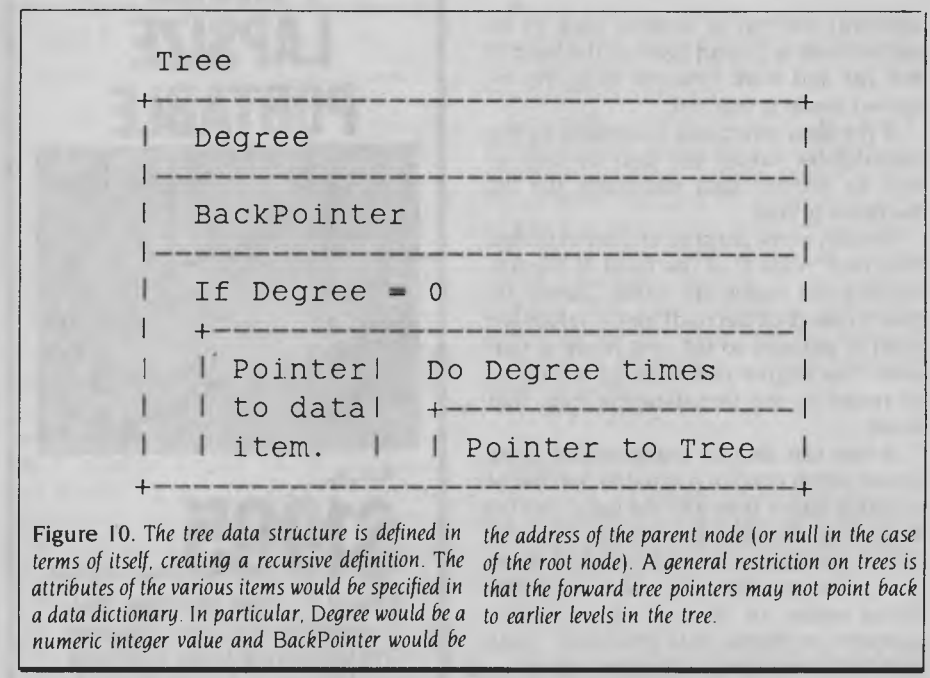

Figure 10. *The tree data structure is defined in terms of itself, creating a recursive definition. The attributes of the various items would be specified in a data dictionary. In particular, Degree would be a numeric integer value and BackPointer would be the address of the parent node (or null in the case of the root node). A general restriction on trees is that the forward tree pointers may not point back to earlier levels in the tree.*

have defined 'tree' in terms of itself. Interestingly, programs which process tree structures are also frequently implemented as recursive procedures. Figure 10 is a pictorial data block definition for the tree.

Binary Trees — Seeing Double?

A special case of the tree structure is the binary tree. In a binary tree, the value of **Degree** is either zero or two. Such trees are of value when expressing or analysing algebraic expressions (as in a compiler).

A more general case of the tree is the directed graph. Here the forward-pointing restriction is relaxed so nodes may point to nodes higher up in the structure; it therefore follows that a node may have more than one node pointing to it. A particular subset of the directed graph is the loop-free directed graph.

In our next article we will discuss some of the uses for lists and trees, and consider some associated processing algorithms. □

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Tax Attack

(*Continued from page 26*)

```
3922 LPRINT USING FMT$;TP
3924 LPRINT TAB(15);"Rebates:"
3926 FOR I%=1 TO 9
3928   IF RB(I%)>0 THEN LPRINT TAB(21);MSG$(I%);"-    $";
3930   IF RB(I%)>0 THEN LPRINT USING FMT$;RB(I%)
3932 NEXT I%
3934 LPRINT TAB(15);"Total Credits:                              -    $";
3936 LPRINT USING FMT$;REB+TP
3938 LPRINT
3939 IF PROV% = TRUE% THEN GOSUB 3970
3940 LPRINT : LPRINT TAB(15);
3942 IF AMT<0 THEN LPRINT "Your refund will be                    -    $";
3944 IF AMT<0 THEN LPRINT USING FMT$;-AMT
3946 IF AMT>=0 THEN LPRINT "You will have to pay                  -    $";
3948 IF AMT>=0 THEN LPRINT USING FMT$;AMT
3950 LPRINT : LPRINT CHR$(12)
3960 RETURN
3970 LPRINT TAB(15);"Add:"
3975 LPRINT TAB(15);'      Provisional tax payable               -    $";
3980 LPRINT USING FMT$;PROVTAX
3985 LPRINT
3990 RETURN
3997 '
3998 ' tax below $4,595 is nil
3999 '
4000 BTAX=0
4010 BASE=0
4020 XTRA=TI
4030 MRGN=0
4040 RETURN
4592 '
4593 ' tax on $4,595 is nil, marginal rate 25%
4594 '
4595 BTAX=0
4605 BASE=4595
4615 XTRA=TI-BASE
4625 MRGN=.25
4635 RETURN
12497 '
12498 ' tax on $12,500 is $1976.25, marginal rate 30%
12499 '
12500 BTAX=1976.25
12510 BASE=12500
12520 XTRA=TI-BASE
12530 MRGN=.3
12540 RETURN
19497 '
19498 ' tax on $19,500 is $4076.25, marginal rate 46%
19499 '
19500 BTAX=4076.25
19510 BASE=19500
19520 XTRA=TI-BASE
19530 MRGN=.46
19540 RETURN
27997 '
27998 ' tax on $28,000 is $7986.25,
27999 '
28000 BTAX=7986.25
28010 BASE=28000
28020 XTRA=TI-BASE
28030 MRGN=.48
28040 RETURN
34997 '
34998 ' tax on $35,000 is $11,346.25,
34999 '
35000 BTAX=11346.25
35010 BASE=35000
35020 XTRA=TI-BASE
35030 MRGN=.6
35040 RETURN
```

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1986 Software Product of the Year 1 your computer MAGAZINE

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Software

Backtrack
Tallgrass Technology (02) 211 2144
Price: $250 or free with Tallgrass System
Backtrack is a software package which offers automatic back-up of files from hard disk to tape, another disk or to floppy disk. This automatic back-up offers a huge saving of time in any repetitive back-up procedure and a totally self-starting system for users who back up to Tallgrass TC/T tape systems or disks. The automatic function ensures error-free procedures and offers a high degree of security against data loss through operator error.

Cartax
Ernst & Whinney (02) 654 4155
Price: Not quoted
Worried about Perks Tax? This new package is designed to come to grips with the complicated formula for the calculation of tax payable on a fleet of company vehicles. A company with 100 cars will face a bill of about $112,000, and miscalculation of this tax could be expensive. The package offers calculations based on any of the six optional methods of paying the tax. When the legislation is finalised, updated packages will be offered.

Pick on IBM PC-AT
KSH Systems (03) 267 2699
Price: Not quoted
Full availability of multi-user, virtual-memory computing running the Pick system on an AT. Capable of running up to six terminals with very good response times. Compatible with Pick-based systems implemented on minis and mainframes, and designed for business and management systems rather than for scientific use. The benefit is that as needs grow, users may update hardware and retain software. Complete with built-in database with dictionary file structure and a non-procedural query language.

DRMagic
DR Graphic Research (049) 46 9922
Price: $420
A new graphics drawing system for the Apricot PC/X1 and Xen range of micros, DRMagic is mouse-driven and based on the GSX graphics operating system. It supports 21 different fill shadings, six line styles, an unlimited number of text sizes plus the ability to load and save screen images from disk files. The entire screen may be saved or just a window, which may be redrawn in any position on another screen. Powerful image printing supports image rotation, expansion and positioning.

KSH-2 Financial Calculator
PC *Accessories* (02) 449 4721
Price: $99
Part of a new range of software imported from K Software House in the United States, this program offers a background calculator specifically designed for financial applications. It is able to import data from the foreground program, carry out calculations and send the answer back, as well as having the ability to generate and print eight types of commonly used schedules including amortisation; it seems like value at the price. It's available for IBM PC/XT/ATs or compatibles, and there's a version for 8087 machines.

KSH-1 Scientific Calculator
PC *Accessories* (02) 449 4721
Price: $75
Similar in concept to the Financial Calculator, this program will also run in the background and pop up when called. Functions include all the standard maths, log, trig and stats calculations. All the functions performed in integers may be expressed in binary, octal or hex, and the KSH-1 can perform logical AND, OR, XOR and NOT. Results of calculations can be placed back into the foreground program. IBM compatible.

Easy-DOS-It
PC *Accessories* (02) 449 4721
Price: $95
Yet another new entry from PC Accessories, this package is a master menu program and DOS tutorial that replaces complicated keyboard entries with one-key commands. The menu screen lists all available software by number, and selection is made by pressing one key. The program automatically returns to the menu on exit of any program. It also features alphabetic listing of all DOS commands for single-keystroke execution. (Needs DOS 2.0 or higher.) The menu also allows password protection of programs.

If you have a genuinely new product or service you would like mentioned in this section, our news editor would like to hear about it. Each month the YC mail box is inundated with press releases vying for a column centimetre or two in 'New Products', so we've instituted a rule to make the selection procedure a little easier: if you include vital details, such as price and phone numbers for publication, your release goes into the pile marked 'editor'; otherwise, it's destined for the pile marked 'shreditor'.

Clinic Software
Medix Software (02) 449 9162
Price: $975
Designed by doctors for doctors, this package completely takes care of patient records, case histories, clinical notes and progress. It is configured to run on a PC or clone with hard disk, and an optional billing package is available. Designed to be very user friendly, Clinic should be easily managed by staff without special training. In its present form, the package would be powerful enough to cater for the needs of a small hospital.

SNS Viatel
SNS *Computer Systems* (02) 438 2665
Price: $495
A Viatel access program, SNS is tailored for users of Convergent Technologies' N-Gen and MDS Systems' Hero computer workstations. It supports both colour and monochrome displays with reverse video and half-tones on monochrome. There are more than 6000 N-Gen computers in use in Australia

Pro Design 2
Pantek Australia (03) 836 9633
Price: $790
This is a new computer-aided drafting package with features which include on-screen zooming of images, full on-screen editing of drawings, easy drawing of circles and other figures, a simple menu, variable line thicknesses. A virtual-screen facility allows users of IBM colour graphics displays to draw to a screen four times larger than the actual screen. A full on-line help facility is available from the ? key, and 'esc' will undo the last command.

Zap Software Utility
Computer Enhancements (03) 267 7829
Price: $79.95
Zap loads into your DOS disk and, with an AUTOEXEC.BAT, slips quietly into the background and speeds up disk access time, allowing programs such as databases to run up to four times faster. Offering speed increases to be almost as fast as RAMdisk without the inherent danger of data loss by power failure, it seems good value. If you calculate your time at as little as $10 an hour it won't take long to pay for itself. ▶

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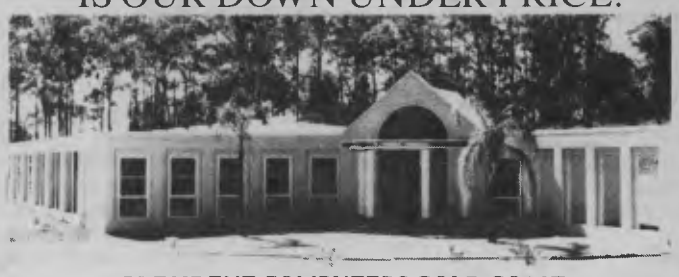

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Miscellaneous

First Touch Keyboard Strip
3M *Australia* (02) 498 9333
Price: $55
A simple, self-adhesive strip, the First Touch is designed to attach to the leading edge of your keyboard and be the first thing you touch when operating the system. It will drain away any static electricity which would otherwise be capable of causing memory loss or erroneous data transmissions. Can I get one for my head? ▶

Memorex Disk Head Cleaner
Memorex (02) 908 2211
Price: $25
This is a new dry type of head-cleaning disk: no more finding your head-cleaning disk has dried out or you have no refills available. A polyester-based material in the cleaning unit is composed of microscopic waveforms which trap and hold dirt. Suitable for both single- and double-sided drives and reusable up to 150 times, there is a mark-off section on the cover to keep tabs on usage.

▲ **Orb 250, 500, 1000, 1700**
Sab Nife (02) 406 4966
Price: from $2500 to $5333
An uninterruptible power supply in a range of 250 VA to 1700 VA, the Orbs offer total protection in the case of power failure for up to 10 minutes — plenty of time to dump files to disk. The supply also features a constant voltage transformer which ensures spike-free current to your computer while it charges the maintenance-free back-up battery. I've seen a computer after a lightning strike and it's not a pretty sight!

Dustcover for PC
DACOM *Business Data Management* (02) 419 6521
Price: $30 one-off; $22.50 for 100+
A dustcover for a monitor with a separate cover for the keyboard, this is designed for the IBM but will fit most personal computers and monitors. Made from 100 per cent anti-static and breathable cotton, it should reduce maintenance and downtime. Companies ordering bulk quantities may have their company logo embroidered free of charge. Keyboard and monitor covers are ◀ available separately.

Services

Unix/Xenix disk conversion
The Automated Office (02) 411 1892
Price: $10 per disk (average)
A new service offered to those who need to transfer files between Unix and Xenix systems. Transfer can be made between different disk formats and operating systems. ▶

New Machines

Amiga with PAL monitor
Chambers Computer Supplies
(03) 700 5344, (02) 356 3155
Price: $2995
Not a new machine, but a long-awaited combination of machine and monitor. The monitor is a 35.5 cm analogue RGB complete with a remote-controlled UHF/VHF tuner designed for Australia. The monitor can be purchased separately at $750 and carries a 12-month guarantee. Both the three-month guarantee on the Amiga and the monitor guarantee can be extended to three years for an unquoted fee.

Atari 520ST
Mobex (02) 406 6277
Price: $2399
This new Atari system comes complete with 512 Kbytes of RAM, an SF354 9 cm 500 Kbyte disk, a high-resolution 30 cm monitor and a mouse controller. Driven by a Motorola 68000 at 8 MHz, the system uses Digital Research's GEM operating system with icons and pull-down menus. The software package includes TOS (Tramiel Operating System), ST basic, ST Logo, First Word Processing and a graphics design program. A colour option with RF modulation enables a standard colour television to be used.

Mentor 1700
Clegg Driscoll Consultants (02) 819 7888
Price: $16,000 to $26,000
A new 1700 series computer which outperforms and supports more users than any comparable Pick-based computer. Based on the 80286, it is available as a three- or nine-user system with 20 Mbyte or 40 Mbyte hard disks. It is more economic to install than a similar number of networked PCs, and is ideal for distributed systems. The 1700 supports the Pick system but will also run MS-DOS. The unit comes with floor-standing CPU, high-res monitor and keylock for security.

Vax 8500
Digital Equipment Corporation
(02) 412 5269
Price: From $481,000 (yes, that's right)
A new toy for those of you who have outgrown your PC, the Vax 8500 offers performance three times better than the industry standard Vax-11/70. With a footprint of only 0.52 sq m, this 32-bit machine is multi-functional and multi-user. Vax offers a one-year on-site warranty, and software may be licensed on a monthly basis. The DECnet/Ethernet supplied provides users with a complete set of networking tools.

Peripherals and Extensions

The First Nice Modem
Bresike (02) 457 9947 (*voice*);
(02) 457 8281 (*modem*)
Price: $279 RS232;
$299 Commodore
An Australian-produced and Telecom-approved modem suited to any RS232-connect computer, the Nice Modem plugs directly into a phone socket and is supplied with its own pushbutton phone and power supply. Modes include CCITT V21, 300 bps full duplex, V23 600/75 half duplex, 1200/75 and 75/1200 half duplex plus Bell standards. It also features auto-answer and disconnect facilities. Order by phone or by contacting Omen II bulletin board.

Furniture

Datalite Copyholder
Sylex (02) 647 2888
Price: $189 and $215
Sylex has introduced two new pedestal-mounted electric copyholders. Copy movement through the holders is smoothly controlled by a foot pedal, both forward and reverse, and the built-in soft light over a magnifying bar affords a comfortable reading level. The height is adjustable on a telescopic leg. The difference between models is simply the width of copy capacity, with the smaller allowing a 350 mm copy width and the larger 455 mm.

Sylex Monitor Bases
Sylex (02) 647 2888
Price: $28, $32, $95, $179
Four new monitor bases designed for maximum flexibility are also from Sylex. The first, with 360-degree swivel and +/- 12.5 degrees of tilt, is designed for 280 mm by 260 mm bases; the second, with the same specs, is for bases up to 260 mm by 310 mm — both incorporating a pencil tray. The third will carry up to 100 kg and spins through 360 degrees with a 'lazy susan' action, but has no tilt facility. The top model allows tilt of +/- 5 degrees, 360-degree swivel and incorporates a copy holder. Available in colours to blend with modern offices. □

Compatible PC XT AT

Specifications:

Description	PC/XT	PC/AT
Processor Processor Speed	8088 4.77MHz or 6.77MHz	80286 6Mhz or 8MHz
RAM	640K	640K
Expansion Slots	8 (5 vacant)	8 (6 vacant)
Ports	2 × Serial 1 × Parallel	2 × Serial (1 installed) 1 × Parallel
Real Time Clock	Yes	Yes
Games Port	Yes	No
Co-Processor Opt.	Yes (8087)	Yes (80287)
Monochrome Hercules Comparible Adaptor	Std. 720 × 348 1 × Parallel	Std. 720 × 348 1 × Parallel port
System Pricing with: (Does not include Sales Tax)		
Single Floppy Two Floppies Hard Disk Drives	360K $1695.00 720K $1995.00 10MB $2995.00 20MB $3495.00	1.2MB $4595.00 2.4MB $5060.00 20MB $5995.00 40MB $7645.00
Video Options	Colour/Graphic Mono/Colour	320 × 200 4 colours 640 × 400 4 colours
Power Supply	150 Watt	200 Watt
DOS	3.1 Std.	3.1 Std.
Warranty	6 Months	6 Months
Availability	Ex-stock	Ex-stock

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Your MICROBEE

BY COLIN TRINGHAM

I HAVE JUST received the first issue for 1986 of the Townsville Microbee User Group's newsletter. The group is to be congratulated on the wealth of useful information it has put together. Microbee owners in the Townsville area should contact this enthusiastic group at PO Box 5751, Townsville Mail Centre 4810, or phone the Secretary, Mannie Van Rijswijk, on (077) 73 4236 after working hours. The group meets at 7.30 pm on the second and fourth Mondays in the month in St Mary's Secondary School, Crowle Street, Hermit Park, and visitors are welcome.

It was interesting to read an article in *The Sting*, the WA User Group's newsletter, about the new Gamma machine, in which the writer echoed my own sentiments. There is no point getting carried away with a machine just because it has the latest chips, more memory and so on. The important point with a computer is what it does and how well it does it, and for most home users the current machines offer plenty of reasonably priced programs and enough speed for most purposes.

Peculiar Code Problem

Back to my battles with machine code, and a peculiar problem which perhaps others have also found. I wrote a program in BASIC using three machine code routines, including one which scrolled the entire screen, colour and all, to add some variety to the usual CLS instruction. The program ran very well on my own machine, but when I tried it on others it produced some terrible PCG characters.

It took some time to work out the cause of the disaster, but it was obvious once I went through the routines very carefully. The Microbee uses the normal method of addressing its memory, but to conserve space some areas of memory hold two sections at one time. The most obvious is the screen area, from 61440 to 63487, which also has a ROM at the same address with the character shapes. You can switch the character ROM into and out of use with the ROMREAD signal which comes from bit 1 of the output port at 0Bh.

The colour RAM is paralleled in the same manner, with the normal PCG RAM at addresses 63488 to 65535. The two different RAMs are switched into circuit by a write to bit five of port 08, and this is where I came unstuck. On a monochrome Microbee there is no connection to disable the PCG RAM, and my routine to move the colour bytes merely moved all the PCG characters one byte in memory. I'll watch this problem in future.

There is no point getting carried away with a machine just because it has the latest chips, more memory and so on. The important point with a computer is what it does and how well it does it.

Assembly language programmers can check if a machine has colour fitted or not by writing a known value to a PCG byte, switching the colour RAM into place, and writing a different value to it. Now if you switch back to normal PCG RAM you will either find the original value if you have a colour machine, or the value which should have gone into the colour RAM on a monochrome machine.

User Group Knowledge

The many user groups continue to accumulate a wealth of knowledge and programs. The Sydney Microbee Users' Group has over 100 different cassettes with up to eight programs per cassette for members' use, plus well over 15 disks full of programs for sale, ranging from public domain material to members' own work in both BASIC and machine code. The Adelaide Users' Group has 19 disks in its library and has printed out details of the programs on each disk in its very 'newsy' monthly newsletter. The Melbourne and Canberra clubs also have many programs available for members' use.

Assembly Language programmers can get some good tips from Lewis Badham's small book *Life after* BASIC or from *Microbee Assembly Language Programming*, both available from Federal Publishing and Microbee Systems stores.

I have had a few enquiries from readers wanting a good assembler for Z80 code. I understand the excellent Microsoft Macro-Assembler is no longer available, but I have received news of a new, reasonably priced assembler from Glyphic Software, PO Box 391, Pennant Hills 2120. The program is called the Mitek Relocatable Z80 Macro Assembler and Z80 Symbolic Debugger; you buy the program in parts if needed. The assembler alone is $67.50, while the linker and debugger (with an 8080-to-Z80 converter) cost $125. The package for the two programs, including manuals, is $165. Write to Glyphic Software if you need more information. I can't go into much detail here, but one of the niceties of this package is that it produces both hex and Microsoft-compatible files, as well as machine code files suitable for including in Pascal routines.

Premium Word Processor

I was lucky enough to see a demonstration of Microbee Systems' latest word processor, suitable for the Premium range of machines. This includes the facility of seeing on the screen exactly what you will get on the printed page, including boldfaced type, underlining, italics, sub/superscripts and more. It is in colour, which makes it very easy on the eyes as the command codes and menus stand out from the printed page so well. I particularly like the page layout feature, which gives an impression of how the final page will look.

The graphics tablet and its associated screen manipulation program should ensure a rapid growth of programs making use of all the extra PCG characters available in the Premium range. A scanner head can be attached to the Microbee range of dot matrix printers to convert pictures into digitised images. Sounds like a winning product at a very sensible price.

In case you missed it, Microbee Systems has very quietly reintroduced the 64 Kbyte 13 cm disk system as part of its 'Mix and Match' concept. The 64 Kbyte unit has a lot to recommend it, as it seems to be happy with most of the public domain CP/M software on the market, whereas the 128 Kbyte small-business machine running under the shell system has been reported to have a few oddities which cause problems on some programs — Submit is an example.

Microbee Systems had a change of heart recently with regard to the many user groups, and has started to try to liaise much more closely with them. Three or four groups (at least) have received free of charge a 32 Kbyte Premium machine for review. There has been much discussion among members of most groups as to how many will upgrade to the Premium series, and the percentage seems to be very high indeed. For the small upgrade cost — around $150 to $200 — you certainly get a lot of extra features. □

Books of Special Interest to Our Readers

THE USER'S GUIDE TO COMMODORE 64 & VIC 20
The editors of Consumer Guide have compiled a thorough introduction to the Commodore 64 and Vic 20 computers, software and peripherals. With colour illustrations and a clearly written text, this reference will guide the newcomer through all phases of learning how to use the computer: From setting the system up,leaming what each key does, expanding the system with peripherals, to buying new software. Specific exercises are included for each of the keys. Spiral bound, 80pp.
H0065G **$8.50**

EASY-TO-UNDERSTAND GUIDE TO HOME COMPUTERS
Confused by all those computer terms? This clearly written book from the editors of Consumer Guide tells exactly what computers are, how they work and why they are so amazingly useful, all in plain English. Here is all of the information needed to understand and use computers, and even to start programming. A special buying section compares the most popular home computers. This book is your ticket to the computer age! Spiral bound, 96pp.
H0066G **$8.50**

COMPUTER TERMINOLOGY EXPLAINED
Concisely explains the most common terms encountered by the home computer enthusiast as well as many of those used with mini- and mainframe computers. Includes tables of ASCII codes and BASIC control codes. 81pp.
H0143B **$5.95**

ALMOST EVERYBODY'S PERSONAL COMPUTER BOOK
Written for the computing beginner to break the enormous barrier of jargon and mystique that seems to surround computers. With a highly readable approach, the author introduces the basic concepts and developes them into a general discussion on personal computers including choosing and caring for a PC. Also offers an introduction to BASIC programming. 160pp.
H0144Z **$8.95**

SPOTLIGHT ON COMPUTER AWARENESS
An introduction to speaking confidently about how computers work, their applications, their history (from abacus to IBM) and employment prospects in computer related fields. Includes a comprehensive glossary. 84pp.
H0145P **$6.95**

A PRACTICAL INTRODUCTION TO MICROPROCESSORS
Takes the reader through the construction of a simple microprocessor and experimenting with it to gain an insight into the complexities of microprocessing. The book assumes a general knowledge of electronics. 90pp.
J0158B **$5.95**

MICROCOMPUTING DESIGN & TROUBLESHOOTING
Explains designing microcomputer systems and making them work without expensive commercial development systems or the need for costly test instrumentation. Includes a complete description of two microprocessors-the 8085 and the 6502. 346pp.
J0161P **$26.75**

EASY ADD-ON PROJECTS FOR COMMODORE 64, VIC-20, BBC MICRO & ACORN ELECTRON
The simple and inexpensive projects include a pulse detector, model controller, light pen, lap sensor and more plus six projects that make up a weather station. 191pp.
J0165B **$6.95**

A Z80 WORKSHOP MANUAL
Intended for those who want to progress beyond programming in BASIC to topics such as machine code and assembly language programming or who need hardware details of the Z80-based o computers. 184pp.
J0283B **$8.95**

SECRETS OF THE COMMODORE 64
A beginner's guide to the C64 with masses of useful information and programming tips as well as describing how to get the best from the powerful sound and graphics facilities. Includes two useful chapters on machine code. 109pp.
J0297B **$5.95**

MICRO INTERFACING CIRCUITS: BOOK 1
Guides those who are unaccustomed to microprocessor techniques but have some knowledge of electronics, through a practical approach to address decoding, parallel and serial interfacing, analogue to digital and digital to analogue converters, etc. 96pp.
J0325B **$6.55**

MICRO INTERFACING CIRCUITS: BOOK 2
Developes the practical side of interfacing introduced in Book 1. Discusses sound and speech generators, temperature and optical sensors, motor controllers, etc. 87pp.
J0326B **$6.55**

AN INTRODUCTION TO MSX BASIC
For those wanting to learn to program, Microsoft Extended (MSX) Basic offers a powerful and flexible version of the most popular computing language. This comprehensive introduction starts with the basics and progresses by stages to the more advanced programming techniques and includes coverage of advanced multicolour, sprite graphics, and the programmable sound generator. 88pp.
K0047B **$6.95**

THE BEST VIC/COMMODORE SOFTWARE
Trying to find the most suitable software for personal computers can be frustrating. The editors of Consumer Guide have compiled comprehensive reviews of VIC 20 and Commodore 64 programs based on ratings by user groups; further evaluation is given by the editors and Commodore software experts Jim and Ellen Strasma. Each review describes the program's purpose and features, detailing both the good points and bad. Each program has been rated for ease of use, clarity of written and on-screen instructions, and overall performance. The program's price, publisher, format and hardware requirements are also included. The reviews are presented in sets by topic: Word Processing, Business, Home, Education, Networking, Strategy Games, Arcade Games and Programming Aids. Spiral bound, 192pp.
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HANDS UP all the Wordstar users. My, aren't there still a lot of you out there! A couple of little snippets for you. Wordstar 3.3 for the IBM PC and close compatibles writes directly to the screen in order to pick up display speed. Older versions wrote to the screen as a serial terminal, which is just a little slower than writing directly to the video RAM.

Occasionally it is still essential to use the older video I/O. Microsoft Windows cannot allow programs which write directly to the screen to work within a window while other programs are running in separate windows. Some MS-DOS machines use different video addresses from IBM, and won't run the unpatched Wordstar. Using programs like Remote, or the CTTY command from DOS, to run Wordstar on a host PC from a remote terminal requires a patched version of Wordstar to really run successfully.

A very simple patch will do the job. First copy WS.COM to a second disk, and then use Debug to patch three bytes in the file. Remember — patch a copy, don't *ever* patch your only copy of any file!

Listing 1.

```
C > debug b:ws.com
-e 2aa
2AEE:02AA  FF.00
-e 2b0
2AEE:02B0  FF.00
-e 2b3
2AEE:02B3  FF.00
-w
Writing 5380 bytes
-q
C >
```

In the example (Listing 1) I had Debug on the C drive and WS.COM on a disk in the B drive. The display is an actual patch session, copied from the screen with Sidekick. Entries made by the user are underlined — the Debug responses are not underlined.

I am writing this column with the patched version of Wordstar — working perfectly with only a tiny loss of speed when rewriting whole screens. I have run it within a window in Windows, and remote-controlled a PC running Wordstar over a phone line!

The Claytons Dot Command

You all know what a dot command is — a full stop on the first character of a line followed by instructions to Wordstar. The Claytons dot command is some other string (like .OBJ) part-way across a line. No problem until a reformat puts the .OBJ (or whatever) at the beginning of a line. Wordstar now ignores the whole line while printing, or does something else unexpected.

The solution is simple — put *two* control-S's immediately in front of the full stop, like this: ^S^S.OBJ. Either use function key 7 twice or Control-PS twice to insert the two Control-S's into the file.

Borland is the firm which effectively proved the insanity of copy protection by selling good products at a price low enough for all users to afford. It proved its point with sales of half a million copies of Turbo Pascal, and made its entry into utility software with Sidekick.

Borland Moves

Borland is the firm which effectively proved the insanity of copy protection by selling good products at a price low enough for all users to afford. It proved its point with sales of half a million copies of Turbo Pascal, and made its entry into utility software with Sidekick. New language products have been rumoured for some time — Turbo BASIC, Turbo C, and others. An 8-bit version of Turbo Modula2 was even reviewed in an American magazine last year. Just released in the United States is Turbo Prolog, and at a price there of under $US100 it is sure to be highly successful.

The add-ons to Turbo Pascal — Gameworks, the Database, Editor and Graphix Toolboxes — all included full source code with documentation, to allow customisation and/or use of procedures within one's own programs. They served the triple purpose of providing running programs, supplying invaluable functions and procedures for use in other people's programs, and acting as advanced tutorials in the use of Pascal.

The first add-on product for Turbo Lightning has also been released. Called Word Wizard, it is designed for crossword puzzle and cipher fanatics and appears to be the reverse of a spelling checker. Written in Turbo Pascal, Word Wizard also includes source code and documentation. In typical Borland style it isn't just a running program but also forms part of a tutorial on preparing applications to run with Turbo Lightning.

The End of 13 cm Disks?

IBM has effectively announced the end of the 13 cm disk. Nine cm 720 Kbyte drives will now be available on most PCs except for the AT, but 360 Kbyte drives using the classic 13 cm disks will still be fitted ex-factory to many units.

Other IBM announcements include:

- An upgrade option for the PC-JX to allow for 720 Kbyte disk drives.
- External 720 Kbyte 9 cm drives for use with desktop PCs.
- Internal 720 Kbyte 9 cm drives for new models of the PC XT.
- DOS 3.2 to make provision for the 720 Kbyte drives.
- A laptop computer called the PC Convertible.

The Clamshell

For well over a year there have been rumours of a laptop from IBM; in these rumours it has been called the Clamshell. It has at last been announced in the United States as the IBM PC Convertible, and comes standard with two 9 cm disk drives with 720 Kbyte capacity each. Using battery power for its 80C88 CMOS processor, it is highly portable, especially since it weighs only around 6 kg. The 80-column by 25-line LCD screen can be detached and various mono or colour monitors attached via a CRT display adaptor. Standard memory is 256 Kbytes, which can be expanded to 512 Kbytes.

Laptops have become a growing market segment, with many people on the move finding them invaluable. The use of 720 Kbyte disks makes hard disks less essential as bigger files can be realistically used with floppies. It will be fascinating to see how well the new Convertible, the new drives and the new DOS gain acceptance. □

Your BONDWELL

BY JEFF RICHARDS

THE BONDWELL screen display is 25 lines of 80 columns, or 2000 characters precisely, yet the memory space allocated to the screen display is 2048 characters. It turns out that the extra 48 characters can be used for a non-scrolling status display at the bottom of the screen.

The obvious use for this status line is to show the current setting of the special function keys, although with only 48 characters available there will probably only be room to describe function keys 1 to 8. An alternative purpose would be to display a name identifying the disk the system was booted from. Custom-written programs could use the line to display specialised status information.

There is one drawback, however. Although the first 48 characters of the bottom line can be displayed, the remaining 32 characters appear as garbage. In fact, these characters are the first part of the top display line. This is because the address range of the display controller wraps around at FFFFh and starts again at the beginning of screen memory. For many programs, such as Wordstar, this does not matter, as the top line only contains status information anyway.

In order to display the extra characters it is necessary to reprogram the video display controller. Strictly speaking, the whole set of display parameters should be recalculated and reprogrammed, but in practice I have found simply changing the number of display lines from 25 to 26 works reliably.

Reprogramming Display Controller

In order to display the extra characters it is necessary to reprogram the video display controller. Strictly speaking, the whole set of display parameters should be recalculated and reprogrammed, but in practice I have found simply changing the number of display lines from 25 to 26 works reliably. There is enough room on the screen for the extra line, and the internal video timing seems to have enough slack in the vertical retrace to cope with the extra display line without any loss of stability.

The procedure to reprogram the video controller to 26 lines is similar to that previously presented to adjust the shape of the cursor. A pair of data values is written to the controller ports. The first selects the controller register to be reprogrammed and the second enters the required data. In this case we wish to write the value 26 into register 6. The sequence is to write 6 to port 10h (to select register 6) and then 26 to port 11h (to enter the number of screen lines into register 6).

Having reprogrammed the controller to display 26 lines we must POKE the data to be displayed into the appropriate memory locations. These locations are FFD0h (65488d) to FFFFh (65535d), and the data can be POKEd either from BASIC or from a machine language program. Listing 1 is an example program that copies the command line tail into the status line area.

Listing 1.

```
ORG 100h
 MVI A,6      ; Select register 6
 OUT 10h
 MVI A,26     ; and set it to 26.
 OUT 11h
 LXI H,0FFD0h
 MVI B,48     ; Clear 48 spaces.
LOOPA:
 MVI A,' '
 MOV M,A
 INX H
 MOV A,B
 DCR A
 MOV B,A
 CPI 0
 JNZ LOOPA
 LXI H,0FFD0h
 LXI D,082h  ; Get the command line
 LDA 080h    ;  tail
LOOPB:
 CPI 0       ; and copy it until
 RZ          ;  there is no more.
 MOV B,A
 LDAX D
 INX D
 MOV M,A
 INX H
 MOV A,B
 DCR A
 JMP LOOPB
END
```

Create the program in a file called STATUS.ASM, copy it to your number two CP/M disk and assemble it with the command MAC STATUS.

Create the executable file with the command HEXCOM STATUS. Execute the program by typing STATUS followed by the status line required: "Status this is the Status Line <Return>".

For those who prefer a full 80-character status line without garbage characters, line 25 of the display can be prevented from scrolling by entering the changes shown in Table 1. This table shows the memory location, the old value and the new value. It also shows the byte offset in CPM 3.SYS for those who can edit a non-textfile. If this technique is used a small utility program will be required to insert the required message at FF80h to FFCFh. The second half of STATUS.ASM could be adapted for this job.

Memory Location	CPM 3. SYS File Offset	Old Value	New Value
EB13	893	18	17
EB23	8A3	80	30
EB2A	8AA	80	30
EC03	783	18	17
EC10	790	D0	80
EC1D	79D	80	30
EC2D	7AD	18	17
EC35	7B5	80	30
EC3E	7BE	7F	2F
EC41	7C1	CF	7F

Table 1. *Patch to scroll 24 lines only.*

Note that these adjustments to the screen handler do not apply to either the clear screen command or the clear to end of screen command. In both these cases memory right up to FFFFh is cleared, and there is not room in the code to alter it without making major changes to the system software.

If these changes are installed, the software supplied with the Bondwell must be reconfigured for a 24-line display. Note all the values in Table 1 are in hex. These absolute memory locations can be expected to change with different revisions of the software, but I have not yet discovered more than one version of the Bondwell operating system. However, don't try installing these changes if the locations do not already contain the 'old value' given in the table. □

A NEW SPECIES - THE COMPUTER ORPHAN

You may even know one! They are the people who saw an ad in the paper or on television for a supposedly compatible computer at a ridiculously low price. When they bought their cheap computer, they couldn't help but brag about their deal to their friends.

Eventually it happened - the cheap computer developed problems.

Unfortunately however, some companies do not even stay in business long enough to honour the guarantee (if any) they give with their computers.

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BY IAN ALLEN

Superscript

One of the first programs released for the 128 was the Superscript word processor, written by the same people who wrote Easyscript for the 64. Easyscript files therefore remain readable with Superscript (including most of the formatting commands). The 128 program has lots more bells and whistles, including a built-in spelling checker (selectable in either American or English versions) which is surprisingly quick and easy to use. It starts with several thousand words, but you can teach it to recognise up to 30,000.

Superscript also has a built-in word counter, which tells you how much you've written in words, sentences and paragraphs, and also gives you the number of unique words. The program even has maths features, making it possible to add up rows and columns of figures. While it is no spreadsheet, it is very useful for simple calculations, so if that's all you need in this line it saves you the expense of buying a true spreadsheet.

Another feature I like is Superscript's mailmerge function. Mailmerging lets you write a form letter and send personalised copies to a number of people. The program should extract details such as name and address and insert them into the form letter at the correct places. With Easyscript, this process was a nightmare: one mistake in your merge list would totally confuse it. Instead of saying 'Dear Mr Jones' it would end up inserting the address, to read: 'Dear Mr Willoughby Rd'. I'm happy to say Superscript has no problems in this regard; its mailmerging even has optional fields allowing for situations where an address might be unusually short or long.

My main criticism of the package is not the software — it's what you don't get in the box. When Easyscript was first released, $100 bought you two program disks plus one of the most comprehensive and easy-to-use manuals I've yet seen. Superscript, at $150, provides just one protected program disk and a rather tacky manual.

No-frills Database

One of my pet hates is Superbase. There's no denying its power and flexibility as a database, but it's a pain in the neck to use! When I think of the number of hours I've wasted trying to figure out from the incomprehensible documentation how to get it to do even the simplest of tasks, my blood boils...

Fortunately Ozisoft has released a low-cost database program which caters for people who don't need massive power and complexity. Developed by Radarsoft in Britain, Databasis is available in both 64 and 128 versions. Its virtues are that it is very simple to use and reasonably foolproof. It's more than adequate for non-business applications like maintaining a club mailing list or details of your cassette collection.

Databasis stores the entire file in the computer's memory. This has the advantage that sorting and updating records is very fast (no need to access the disk), but it also limits the maximum size of the file. On the 128 version I had no problems storing a mailing list with 500 entries, although you wouldn't be able to cope with this on a 64.

Rambo Reproductions . . .

Ozisoft has been distributing the Rambo game for some time, so if you're into the sentiments of the movie you probably have a copy by now. What you might not know of is the existence of a more up-to-date scenario. It's called Infiltrator, and combines Rambo ethics with the style of 'Blue Thunder'. Unlike in Rambo, the enemy is not named: he's just the "insane leader of a small militaristic nation". You are Captain Johnny 'Buckaroo Rambo' McGibbits and your job is covert: fly your unmarked helicopter into the country, rescue the hostages, blow up everything and assassinate the leader!

Mickey Mouse politics aside, Infiltrator does have amazing graphics and sound. Its flying is like Flight Simulator II, except better. The point of view is from inside the cockpit, and you can even see your hands — they move as you push on the joystick. You not only have to master flying, you also have to learn how to turn on the various weapons systems, how to navigate, how to trick intercepting aircraft into thinking you are friendly — and that's before you get to your target. Once there you have to undertake extra-vehicular activities in order to effect a rescue, and so on. One wonders just how much more can be squeezed into a 64. □

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LOTUS HOTLINE

Listen to the Experts

On occasions we are privileged to hear an expert speak on his or her chosen subject, but it's rare to have three experts speaking at one meeting. This happened at one of the recent Sydney meetings of the Lotus Users' Group. Sarah Puffer of Lotus was on a visit to Australia and was persuaded to stay an extra day to address the meeting, and she was accompanied by David Lewis and Adrienne Erwin of Imagineering.

Lotus has two companies: Lotus Development Corporation, which handles program development, and Lotus International Support Division, which deals with support to countries like Australia. Sarah Puffer is the International Support Manager of the International Support Division of Lotus — which means any technical problems encountered by Australian Lotus users are directed by Imagineering to her.

A Change of Heart

Sarah told us Lotus has had a change in its approach to software developers. In the past it would refuse to give any information about Lotus file formats on the grounds that it was proprietary information and releasing such information would only lead to competitors producing Lotus clones.

Now the company is welcoming developers with open arms, and has prepared tools and resources for such developers to work with 1-2-3 and Symphony. The materials available are:

- Macro conversion aid — for converting 1-2-3 macros to Symphony.
- Standalone decoder — to produce a report on all file attributes.
- Add-in tutorial — a Symphony macro-driven aid to developers.
- Public domain software — examples of add-in products.
- Public domain templates — there are over a hundred of these.
- The details of the Microsoft-Intel-Lotus expanded memory specification (EMS). Lotus refers to this as LIM; everyone else calls it MIL!
- Developers' tips and techniques — for Release 1A; describes differences in Release 2.
- *Lotus* magazine — international subscriptions are available.
- Six books written by Lotus staff (which go beyond the Lotus documentation).
- Lotus courseware — end-user training and courseware.

Lotus is now welcoming developers with open arms, and has prepared tools and resources for such developers to work with 1-2-3 and Symphony.

In addition there is a Worksheet File Format for Release 1A of 1-2-3 and Release 1.0 of Symphony. A new updated version is expected in May.

How did Architecture Come into This?

If you're contemplating producing third-party software for Lotus, you need to be aware of the differences between 1-2-3 and Symphony. 1-2-3 uses what is called closed architecture, while Symphony uses open-ended architecture. The difference is that Symphony includes what are called 'hooks' which allow software to be attached and become an extension of the Symphony code. 1-2-3 does not have these hooks and isn't likely to get them, as this would mean a complete rewrite of the program.

Lotus uses the term 'add-ins' to refer to programs that use hooks to attach themselves to Symphony; you may be using some of these programs without realising they are add-ins. Examples are the DOS System command, the tutorial, spelling checker, text outliner and the communications package. Others include file translation capabilities, interfaces to high-level languages, interfaces to scientific instruments, and statistical functions.

Two tools are available from Lotus for add-ins, called a data model and an open model. The data model allows the developer to read and write worksheet files directly into a 1-2-3 or Symphony program using /File Import, and performs file translation from another program. The open model allows "pretty much unlimited add-ins", but the catch is you need to be a good assembly language programmer.

In Australia Imagineering wants to 'Australianise' 1-2-3 and Symphony and is actively seeking software developers to help with this aim. In particular, it is looking for someone to write printer drivers for those printers available here that are not currently supported by Lotus.

In the United States Lotus has entered into an agreement with Phoenix Software to write printer drivers. Phoenix is best known for writing an IBM BIOS that is compatible with IBM without breaching IBM's copyright. This agreement and the encouragement of third-party software development are intended to allow Lotus to concentrate on the further development of its products.

Good luck to Lotus if it can do this. So far only a company like IBM has been able to put out products and leave it to others to produce the software to make them work in the real world. A case in point is IBM's PC Displaywrite software, which supports only a couple of IBM printers and one NEC printer. Every other software manufacturer has to try to provide printer drivers for the enormous variety of printers on the market; for example, Micropro provides well over a hundred with its latest word processors.

Q & A

After her address Sarah bravely volunteered to answer questions from the audience, and we were able to gain further insight into the way Lotus is going. Lotus sees the MIL EMS (expanded memory specification) as being only a temporary solution to the 640 Kbyte memory limit, a solution which will be rendered obsolete by the introduction of some other version of DOS — 4.0 or 5.0 or whatever.

Why does EMS split memory between normal and expanded memory in such a peculiar way? We don't know, but it is something you should be aware of; depending on the use of formulae and calculations you may run out of memory in either normal or expanded memory while still having plenty of room in the other.

The Softguard system of copy protection used in Lotus 1-2-3 Release 2 was criticised on the grounds that you have to 'uninstall' it before backing up from a hard disk. This didn't get much sympathy; Lotus's line is that you can use the BACKUP command in DOS, or use a tape back-up system that does allow you to ignore protected files.

In reply to a statement that not all error messages appear in the manuals, Sarah undertook to see whether this could be rectified. I doubt whether she can achieve this; undocumented error messages seem to feature in every program I've seen.

As we start to move into multiple use of a program and to introduce local area networks (LANs), we need something more than the customary 'use on only one computer at the one time' licence agreement. Lotus is looking at multiple-site licensing — it prefers to call it 'corporate user agreements' — and expects to make an announcement this year, but believes agreements for LANs are a more pressing issue. David said he believed the solutions now being considered for both problems would be well received, particularly in networking, and would be simple, no-fuss solutions.

I hope you have found these comments illuminating; it appears Lotus is listening to criticism and responding to it — even from a country like ours that must make only a relatively small contribution to its profits.

Public Domain Software

You should be aware that the PC Users' Group has a wide range of public domain software available to its members. This includes many programs of interest to Lotus users. Here are just a few of them:

Disk 56	1-2-3 utilities, including macro and printer tutorials.
Disk 63	Programmers' calculator, stepwise linear regression.
Disk 122	Encryption, Symphony macro conversion aid.
PC SIG 64	Managers' desktop.
PC SIG 65	Desktop documentation and instruction worksheet.
PC SIG 135	1-2-3 desktop-type worksheet.
PC SIG 140	1-2-3 worksheet macros for drawing flowcharts.
PC SIG 141	Convert textfile to form loadable by 1-2-3.
PC SIG 257	19 1-2-3 tutorial and utility programs.
PC SIG 301	25 1-2-3 hints, utility and template programs.
PC SIG 302	26 assorted worksheets from amortisation to biorhythms.
PC SIG 303	Optionware, and 1-2-3 and Symphony file formats.
PC SIG 304	Financial worksheets.
PC SIG 305	Symphony worksheets, macro aids and setting sheets.
PC SIG 306	More Symphony worksheets, filename library.
Disk 114	Assembly language tutorial, 1-2-3 exponential curves.
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Disk 165	1-2-3 personal general ledger.
Disk 199	PC-Calc (see why 1-2-3 is so much better).
Disk 207	1-2-3 templates: gas mileage, jogging log, desktop.
Disk 209	Power worksheets: menu-driven for standard problems.
Disk 406	1-2-3 templates for personal business, real estate.

Why does EMS split memory between normal and expanded memory in such a peculiar way? We don't know, but it is something you should be aware of; depending on the use of formulae and calculations you may run out of memory in either normal or expanded memory while still having plenty of room in the other.

Each of these disks — plus many more — is available to members for $10, which includes the cost of a blank diskette and copying. Some public domain software is just junk, but every now and again you find a real gem. □

IBM UNDERGROUND

BY JOHN HEPWORTH

BUILT INTO DOS is a simple but powerful programming language — the Batch commands. Users can create ASCII files of commands, and DOS will read a file and execute the commands one after another. Only a few commands are available, but with their aid it is possible to automate some quite complex routines.

Many batch files try to make themselves somewhat interactive with a statement like:

ECHO Press control-c to exit

or

PAUSE

which will cause the screen to display the lines:

Press control-c to exit

or

Strike a key when ready . . .

In these cases pressing control-c gives the message 'Terminate batch job y/n'. A Y drops the operator back to DOS, while an N goes to the next batch command. But what if neither is appropriate, and a branch to a line in the batch file (earlier or later) is required? Within DOS are two functions (the IF batch command and the ERRORLEVEL function of DOS) which can be used in interactive batch files.

Error Level

When a program terminates, the error level is set. Using the DOS batch file IF command, it is possible to check the error level and branch to a label anywhere in the batch file, with a line of the form:

IF ERRORLEVEL 'value'
THEN GOTO 'label'

where 'value' is a number. If the error level is less than or equal to 'value', flow of the batch file will branch to the line which holds the label. It's absolutely vital to remember that if the error level is less than 'value', program flow will branch exactly as if the error level were equal to 'value'.

So far so good, but you still have no control over the error level, and can't affect the program flow.

ASK.COM

Would you like a simple program which sets the error level for you, after asking a simple question? In the public domain is a little program called ASK. The person writing the batch file puts in a line such as:

ASK Do you want to copy another ? (Y/N)

When the batch file reaches this line the message 'Do you want to copy another? (Y/N)' will be displayed, and the batch file will wait for the operator to reply before moving on. If the answer is a y or a Y, ASK will set the error level to 0. If the answer is n or N the resulting error level will be 1.

Remember the music which called the spaceship in the movie 'Close Encounters of the Third Kind'? How would you like to be able to use a couple of bars as a signal that some operation has finished and the computer is waiting for the operator?

A later line in the batch file can check the error level and allow for branching to a label under the instructions of the operator. Try the sample batch file below. Enter it with your word processor in document mode, or use EDLIN, and call it TEST.BAT:

```
echo off
:start
ask Do you want to quit?
rem press Y or y for a yes answer
rem press N or n for a no answer
rem y or Y sets error level = 0
rem n or N sets error level = 1
rem
if ERRORLEVEL 1 goto start
if ERRORLEVEL 0 goto exit
:exit
echo on
```

When it reaches the right line, TEST.BAT will run the program ASK.COM (which must be in the default directory or be able to be found through the active PATH) and display the message shown on the same line. ASK.COM will only respond to a Y or N (upper or lower case) and will set the error level equal to 1 for a no answer, and equal to 0 for a yes answer.

We now come to the lines which read:

IF ERRORLEVEL value GOTO label

Notice they start by testing the highest error level first, followed by the lower ones. This is because the IF ERRORLEVEL statement is true if the error level is less than or equal to the value in the statement. As an example, if the lines are rearranged in the order:

if ERRORLEVEL 0 goto exit
if ERRORLEVEL 1 goto start

then no matter what is pressed, the file will always branch to the :exit label. The error level set by ASK will be a 0 or 1, and will be interpreted by the IF statement as true in both cases because 0 is less than or equal to both 0 and 1.

ERRLEV.COM

If a simple yes/no answer isn't good enough, help is at hand. In the May 1984 issue of the American magazine PC *World*, BASIC and Assembler listings were given which create a program called ERRLEV.COM. Here any character in the alphabet can be entered. Lower case is converted to upper case, and the error level is set to the ASCII value of the input character.

Many more error levels are possible, making it even more necessary to start the IF testing from the highest desired value and work down. This is not public domain software, but users have typed in the code and uploaded it to a number of bulletin boards as an aid to those without the time to type it in.

TUNE.COM

Remember the music which called the spaceship in the movie 'Close Encounters of the Third Kind'? How would you like to be able to use a couple of bars as a signal that some operation has finished and the computer is waiting for the operator? TUNE.COM is a program which can be called from a batch file. It has six brief tunes in it (including some Beethoven), and the sequence and speed can be controlled by parameters on the command line. Entertaining, useful, and more relaxing than a simple beep.

Public Domain Channels

Public domain and user-supported software is available from user groups, and from computer bulletin boards around the country. Any I mention (except for the really big ones like PC-Write) can be downloaded from the Sydney PC Users' Group bulletin board on (02) 238 9034. The group is grateful for the assistance of the Sydney Grace Bros store, which has provided the bulletin board equipment and its accommodation. □

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One of the best places to get information and help with a particular machine is through a computer user group or club. Such little pockets of wisdom are scattered throughout Australia, as you can see from our listing ...

Australian Capital Territory

ACT PC Users' Group, Nick Hammond, PO Box 188, Parkes 2600. Meetings last Monday each month at Reid Tafe, 8.00 onwards. (062) 86 1102.

ACT VIC-20 Users' Association, Chris Groenhout, 25 Kerferd St, Watson 2602. Meetings first Monday each month at Boys' Grammar Scout Hall, Red Hill, 7.30 onwards. (062) 41 2316.

Albury Wodonga Apple User's Group, Jenny Scott (secretary), (060) 24 3225 or Don McLennan (president), (060) 46 028; meets second Wednesday every month at Wodonga High School at 7.30 pm.

ATARI, Chris McEwan, co-ordinator, ACTARI, PO Box E112, Canberra 2600, (062) 88 7861.

Apple User Group (ACT), Jeff Brock, 1 Buckley Circuit, Kambah 2902, (062) 31 3630.

Australian ZX80 Users' Association (AZUA), David Vernon, 50 Waller Crescent, Campbell 2601; for ZX81, ZX Spectrumand Sinclair QL owners. Meets on the last Wednesday of every month at the Woden Valley High School library at 7.30 pm.

Canberra ACT Sirius User Group, Jim Bland, (062) 81 2824, (062) 81 2832.

Canberra Compucolor Club (CCC), Meets 7.30 on first Sunday of every month at the offices of Digital Equipment, 28 Lonsdale Street, Braddon ACT.

Canberra Microbee Users' Group, Meets 7.30pm on firstTues of every month at Woden Valley High School Library. Bill Horsfall (062) 58 3193. PO Box 227, Weston Creek, ATC 2611.

Canberra Micro-80 Users' Group, Harry Cooper, 113 Owen Dixon Drive, Evatt 2617; meetings 3rd Monday each month, 7.30 pm in the large theatre, 'J' Block, Reid TAFE, for System 80, TRS80 and similar. (062) 58 3700.

Canberra NEC Users' Group, Mal Smith, PO Box 173, Belconnen 2616; meets first Tuesday each month at Main Conference Room, CSIRO Headquarters, Limestone Avenue, at 7.30. (062) 54 1614.

Canberra Osborne Group, c/o Geoff Cohen, PO Box 136,
Kippax 2615, (062) 54 7608.

Kaypro User's Group (ACTKUG), meets on the third Thursday of each month from 6.30 pm in the J Block theatre, Canberra TAFE, Constitution Avenue, Reid. Contact Des Ireland, on (062) 47 5330.

Micsig, Registrar, PO Box 446, Canberra 2601.

PC Users' Group (for users of IBM PC and similar machines); meets on the last Monday of each month at 8 pm in the main theatre, Building J, Canberra TAFE. Contact address: PO Box E188, Parkes, ACT 2600.

Sirius/Apricot User Group, M J Sim, 253 Hindmarsh Drive, Rivett 2611; meetings 7.30 pm third Tuesday each month, 88 Wollongong Street, Fyshwick 2609.

New South Wales

Albury-Wodonga District Microbee User Group, Eric Eulenstein, 202 Kooba St, Albury 2640, (060) 25 1601.

APF Users' Group, Norm McMahon, 288 Kissing Point Road, Turramurra 2074, (02) 44 2645.

Apple Team Australia, 5 Walpole Place, Wahroonga 2076; (02) 48 1018.

Apple Users' Disk Exchange Club, Phillip Donnadieu, Flat 1 8-10 Lancelot Street, Allawah 2218; (02) 579 4547.

Apple Users' Group, Colin Rutherford, PO Box 505, Bankstown 2200; meets 6.30 pm second Monday of each month (Tuesday after public holidays) at Sydney Grammar School, Stanley Street, Sydney. (02) 520 0926.

Atari Computer Enthusiasts, Tony Reeve, PO Box 4514, Sydney 2001.

Ausborne, The Secretary, PO Box C530 Clarence Street, Sydney 2001; meetings third Wednesday each month at 6.30 pm, at Burwood RSL, 96 Shaftesbuyr Road, Burwood. (02) 95 5378. Bulletin board: (02) 439 7072.

Ausbug, Stephen Ford, PO Box 62, Londonderry 2753.

Bankstown-Fairfield Computer Group, Arthur Pittard, 36 Hubert Street, Fairfield 2165; meets 4th Wednesday of the month at Canley Vale High School, Prospect Road, Canley Vale at 7 pm, (02) 72 2881.

BEDBUG, Chris Fallshaw, Eltham College.

Blue Mountains Microbee User Group, Roger Cooper (president), (047) 58 7238.

Blue Mountains Homebrew Computer User's Group, Eric Lindsay (secretary), 25 Reserve Avenue, Blaxland 2774, (047) 51 2632.

Bondwell User's Group, Ray Richards, 7/39 Ross Street, North Parramatta 2151, (02) 683 3940.

Broken Hill Microbee Users' Group, Peter Cotter, 533 Radium Street, Broken Hill 2880, (080) 88 1621.

Casio PB 700 User Group, Terry Gill, 27 Greenleaf Street, Wentworthville 2145, (02) 636 1652.

Central Coast Apple Users' Group, Charles Lee, (043) 67 6845 or Mick Tierney, (043) 41 9350. Meets first Tuesday each month at the Central Coast Grammar School, Erina Heights from 7.30 pm. (043) 84 3419.

Central Coast Microbee Club, Max Maughen, PO Box 36, Ettalong Beach 2257, first Tuesday every month at Applied Technology, West Gosford. (043) 24 2711.

Compucolor Users' Group, Tony Lee, 52 Cowan Road, St. Ives 2075, phone (02) 449 8824.

Cooma Microbee User Group, Phil Zikan, PO Box 92 Cooma 2630, (064) 82 3315; meets on the second Friday of the month.

Cumberland Computer User Group, S O'Neil, (02) 682 3851.

Dataflex User Group, Roger Walker, (02) 699 3877.

dBase Users' Group, PO Box 297, Neutral Bay Junction 2089; meets every second Tuesday each month at the Cowper Room, St. Andrew's House, corner Bathurst and Kent Sts, Sydney.

DEC Personal Computer Special Interest Group, Maggie Alexandria, DEC Australia, Northern Tower, Chatswood Plaza, Railway Street, Chatswood 2067, (02) 412 5252.

Dubbo and District Microbee Users' Group, Coralie Taylor, 18 Cunningham Street, Dubbo 2830; meets fourth Wednesday each month at 7.30 pm in the Dubbo High School Computer Room.

Griffith Computer Association, Ron Gauci, PO Box 425, Griffith 2680, (069) 62 5877.

Griffith Microbee User's Group, Ingmar Meins, (069) 62 3074; meets the fourth Monday of each month at Neighbourhood House at 7.30 pm.

Hawkesbury Apple User Group,Secretary Steve Bennett; meets fourth Monday each month at 7.30 pm, Richmond Primary School, (045) 78 2195.

Hawkesbury Commodore Computer Club, Richard Farrell, 12 Inverary Drive, Kurmond 2757; meets fourth Tuesday of each month at 7.30 pm at Neighbourhood Centre, West Market Street, Richmond 2753.

Hawkesbury Microbee Computer Club, Bruce Rennie, 6 Warks Road, Kurrajong Heights 2758; workshops 7.00 pm third Friday, and general meetings 7.30 pm first Friday of each month in the Microbee Network Room, Library Building, Richmond High School, Cnr Penrith and Lennox Streets, Richmond 2753. (045) 67 7329.

Hitachi/6809 User Group, meets on the first Saturday of each month, at 2 pm; contact Robert Lohr on (02) 662 4150, after 6 pm for locations.

HP Desktop Computer Users' Group, Dr R W Harris, CSIRO Division of Mineral Physics, PMB 7, Sutherland 2232, (02) 543 3460.

Hunter Users' Group — All Microcomputers, Secretary, PO Box 39, Broadmeadow 2298; meets on the second Wednesday of each ▶

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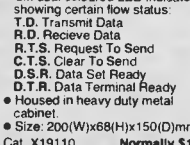

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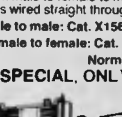

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CLUBFILE

month in Room 308, Building W, University of Newcastle, at 7.45 pm. Membership is primarily Apple II oriented, but anyone with interest in micros welcome.

IBM User Group, Ron Pollack (president), PO Box 501, Sydney 2001; meets third Monday of every month on the 11th floor, 50 Bridge Street, Sydney in the Price-Waterhouse seminar rooms at 5.30 pm. (02) 290 3655.

Illawarra Apple Core Secretary, Chris Haley (042) 71 2238. Meets at 8 pm in the library of the Holy Spirit College Bellambi on the 4th Monday of each month.

Illawarra IBM PC Club — All IBM compatibles, Dick Adams (secretary), c/o John Lysaght Ltd, Delivery Code 29, PO Box 77, Port Kembla 2505; (042) 75 6721.

Illawarra Microbee Computer Club, Ronald Read, PO Box 271, Warrawond 2502; meets every 4th Monday at 7.30 pm, Wollongong Institute of Education, Northfield Ave, Gwynneville; (042) 71 2384.

Illawarra Super 80 Users' Group, Jim O'Grady, Chairman, PO Box 1775, Wollongong 2500.

Macarthur Computer Association, J Napier, 23 Athel Tree Crescent, Bradbury 2560; meets first Monday each month at Airds High School, Briar Road, Campbelltown 2560, at 7.30 pm each month; all machines are catered for. (046) 25 2055.

Macquarie Microbee Users' Group, Brian Thompson; meetings first Monday each month at Denistone East Primary School at 7.30 pm. (02) 85 1659 after hours.

Macwest Users' Group, PJ Lynden, 11 Toohey Ave., Westmead 2145; Services will include newsletter, bulletin board and public domain library. Membership $10 pa.

MEGS (Microcomputer Enthusisasts' Group), John Whitlock, PO Box 1309, Chatswood 2067; meetings third Monday each month at rear of St Andrew's Presbyterian Church, 37 Anderson Street, Chatswood 2067, (02) 638 1142.

Microbee Users' Club (Broken Hill), Peter Cotter, 533 Radium Street, Broken Hill 2880, (080) 88 1621.

Newcastle Microbee Users' Group, Lee Osman, 12 Cleverton Close, Warners Bay 2282, (049) 48 8813.

Newcastle Microcomputer Club, Angus Bliss, PO Box 293, Hamilton 2303; meetings 7.30 pm second and fourth Monday each month at Room G12, Physics Building, Newcastle Uni. (049) 67 2433.

Nightline, is an after-hours (10 pm to 7 am, seven days a week) computer information service, which provides local and overseas news, clues and reviews. Mainly for Apple users, but others are welcome. Offers around 20 different bulletin boards, and uploading and downloading facilities; phone (02) 528 8968. Sysop: Hamish Bowly.

NSW Primary School Microbee Users' Group, Mr Peter Stretton, c/- Hunters Hill Primary School, Alexandra Street, Hunters Hill 2110.

NSW 6800 Users' Group, 27 Georgina Avenue, Keiraville 2500.

Northern Beaches VIC User Group, E. Tuxford, 161 Barrenjoey Road, Newport 2106, (02) 997 2467.

Northern NSW MICC Chapter, Alen Hartley, Dundurrabin via Dorrigo 2433, (066) 57 8160.

Open Access User Group, Steve Cook, Advanced Data Technology Pty Ltd, 1 Terrell Avenue, Wahroonga 2076; (02) 48 0511.

OSI Users' Group, Nigel Bisset, (02) 411 7142.

Ozbeeb User Group for the Acorn BBC Microcomputer, Meets twice a month at the Australian Film & Television School — Open Program, 3 Lyon Park Road, North Ryde — 2nd Wednesday of every month at 7 pm (organised talks and demonstrations); 4th Monday of each month at 6.30 pm (general meeting). Annual subscription for full membership $10.

Pocket Computer Users' Club, George Antonijevic; for those interested in pocket computers, whatever the brand. Meetings held on the first Wednesday of each month at 7.30 pm at the Woodstock Community Centre, Church St, Burwood 2134, (02) 683 4296.

President Computer Users' Group for owners of President and other IBM-compatible PC and AT computers. Meets on the last Tuesday of every month at the Hornsby Inn, (Claude Fay's Hotel), 29 Florence Street, Hornsby, from 8 pm. Contact Raymond or Trichia Toms (02) 456 3756, or Rick West (02) 872 4177.

Sega Users' Club, Jim Robinson — Penrith branch, (047) 30 1834; Jeff Wilson — Parramatta branch, (02) 684 4128.

Sharp PC-1350 User Group, contact Bob Hamilton, (02) 639 3637.

Sharp MZ-700 User Group, contact Terry Gill, 27 Greenleaf Street, Wentworthvill 2145; (02) 636 1652.

Sirius/Apricot User Group, Mark Dickinson, BarsonComputers; meets first Tuesday each month at 6.30 pm, Unit D, 55 Talavera Road, North Ryde 2113, (02) 888 9444.

Sorcerer Users' Group, PO Box E162, St James 2000; meetings third Friday each month at 8.00 pm in Greenwich Community Hall, Greenwich Road, Greenwich 2065.

Southern Districts Commodore Users' Group, Lex Toms, 3 Lucille Crescent, Casula 2170; meetings first and third Wednesdays each month, API Hall, Currajong Road, Prestons 2170. (02) 602 8691.

Sutherland Super 80 Group, Jim Traeger, (02) 525 2018.

Sydcom 64 (C64 User Group), Philip Dean, GPO Box 1542, Sydney 2001; meets on the second Wednesday of each month at the Abraham Mott Hall, Argyle Place, Miller's Point.

Sydney Forth Group, Peter Tregeagle, 10

CLUBFILE

Binda Road, Yowie Bay 2228; meets second Friday of each month at 7.00 pm in the John Goodsell Building, UNSW room LG19. (02) 524 7490.

Sydney Kaypro Users' Group, Hans Schneider, C/O Dr H. Schneider, Geography Department, UNSW, PO Box 1, Kensington 2003; meetings second Tuesday of each month, 8.00 pm, Burwood RSL Club. (02) 697 4400 (w) or (02) 309 2961 (h).

Sydney Lotus 1-2-3 User Group, Ron Pollak, (02) 29 5316.

Sydney Microbee User Group, Ron Taylor (secretary), (043) 41 5251 after 7 pm; PO Box C233, Clarence St, Sydney 2000. Meets third Saturday each month from 1 to 4.30 pm, in the assembly hall of Strathfield Girls' High School, Albert Road, Strathfield, (02) 92 6408.

Sydney TRS80 Users' Group, meetings second, third and fourth Saturday of each month at Botany. (02) 666 4716 bh.

System 80/TRS-80 & Colour Computer Users' Group, Jim Fisher, 37 Fairburn Avenue, West Pennant Hills 2120.

TAG — The Access Group, Bob Dolton, PO Box 943, Orange 2800; for Access and Actrix users.

The Great Western Computer Users' Group Jim Graham, PO Box 210, Wentworthville 2145; (02) 636 9219. All micro users are welcome. A 40-minute beginner's session is held at the beginning of each meeting. The club meets on the first Tuesday of each month, at 8 pm.

The Morrow User Group Alan Stern, (02) 750 8274; meets on the fourth Wednesday of every month at the Woodstock Community Centre, Church Street, Burwood at 7.30 pm.

Western Sydney PC and Compatible User Group, Ben Sharif, (047) 36 4825; meets on the third Sunday of the month at 1.30 pm, 27 Cosgrove Crescent, Kingswood 2750.

TI Sydney Home Computer Users' Group, PO Box 149, Pennant Hills 2120.

Tuggerah Lakes Computer Users' Group, Frank James, 125 Woolana Avenue, Budgewoi 2262; meetings second Thursday each month at Old Primary School, Wyong, at 6.30 pm. (043) 907 339.

Wagga Microbee Users' Group, John Simmons, 47 Undurra Drive, Glenfield 2650; meetings first and third Tuesdays each month in the Tolland-Glenfield Neighbourhood Centre at 8.00 pm. (069) 31 1302.

Wizzard User Group, John Mifsod, 150 Bouganville Road, Blackett 2770, (02) 628 0801.

ZX-Spectrum Users' Club, Craig Kennedy, PO Box 466, Epping 2121.

Victoria

Albury Wodonga User's Group, Jenny Scott (secretary), (060)24 3225 or Don McLennan (president) (060) 46 028; meets second Wednesday of every month at Wodonga High School at 7.30 pm.

Apple Users' Society of Melbourne, D Halprin, PO Box 43, Forest Hill 3131, (03) 387 3221.

Atari User Group Melbourne, Kelvin Eldridge, PO Box 173, Reservoir 3073.

Australian Forth Interest Group, Tony Latermore, PO Box 704, Sale 3850, (051) 44 2011.

Australian North Star Users' Association, PO Box 194, Wangaratta 3677.

Ballarat Computer Users' Group, Publicity Officer: John Preston, (053) 31 4363.

BBC Users' Group, Mr Howell (Secretary), 1 Washusen Road, Heathmont 3135, (03) 420 2611 (B). Meets last Wednesday each month from 7 to 9.30 pm at Copiquest, 423 Clarendon Street, South Melbourne 3205.

Billanook Computer Forum, Maurie Canterbury, Cardigan Road, Mooroolbark 3138, (03) 725 5388.

Chip 8, 6800, 1802 User Group, Frank Rees, 27 King Street, Boort 3537.

Compucolor Users' Group, L Ferguson, 12 Morphett Avenue, Ascot 3342.

DEC Personal Computer Special Interest Group, see NSW entry.

Essendon Commodore 64 User Group, George Stathoulis, 8 Byron Avenue, East Keilor 3033, (03) 337 4159.

Forth Interest Group, Lance Collins, PO Box 103, Camberwell 3124; meets on the first Friday of the month at the Bowen Street Neighbourhood Centre, 102 Bowen Street, Camberwell South 3124. (03) 29 2600.

Geelong Commodore Computer Club, D Gerrard, 15 Jacaranda Place, Belmont 3216, (03) 44 2863.

Geelong Computer Club, Colin Lowne, PO Box 520, Geelong 3220; (052) 55 1232. Meets at 8 pm, on the first and third Friday of each month in the rooms of the Geelong Amateur Radio Club, Storrer Street, East Geelong.

IBM & Columbia Computer Users' Club, Giles Bray, 22/11 Auburn Grove, Hawthorn East 3123; meets second Tuesday each month, 7.30 pm, at the Victorian College of Pharmacy, (03) 82 7632.

Kaypro Users' Group of Victoria, George Kunz, PO Box 159, Forest Hill 3131; meetings fourth Sunday each month at Burwood State College Community Resources Centre at 2 pm. (03) 857 5462.

KAOS (Ohio Scientific), David Anear, 49 Millewa Crescent, Dallas 3047.

Latrobe Valley Colour Computer Users' Group, George Francis, 31 Donald Street, Morwell 3840; for TRS80 and MC10 users. (03) 22 1389.

Melbourne Atari Computer Enthusiasts, PO Box 340, Rosanna 3084; meetings held on secondSunday of each month (except January) at 12 noon at Monash University Rotunda.

Melbourne BBC Users' Group, Meets last ▶

Wednesday in the month at Conquest P/L, 423 Clarendon Street, South Melbourne. Ring the secretary on (03) 729 4619 (AH).
Melbourne Lotus 1-2-3 Users' Group, Robert Taylor, (03) 267 4800.
Melbourne Microbee Users' Group (MBUG Australia Inc.), President: Grant Forrest, PO Box 157, Nunawading 3131; meets at 7.30 pm on the second Wednesday of each month at Mount Waverley Community Centre, Cnr Miller Crescent and Stephenson's Road, Mount Waverley. Different types of membership, including country, bulletin board, city, and student.
Melbourne PC User Group, meets on the firs Wednesday of the month at 6 pm in the Ground Floor Auditorium, Clunies Ross House, 191 Royal Parade, Parkville. Contact Garry Bryant (03) 615 4844. Mail to PO Box 1728P, Melbourne 3001.
Melbourne Hitachi Users' Group, Branko Colavizza, PO Box 191, Rosanna 3084, (03) 434 2541.
Melbourne Super 80 Users' Group, Hon. Sec. Victor Shuttleworth, (03) 723 2713.
MICOM (Microcomputer Club of Melbourne), PO Box 60, Canterbury 3126.
National Mutual Micro Users' Group, R Prewett, NMLA, PO Box 2830AA, GPO Melbourne 3001; for National Mutual staff.
National Sinclair User Group, PO Box 148, Glen Waverley 3150.
NEC Portable Users' Group, D Green; meetings second Wednesday of each month at Myers Computer Centre, Lonsdale Street, at 7.30 pm. (03) 611 3380.
Northern/Western Suburbs Computer Users' Group, John King (Secretary), 284 Union Road, Moonee Ponds 3039. Contact CP/M Data Systems, (03) 338 9304.
Peninsula Computer Club, George Thompson, 3 Patterson Street, Bonbeach 3196; meets second Tuesday each month at Chisholm College, Frankston 3199; many types of computers catered for. (03) 772 2674.
Sega Users' Club, Peter Lindeman, 6 Bay Street, Port Melbourne 3207.
Seymour-Pucka Computer Club, Garry Sutton, 25 Malaya Road, Puckapunyal 3662; (057) 93 1091.
Sharp Computer Users' Association, The President, 7 Faye Street, East Burwood 3151.
Sharp MZ-700 User Group, contact Anthony Saliba, 6 Elm Court, Rosebud 3939; (059) 86 3024.
Spectravideo Users' Group, Mitch Raitt, 3 Clivejay Street, Glen Waverley 3150, (03) 233 2357.
Sorcerer Computer Users' (Australia), Secretary, GPO Box 2402, Melbourne 3001.
TI-99/4A Users' Group Melbourne, Wayne Worladge, 123 Ashburn Grove, Ashburton 3147, (03) 25 1832.
The Motorola User Group (MUGS), Clive Allan, 11 Haros Avenue, Nunawading 3131: group is interested in 6800/02/09-based computers, particularly if running Flex, although this is not a prerequisite to join. (03) 878 1298.
Upper Yarra Computer Reference Group, for microcomputer enthusiasts and educators. Contact Albin Wallace, Woori Yallock Education Centre, (059) 64 6617.
Victorian Association of Computer Educators, Arthur Totrall, PO Box 69, Whittlesea 3757.
Victorian Osborne Users' Group, Bill Baker, PO Box 169, Camberwell 3124, (03) 850 4187.
Victorian VZ-200 User Group, Luigi Chiodo, 24 Don St, Reservoir 3073, (03) 460 3770.
Victorian Wizzard Users' Group, Barry Klein, 24 Russell Street, Bulleen 3105, (03) 850 7275.
Wizzard User Group, for owners of Dick Smith Wizzard and Funvision computers. The group operates only by mail and phone at present. Contact Barry Klein, 24 Russell Street, Bulleen 3105, (03) 850 7275.
Yarra Valley Commodore User's Group — affiliated with the Melbourne Central Commodore User's Group, Barrie Vickers (secretary), PO Box 176, Lilydale 3140, (03) 735 0638; meets on the first Tuesday of each month at the Melba Hall, Cnr Market & Castella Streets, Lilydale at 8 pm.
Yarrawonga Computer User Group, Chris Younger, 10 Witt Street, Yarrawonga 3730, (057) 44 385; for all machines.

Queensland

Adventure Club, Christine Ogden, 37 Samford Road, Leichhardt, Ipswich 4305; for all Adventure-type game players.
Adventure News, Stuart Elflett, MSF.550, Toogoolawah 4313. For Coomodore 64 adventures only.
Adventure Special Interest Group, Ernie Sugrue, PO Box 594, Maryborough 4650.
Amstrad Postal Users' Group, Frank Elliot, 59 27th Avenue, Palm Beach 4221; a group for isolated Amstrad users — meets monthly by cassette.
Apple-Q — The Brisbane User Group, The Secretary, PO Box 721, South Brisbane 4101; meetings every third Sunday of month at Hooper Education Centre, Kuran Street, Wavell Heights 4012. Centre is open from 8.30 am till 4.30 pm; members encouraged to bring Apple along.
Australian Sirius Users' Group, PO Box 204, Chermside 4032; looks after the needs of Sirius One and Victor 9000 computer users; (07) 350 2611.
BASIC User Group, Chris Lucey, Cranium Computers, 34 Lawless Street, Blackwater 4717.
Brisbane Medfly Users' Group, K J Walker, 120 Highgate Street, Coopers Plains 4108.
Brisbane Sinclair (Spectrum) Computer Club, V Lewis, 37 Samford Road, Ipswich 4305; meets third Sunday at Everton Park State High School, at 2.00 pm. (07) 355 7809.
Brisbane Super 80 Users' Group, Gary Gatfield, (07) 355 3173.
Brisbane Youth Computer Group, A Harrison, PO Box 396, Sunnybank 4109.
Brisbug, Roy Willie (Secretary), PO Box 305, Wynnum Central 4178. Meets at 2 pm on the 3rd Sunday of each month at the Toowong High School. (07) 393 3388.
Cairns District Microbee Users' Group, Chas Eustance, 21 Marr Street, Edmonton 4869, (070) 55 4531.
Commodore Computer Users' Group, Mr NR Chambers, PO Box 274, Springwood 4127, (07) 808 2125.
Computer Owners' Group, Betty Adcock, 42 Lucan Ave, Aspley 4034; meets second Wednesday each month, 7.45 pm; all kinds of computers are catered for. (07) 263 4268.
Darling Downs Apple Users' Group, Lloyd, PO Box 53, Darling Heights 4350. (07) 38 3060.
DEC Personal Computer Special Interest Group, see NSW entry.
Gold Coast Microbee User Group, Col McLaren, 1/100 Imperial Parade, Labrador 4215; meetings first Sunday each month, 3.00 pm, at the Southport High School. (075) 31 4610.
IREE Microcomputer Interest Group, N Wilson, PO Box 811, Albion 4010.
Mackay Microbee User Group, Geoff Gehring, PO Box 230, Mackay 4740, (079) 42 3214.
MSX-Australia, PO Box 1319, Southport 4215.
Osborne Users' Group of Queensland Uni, Glen McBride; meetings second Wednesday each month, open to all. (07) 870 1177.
PC-8000 Users' Group of Queensland, David Clark, (07) 343 7680 (AH); Meets 2nd Friday of each month at the Old Town Hall, South Brisbane.
QBUG (Queensland BBC Users' Group), Meets 1st Tuesday each month. Ring (07) 386 022 (AH) for details.
Queensland CP/M Users, The Secretary, PO Box 1025, Milton 4064; meets on the last Sunday of each month at the University of Qld, Civil Engineering Room 1.01 (off Staff House Road) from 1 pm.
Sharp User Group of Brisbane, meets on the second Wednesday of each month at Graceville State School. All Sharp owners welcome. Contact Bill Laidlaw, 51 Sandon Street, Graceville 4075; (07) 379 3457.
Sega Users' Group, Robert Horkings, PO Box 148, Fortitude Valley 4006, (07) 52 5603; meetings first Saturday of each month, YMCA Hall at 1 pm.
Southport Commodore Computer Users Group, Bill Fitzpatrick, PO Box 790, Southport 4125, (075) 32 0061.
Superboard Users' Group, Ed Richardson, 146 York Street, Nundah 4012.
Tandy, Apple, Commodore User Group, Chris Lucey, 34 Lawless Street, Blackwater 4717.
The Microcomputer Society, The Secretary, PO Box 580, Fortitude Valley 4006; meetings ▶

are held on the second Friday of each month in the Old Town Hall, corner Vulture and Graham Streets, South Brisbane 4101. Meetings start at 7.30 pm; if main gate is closed use the back stairway.

Townsville Microbee User Group (TMUG), Mannie Van Rijswijk, PO Box 5751 MC, Townsville 4810; meetings 7.30 pm on second and fourth Mondays each month on the Ground Floor, St Margaret Mary's Secondary School, Crowle Street, Hermit Park 4812.

TRS80/System 80 Computer Group, Secretary, 16 Laver Street, Macgregor 4109; meets first Sunday each month at Lindum Hall, Lindum Street, Lindum 4178, at 2.00 pm. (07) 343 5771.

University of Queensland Osborne User's Group, Glen McBride (president) (07) 870 1177, or Richard Duczmal (treasurer) (07) 377 3139; meets on the second Wednesday of the month, in the Axon building on campus. Membership is open to both students and non-students.

VZ-220/300 Computer Club, Michael Novakovic, 24 Albert Street, Goodna 4300. Phone (07) 288 3045 between 3.20 pm and 8 pm.

VZ-200 Pacific Region Club, J D'Alton, 39 Agnes Street, Toowong 4066, (07) 371 3707.

ZX81 Club, P Carswell, 22 Braud Street, Bundaberg 4670.

South Australia

Adelaide Atari Computer Club (AACC), Secretary, PO Box 333, Norwood 5067; meets at Gilles Street Primary School, City, on first Monday (second if first is on public holiday) of each month, 7.30 — 9.30 pm.

Adelaide Beebnet, Contact the secretary at PO Box 262, Kingswood, SA.

Adelaide Lotus 1-2-3 User Group, Paul Wragg, Pannell Kerr Foster, GPO Box 1969, Adelaide 5001.

Adelaide Micro User Group, Helen Ross, 36 Sturt Street, Adelaide 5000; for TRS80 and System 80 users.

Adelaide Osborne Group, Russell Barter, The Secretary, GPO Box 603, Adelaide 5001.

Adelaide PC Users' Group, PO Box 68, Walkerville 5081; contact John Roberts (08) 212 5020 (B). Meets on the second Thursday of each month, at 195 Gilles Street, Adelaide, at 7.45 pm; or as advertised in the computer section of the *Advertiser* on the Saturday prior.

Adelaide Sega User's Group, Jamie Andersen, (08) 263 5020 (after 4 pm); meets on the first and third Wednesdays of the month, from 7 pm, at the Lutheran church hall, 137 Archer Street, North Adelaide.

Adelaide Super-80 User's Group, Mr L White, The Secretary, 503 Churchill Road, Kilburn 5084; meets on the third Monday of each month, (the second Monday in the case of a public holiday) at 7.30 pm in the canteen of Mason & Cox Foundry, 123 Hayward Avenue, Torrensville 5031, (08) 260 6226. Subscription: $5 pa.

Aquarius Users' Club, Benedict Sabel, 7 Duncraig Lane, 5152. $5 membership fee covers the cost of a bimonthly newsletter.

Beebnet, BBC and Econet User Group PO Box 262, Kingswood 5062; the group intends to produce a newsletter on a monthly basis. It is interested in any software producers or distributors who would be interested in serving the group's market requirements.

Commodore/VIC Computer Users' Association, Mr Eddie Hann, 13 Miranda Road, Paralowie 5108; the SA branch meets monthly.

Compucolor-Intecolor Users of South Australia, PO Box 86, Torrensville 5031, (08) 352 3296.

DEC Personal Computer Special Interest Group, see NSW entry.

Kaypro User Group, Ralf Engler, 16/34 John Street, Payneham 5070.

Microbee Users' Group of South Australia (MUGSA), The Secretary, GPO Box 767, Adelaide 5001.

Sega Users' Club, H.A. Jacobson, 10 Pioneer Avenue, O'Sullivan Beach 5166; (08) 382 7967.

South Australian Apple Users' Club, PO Box 322, Prospect 5082; secretary (02) 293 7183. Club caters for Apple II series and Mac computer users. Meets on the first Friday of every month at the Prospect Town Hall.

South Australian Commodore Computers' User Group, Eddie Hann, Secretary, PO Box 427, North Adelaide 5006; meetings second Tuesday each month, 7.30 pm, at Royal Caledonian Hall, 379 King William St, Adelaide 5000. (08) 258 6367.

South Australian Foundation for Computer Literacy, Michael Kennett, PO Box 210, Norwood 5067; caters for children from six years (unaccompanied) or four years with older friend or brother or sister. Special emphasis on the needs of handicapped, educably disabled and socially disadvantaged children, but *all* children welcome. Family participation encouraged. (08) 51 5474.

South Australian Peach User Group, Geoff Drury, 27 Creslin Tce, Camden Park 5038; special interest group attached to the SA Microprocessor Group, which holds separate meetings; (08) 295 2778 ah.

South Australian Microprocessor Group Inc (SAMG), The Secretary, PO Box 113, Plympton 5038, (08) 278 7288.

Sorcerer Users' Group of South Australia, Don Ide, 14 Scott Road, Newton 5074.

South Australian Apple Users' Club, The Secretary, c/- The Bookshelf, 169 Pirie Street, Adelaide 5000.

South Australian Microprocessor Group Inc.(SAMG), secretary Rick Matthews, 9 Anglesey Ave, St Georges 5064; (08) 79 3445; meets second Friday of every month, Institute of Engineers, Aust Bldg, 11 Bagget St, North Adelaide.

South East Computer Enthusiasts' Group, Glenn Mibus, 3 Millard St, Mount Gambier 5290; meetings second and fourth Tuesday of each month from 6.30 pm at Mt Gambier High School Computer Room, for all machines and interested parties. (087) 25 1046.

Northern Territory

Alice Springs Microbee Users' Group, Douglas Craigie, c/- PO Box 3230, Alice Springs 5750.

Darwin Microbee Users' Group (DBUG), Felino Molina, PO Box 3111, Darwin 5794, (089) 82 5613 bh, (089) 88 1455 ah.

Darwin PC Users' Group, meets on the first Sunday of every month at 8 pm, at 5 Binet Court Malak. Contact Terry O'Brien (089) 27 4454.

Northern Territory Computer Club, Ian Diss; meets at Wulagi Primary School on the first and third Thursday of each month at 7.30 pm. Users of all machines and other interested parties welcome. (089) 27 9208.

Northern Territory 80 Computer User Group, R T O'Brien, 433 McMillans Road, Jingili 5792.

VZ-200 Users' Club, 7 Abbott Crescent, Malak 5793, (089) 27 2830.

Western Australia

Agriculture Users' Group, c- Mr R Fenwick, Dept. of Agriculture, Albany 6330. For farmers and the agriculture service industries.

CU West WA Compucolor/Intecolor Users' Group, John Newman, 8 Hillcrest Drive, Darlington 6070.

DEC Personal Computer Special Interest Group, see NSW entry.

Domestic Apple Users' Group, Contact Todd Venning, 73 Sydenham Road, Doubleview 6018.

KAOS-WA,Gerry Ligtermoet, 39 Cloister Ave, Manning 6152; for Ohio Scientific Users. (09) 450 5081.

Kaypro User Group of Western Australia, Ainslie Sharpe, PO Box 91, Claremont 6010; meetings second and fourth Mondays of each month in the Canteen of the Department of Agriculture, Jarrah Road, South Perth 6151. (09) 384 5511.

Microbee Users' Group of Western Australia, meets at 7 pm on the first Sunday of the month in the Nurses' Lecture Theatre of the Sir Charles Gairdner Hospital at Shenton Park. Contact (09) 294 1833, or write to GPO Box N1090, Perth 6001.

PC Micro Users' Group, meets on the first tuesday of the month at Royal Kings Park Tennis Club, Lower Tennis Pavilion, Kings Park Road, at 5.30 pm. Contact Peter Goodwin on (08) 274 5911 (B), or on 386 4502 (H).

OSWEST-Osborne Users' Group of Western Australia, Mal Ferguson, PO Box 149, Applecross 6153; meets first and third

Wednesdays at the Palmyra Recreation Centre and the Subiaco Exhibition Hall respectively from 7.30 pm, for Osborne and other interested computer users. (09) 295 1449.
Perth 80 Users' Group, C Powell; for System 80 and TRS80 users. (09) 457 6849.
Perth Hitachi Peach Club, The Secretary, 1 Charf Court, Riverton 6155; for Hitachi Peach and 6809s. (09) 367 5880.
Sharp PC Users' Group, John Paulic, PO Box 79, Gosnells 6110, (09) 398 6303.
Sega Users' Group, John McClemmon, 33 Favell Way, Balga 6061; (09) 342 5905.
The Sorcrer & CP/M Users' of Australia, Dave,22 Verbena Road, Willetton 6155, (09) 457 1917. Meets every fortnight.
Sorcerer Computer Users of Australia, The Secretary, 90 King George Street, South Perth 6151, (09) 367 6351.
The West Australian Atari Computer Club, Mr Alf Gaebier (Secretary), PO Box 7169, Cloisters Square, Perth 6000.
The WA Cromenco Users' Group, CA Marshall, Suite 2, 294 Rokeby Road, Subiaco 6008. Meets third Tuesday each month. (09) 382 2692.
VIC-Ups, G. Padfield, (09) 451 4629.
Western Australian Wizzard Users' Group, John Reid, 13 Wenlock Road, Wattleup 6166, (09) 410 2359.
Western Australian ZX Users' Group, Phil Taylor, (09) 328 4111 bh.
Western Australian University Computer Club, 2nd Floor, University of WA, Guild Building, (09) 386 1455.

Tasmania

Apricot User's Group, Rick Snell, PO Box 286 C, GPO Hobart 7001, (002) 23 399926.
DEC Personal Computer Special Interest Group, see NSW entry.
Devonport Computer Interest Group, John Steveson, RSD 422, Sheffield 7306, (004) 92 3237.
Hobart Tasbeeb. Meets on the first Friday of the month at Rose Bay High School at 7.30 pm. Ring (002) 34 2704 for details.
Down Under Atari User Group; contact Robert Bronstein, 191 Rokeby Street, Howrah 7018.
Spectravideo Computer Users' Group, PO Box 191, Launceston South 7249; membership costs $20, which entitles members to a newsletter and to discounts on computer equipment. (003) 44 2493.
Southern Tasmanian Amstrad Club, meets at 7.30 pm on the first Wednesday of the month at Elizabeth Matriculation College (first floor). Contact Vern McKay (002) 29 4528.
Tandy Hobart Users' Group, Ms KJ Rees, GPO Box 1271 N, Hobart 7001, (002) 72 1426; meets on the third Thursday of each onth — contact Ms Rees for details of venue.
Tasbeeb, John Hannon, PO Box 25, North Hobart 7000; meetings first Monday each month at Elizabethan Matriculation College in D Block at 8 pm, for BBC computers. (002) 34 2704.
Tasmanian Apple Users Group, Ray Williams, PO Box 188, North Hobart 7008, meets third Tuesday each month at 8.15 pm, 73 Murray Street, Hobart.
Tasmanian TI User Group, Co-ordinator, 1 Benboyd Court, Rokeby 7019; meetings third Sunday of each month at University of Tasmania, room 373. (002) 29 4009.
TAS-Micro, Peter Deckert, 1/456 West Tamar Road, Riverside 7250.

New Zealand

Palmerston North Microbee Users' Group, Contact R. Anderson, 6 Hendon Place, Palmerston North, New Zealand. □

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SERVICES

LETTERS TO THE EDITOR

We are happy to receive your comments and, if they are of interest to other readers, publish them. Letters will only be considered for publication if they include your name and address, although we can withhold such details from publishing on request. Note that we reserve the right to (and probably will) edit all letters for the sake of brevity, clarity or accuracy.

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Contributions to *Your Computer* are welcomed and will be given every consideration*. Please read these notes carefully to get an idea of the style and format we prefer.

All Contributions: should include your name, address, and home and office phone numbers (in case we need to check details). Each page of your submission, and any material sent with it, should also carry your name.

Contributions by Telephone: Contributors who have modems and suitable software (in the MODEM7/YAM mould — see our stories on Christensen Protocols in the May and June 1983 issues) can arrange direct transfer to our computers through our Bulletin Board system, which is on-line 24 hours a day, seven days a week. Contact our office by phone for details on transferring material in this way.

Contributions on Disk: Contributions can be accepted in most disk formats, although some have to be converted outside our offices, which will add to the (often lengthy) delay between receipt and acknowledgement. The preferred medium is IBM standard format single-sided, single-density, 20 cm CP/M disks or IBM PC-DOS minifloppies. We can also handle, in-office, most soft-sectored 13 cm disks, thanks to PC-Alien — so unless you have a particularly strange format, send it on disk straight from your machine. Please pack them extremely carefully if posting and label all disks with your name, address and phone number.

Listings: Unless it is absolutely impossible, we want listings produced on the computer. This reduces the risk of error - if the computer typed it, the computer probably accepted it. Print listings with a dark — preferably new — ribbon on white paper, and try to format the output to a narrow (40-characters) width. If they can't be produced on a printer, borrow a good typewriter — hand-written material is likely to sit around the office for a year before someone can find time to type it all out for you! Please provide an account of what the program does, how it works and so on. Any comments on the program should refer to the address, line number or label rather than to a page number. Any comments on modifying the program to work on other machines will be appreciated. Try to include a printout of at least part of a sample run if possible.

Style: All items should be typed (or printed) and double-spaced on plain white paper. We will only accept original copies - no photostats. Include your name, address, telephone number and the date on the first page of your manuscript (all manuscript pages should have your surname and page number in the top right-hand corner). Be clear and concise, and keep jargon and adjectives to a minimum.

*Although the greatest care will be exercised with contributions, no responsibility can be accepted for the safety or return of any letters, manuscripts, photographs or other materials supplied to *Your Computer* magazine. If return is desired, you should include a stamped, self-addressed envelope. If return is critical — say it's something you can't afford to lose — then don't send it; we *are* careful, but we're not perfect. □

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HAPPI BURTDAI, here's a little something ... don't throw the ribbon away (you won't be able to use the printer) ... five is such a lovely age, don't you think? Let's play musical ports — whichever one's left over after we've plugged in all these is obviously left over, so we'd better start again. Keep those chocolate crackles away from the keyboard, sweetie.

SURPRISE! It's our birthday in July. It'll be triffic, just triffically, pulsatingly, swirlingly, layer upon layer upon layer (like our cake), undulatingly, brilliantly graphic. Oh wow, Debbie, that's amaaayzing. Dr Who eat your heart out. "Gasp," said the Science Show. And you thought the Sixties were colourful. Can you believe your eyes? Wait and see.

So how does it feel to be five? Matt still feels furry (furry eyeballs), Natalie feels as hungry as ever (famished), Jane feels fantastic to be back (remember Jane Mackenzie — fun and functional?), Felicity feels orange (she's a fiery redhead) and a little frazzled by all your fan calls, and Les ... well, does Les feel? Does he feel for us, waiting, month after month, for Birdwatchers, Computers in Marketing, HIS PARADOX REVIEW? DOES HE? WELL, ANSWER ME? (gurgle, gurgle, flail, flail, flop).

GETTING CARRIED AWAY

Hmmm, sorry. We had to carry her away. This is the voice of reason speaking (though I do see her point). Honestly, it's been great f ... we've had a wonderful time. We've worked out where all the plugs go, and helped you to get it right, too. Computing has busted most of the boundaries we conceived of back then; when we were little we thought we were big if we could tie our shoelaces — these days, beginners have got Velcro and friendly user interfaces.

We're looking forward to the next five years with even greater expectations. Matt reckons it's just a matter of time before our ATs will be built into our wristwatches — bah humbug.

Speaking of advancements, haven't graphics gone bananas since we last covered them in depth, in March 1984? Talk about flashy, and fifty-up-manship.

Next month will be a celebratory explosion, graphically speaking, of course, of colour and high res and even higher res.

We'll be trying our skills with a range of graphics packages, from low-cost programs like Bee Artistic, to professional software like Autocad, to the whizz-bang world of dedicated supermicro and minicomputer graphics generators.

We'll take a special look at business graphics packages for the IBM PC — what's available and how to make the best use of it. And there'll be a rundown on graphics-oriented machines like the Amiga (just a short bit, concentrating on graphics, since you've read most everything else this month), the Atari 520ST and the new Microbee Gamma.

Having filled our screens with fantastic images we might even find the time to investigate what kinds of machines are around to put them on paper, or maybe slides.

On the reviews side, Ewart Stronach has developed a fatal attraction for Lettrix, a new memory-resident program that allows IBM PC software to print proportionally spaced, microjustified text in 20 different letter-quality typefaces and languages on dot matrix printers. John Hepworth gleefully announces he had dBase, Lotus 1-2-3 and Wordstar running simultaneously under Microsoft Windows — and we've got the pictures to prove it. As for Les, we have ways of making him feel our displeasure, so maybe you'll see that *expose* undercover overview of Paradox in July.

Then, in addition to your correspondence courses on C, Structured Programming, Birdwatching and Marketing, and all the machine-specifics, new products and what-have-you in Public Domain ... we'd like, in honour of our birthday, to present you with a special compilation — the dLetter Annual. A dLight usually available only to dRegular subscribers, dLetter explains dVagaries and complexities of dBase, and is generally dSigned to help you cope. We thought we'd put together all dIssues published to dDate, for those of you who didn't know about it (but will want to subscribe now that you do) and for anyone who is missing one, two or several vital and dSirable editions. Hippo birdy two ewe, as they say.

CRYSTAL BALD

After the party, we'll toss our striped scarves over our shoulders, climb into our police box (not a record — there are only 11 of us) and launch ourselves into the future.

Where is the computer industry rocketing off to? Stumbling about in that not-so-distant computer landscape, we'll hazard some educated predictions in our August publication. What will we see through the looking glass? Will the processors be running so fast we won't see anything at all? Will the contents of the National Library fit into a Rice Bubble? Will resolution be so realistic the three dimensions are no longer required? Computers already have graphics and sound, will they also have smell? Will the Viatel of the future not only allow you to book your travel, but simulate your destination so you don't even have to go there? Can't you smell the French onion soup? The Indian curries? The sukiyaki? The English pub lunch? The coconut oil? The sea? Can you feel the waving palm fronds? Oh my! What's that on your wrist, Matt?

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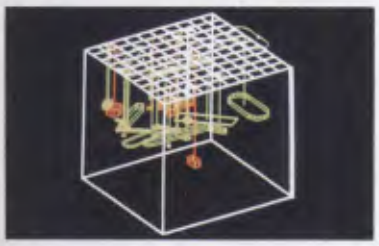

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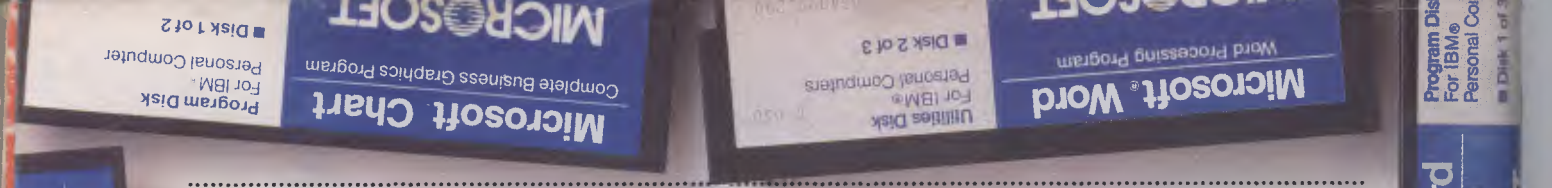

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