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October, 1982 \$2.00\* NZ\$3

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# inside your computer

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Rod Stevenson reviews one of



**Win, win, win!** We have two competitions for you this month. You could win Arton Expansion for your VIC — \$1100-plus worth — just by filling out the coupon, on page 18. The TRS-80/System 80 fans can improve their software library in the other competition, on page 81.



**NEC's Advanced Personal Computer** — reviewed separately on page 24, it is also just one of the new-generation machines surveyed in our special examination of the 16-bit 'wave' currently sweeping the micro world. That story's on page 20.

the current 'hot' games for the TRS-80 and System 80 — and you'll find some answers in here that could help you win the \$150 worth of software in our competition.

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### Popular Systems

Individual columns devoted to the popular systems, including our latest additions, the Micro-Bee and the Hitachi Peach.



# editorial



*IN THE* midst of the 'bottom-of-the-harbour' tax evasion scandals, this may not seem like an opportune time to have a whinge about tax. However, needs must...

The current situation with regards to sales tax on software is ridiculous. Senator John Siddons (Australian Democrats, Victoria) has pursued the matter in Parliament, and is not satisfied with the reply he received from the Treasurer.

To quote a letter we have received from Senator Siddons: "I have been told since this question was asked that there are a number of problems with foolishly arbitrary customs duties on computer software, disks and cassettes. I am seeking more information on this subject and will have a Bill prepared to amend the Customs Act and any necessary regulations to clarify and simplify this appalling mess.

"I have already had prepared a Bill to exempt computer software from sales tax. The question has now arisen whether the Bill ought to apply to all computer software, or only that produced in Australia. Any feedback you can provide would be most helpful. I am seeking the industry's reaction and will act accordingly."

I should imagine that Australian software authors are finding themselves in a bind over this topic; programmers are amongst the biggest consumers of software, particularly in the microcomputer systems software area.

Personally, I'm all for a tax on computer games, regardless of country of origin, on the grounds that they are totally anti-productive and probably cost the software industry a fortune already.

However, when it comes to more useful software, the philosophical arguments can rage at length, with good points on all sides. I've been debating this topic with myself for a couple of weeks now, but perhaps I'm just not a political enough animal to come to a clear conclusion (although I do know I resent paying sales tax, full stop).

Interested people in the industry should send their comments to Senator John Siddons, Commonwealth Parliament Offices, 400 Flinders Street, MELBOURNE VIC 3000. ■

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# VISIT

## The CP/M Event Of The Year

Join Your Computer's Tour To:



**CP/M '83 is:** The biggest-ever assembly of CP/M-related hardware, software and people. Organised by Digital Research, and presided over by the man who wrote CP/M, Gary Kildall, this conference and show will be entirely devoted to the furthering of CP/M development and value to the user. You'll be able to find out anything you've ever wanted to know about CP/M, and see all the new releases and upcoming advances.

**CP/M '83 is:** A vitally important — and interesting — event for anyone involved in CP/M. It will be of particular benefit to dealers and salesmen who have found themselves thrown in at the deep end with the recent upsurge in CP/M implementations.

**CP/M '83 is:** A tax-deductible business trip for those who make their living out of microcomputers, as is the Study Tour we will conduct, for those interested, after the 'Main Event'.

**CP/M '83 is:** On soon, so you have to act NOW! We'll be leaving for San Francisco around January 18.

### TOUR PRICE

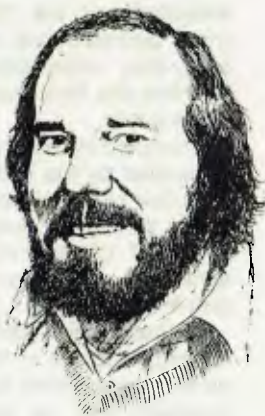
# \$1550\*

Join one of Australia's most informed CP/M'ers, YC columnist Bill Bolton, who will lead the tour, conduct an in-depth post-conference debriefing, and take those interested on a further industry study tour, visiting such places as the Osborne factory and Digital Research itself.

#### PLUS:

This is no follow-the-leader, never-stray trip. You'll have to leave Australia on the same flight, but after that your time is your own if you choose to leave the group. Return flights are entirely optional — you can go your own way, or select one of our alternatives: The study tour; a break in Hawaii; or a family trip to Disneyland!

\* Basic price ex-Sydney, includes return air fare and accommodation in the Sheraton Palace, a first-class hotel just a few blocks from the exhibition centre. Optional extensions to the tour will be at extra cost, to be advised in the detailed information we will forward to those who send in the accompanying coupon.



For further details, cut out this coupon (or copy it) and return it as soon as possible to:

Your Computer CP/M '83 Tour  
PO Box 21 WATERLOO 2017

or phone Joy Quinn on (02) 662-8888.

\* **YES, please, tell me more!** I want to keep right up with what's happening in the microcomputer world, so send me the details of:

**Conference/Show Tour:** For those who want to be out and back within a week — or do their own thing after the show — the basic trip outline.

**Show and Study Tour:** We're in the process of arranging visits to Osborne, Digital Research, Silicon Valley (of course!), and others. This, too, will be tax deductible for the business tripper.

**Business and Pleasure:** Wind down — and be the envy of your friends — with a spell in Hawaii on the way home.

**Family Fun Tour:** Take the family along (they'll have plenty to do in the short time you're at the show), and afterwards head off to Disneyland. A week in Hawaii on the way home wouldn't lose you any points, either...

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# your computer news



## Kaypro Storms Ahead

AUSTRALASIAN distributor President Office Machines says the first two 100-machine shipments of its new Kaypro II portable computer (announced last month in *Your Computer*) sold out before they arrived.

President claims the Kaypro is generating better dealer response than the Osborne 1, which it launched here in February before Osborne established a local operation.

The \$2990 Kaypro features an 80-column, 22cm (9-inch) screen and double-density disk drives. It comes with the CP/M operating system and four applications packages as standard.

Other software already available for the machine includes accounting and packages for doctors, dentists, real estate agents, farmers, dieticians, hotel owners and payroll operators.

President has also obtained Australian rights to a new database package called GBS (General Business System), and is making it available for the Kaypro as well as most other CP/M machines.

The package is said to rival market leader Ashton-Tate's superb dBase II.

GBS claims several file-handling advantages like: the ability to work with three files simultaneously; use of up to 10 indexes at a time; data files can span four disk

drives; reports can use multiple lines for each record; compact indexes; and GBS need not be resident on disk to run applications programs developed under the system.

It comes in four separate modules: GBS, the main package, for \$300; Quickgen, similar to dBase's Zip screen/command file generator, for \$125; Reportgen, the report generator, for \$150; and Menugen, which will tie all the programs together and allow full menu-driven operation, for \$75. The prices include sales tax.

For further information, contact President Office Machines, on (02) 476 2700 ■

## Datakey Opening

AT A time when many organisations are tightening their belts, computer and office equipment supplier Datakey has gone against the trend.

The company says the opening of new premises in Gladesville, NSW, confirms its choice of product and marketing philosophy.

Datakey sells and services Sharp and Hewlett Packard Computers, copiers and calculators.

"Datakey has based its business and future on the sales and service of high quality products from manufacturers who are represented in Australia and back their products," Mr Mal Whelan, Datakey managing director, said at the official opening. ■

## New Intelligence Products

INTELLIGENCE Australia, which already sells the popular financial modelling package MicroModeller, has released two new products recently which will be of interest to Apple owners.

Linkline is a data communications package which can be used to capture files from mainframe systems and convert them into a format suitable for processing by Pascal programs — specifically Micromodeller, one would presume.

According to Roger Walker, Intelligence managing director, Linkline will enable executives to reap the benefits of a financial modelling approach which combines both mainframe and micro-computer power.

Linkline will sell for approximately \$1500.

Similarly associated with financial modelling is a new 64 Kbyte RAM card for the Apple which can be used to expand the Micromodeller sheet size to over 32,000 cells. A typical Extended Matrix System installation would cost around \$900. ■

## Real Men Don't...

SEAHORSE Computers' Keith Stewart livens up weekends at his Camden (near Sydney) shop by running zany competitions — and this one he's decided to make public.

Prompted by the interested generated by the book *Real Men Don't Eat Quiche*, he recently started his customers and staff off searching for similar computer-related one-liners.

He had the YC staff rolling around (laughter or horror?) when he opened his last conversation with us with the statement **Real Men Don't Make Back-ups**. He then threw in a few more like: real men have eight (or sixteen) fingers; real men remember telephone numbers in binary (one of his staff program-

mers, who can never come to grips with the phone system, stated recently he'd be happier if it was all done in binary); real men prefer hex appeal; and more.

If you want to join in, Keith's offering a box of 10 diskettes to the best entry. Let's hear it from all the real men out there!

Send your one-liner to Keith at PO Box 47, Camden 2570, or send it in to us at PO Box 21, Waterloo 2017. ■

## Sales Tax Eliminated?

A DISPUTE between manufacturers of computer software and the Australian Taxation Office would be resolved if a Bill introduced by Senator John Siddons was passed.

The Sales Tax (Exemptions and Classifications) Bill 1982 would remove sales tax on all computer software which originated in Australia, thus clarifying a situation in which some computer software manufacturers had been paying sales tax and others had not, the Senator said.

Senator Siddons, who is the Democrats' spokesperson on Industry and commerce, said the Australian Taxation Office had been seeking up to three years' back sales tax from some software manufacturers after apparently re-interpreting tax law.

"This retrospective sales tax is completely unacceptable. Although the industry accepts that its products are goods, and thus liable to sales tax, the Tax Office must clarify the situation before it again levies a sales tax on software. This Bill will give the tax people five years to work out exactly what they want to tax, since guidelines issued this year apparently did not meet the needs of the industry," the Senator said later.

Earlier, speaking on his Bill, he said the Australian



computer software industry was rapidly expanding and showed promise of becoming a major export earner.

"It is an industry which is both labor and 'intellect' intensive. The Australian Democrats believe it ought to be encouraged to the greatest possible extent without imposing tariff or similar barriers.

"Computer programs should be viewed as mechanisms for information transfer and thus analogous to books and should thus be free from tax," he told the Senate.

He later said that if the government wanted to tax software, it should at least have the decency to recognise the importance of the industry and give it research and development grants and other non-tariff aid. ■

**Apple Course**

SYDNEY'S City Personal Computers is introducing a range of computer courses geared to both the business and personal user of Apple computers. The first in the series will cover the popular VisiCalc program.

The VisiCalc course is for beginners and intermediate users, the only pre-requisite being that the student has completed and understands the tutorial section of the VisiCalc manual.

The one-day course will cover such areas as improved techniques of modelling, graphics and other interfacing and expanded RAM modelling.

Other courses to be announced soon will include Advanced Applesoft Programming and Introductory Apple Assembly Language

Programming. All will be held at City Personal Computers' new Crows Nest offices.

Prices have yet to be finalised but a prospectus is being prepared for all of the courses and will be available from the city store, or from the Crows Nest store at 5/385 Pacific Highway, Crows Nest, 2065, telephone (02) 922 3600. ■

**Apple Software**

EIGHT new, independently developed programs for business, education, and the home are being offered by Apple Computer.

Data communications, graphics, graphic drafting, and several educational programs are among the new offerings.

Independently developed software programs are

selected for publication by Apple's software evaluation group. The new selections comply with Apple's requirements for user-friendly, quality programs.

The packages include three business applications programs which provide managers, drafters, graphics programmers, and architects with tools to expand productivity and increase efficiency.

Comm-Pac is a data communications program that enables an Apple II to communicate with other computers, time-sharing systems, networks, newswires, and other subscription services.

Paralax is a collection of graphics utilities which lets the user develop and manipulate high-resolution shapes for Applesoft basic programs. The Apple II program allows the user to gener-

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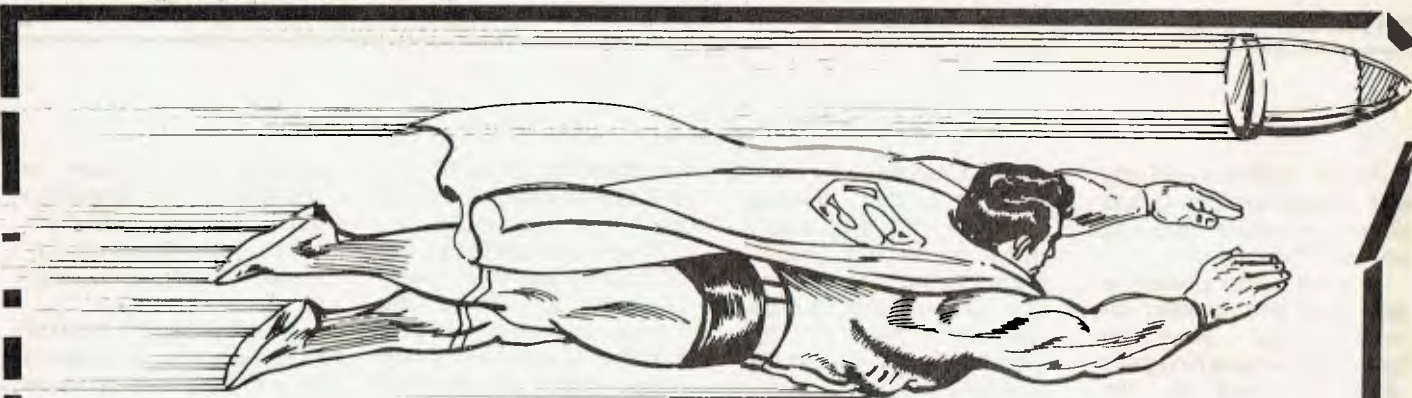


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ate a shape, automatically copy it, change its scale, merge it with other shapes, rotate and animate it.

Designer's Toolkit is a program for the Apple II that computerises the drafting table. Emulating pen, pencil, and brush on paper, Designer's Toolkit and the Apple Graphics Tablet let the user generate graphics for mapping, architecture, and drafting.

To submit programs for evaluation by Apple, write to Software Evaluation, 2025 Mariani Ave, Cupertino, CA 95014, USA.

### **Networking Computer**

SYDNEY-BASED computer manufacturer General Electronic Developments has introduced a powerful new networking computer system offering 'exceptional growth potential'.

Designed as a true distributed computer system with a networking speed of 800K bps, the Networking Computer is built up by terminals each of which includes a 64K microcomputer.

The system can be expanded to handle up to 25 completely independent terminal/computers. Each of these branch computers may be equipped with its own printer and as many as eight 20cm disk drives.

Yet the initial installation of the system need only consist of a single terminal unit. This unit, as well as containing its own microcomputer, also housed the central data management computer.

As each branch computer is added to the system it communicates with the central data management computer which controls the data traffic for the entire system. Central data storage — either floppy or hard disks — and over 30 other individual peripherals including printers, readers, modems, and soon can also be connected to this data management unit.

For further information contact General Electric Developments at 396 Victoria Road, Gladesville, 2112. Phone (02) 816 2211. ■

### **Osborne Batteries**

COMPUTER Products, the Western Australian parent company of Computer Country Holdings in Perth, has released an interesting new product for the Osborne-1 computer: the O-1 Battpak.

The Battpak is a rechargeable battery back up system for the Osborne computer.

It features an LED display front panel to indicate both operational and power status of the unit. It incorporates a built-in electronic recharge circuit that allows for speedy 'ideal charge' characteristics to ensure long battery life (approximately 4-5 years).

Another feature of the Battpak is that it has an automatic take-over facility that will power the Osborne immediately the power is cut off, be that through power mains failure or merely by someone accidentally disconnecting the power source.

The Battpak and further information are available now from Computer Products at 128 Hector Street, Osborne Park, 6017. Phone (09) 444 7431. ■

### **Mitsui Keeps Diablo**

FOLLOWING detailed discussions held in Sydney late in August, US headquartered Xerox subsidiary Diablo Systems Inc has announced that the exclusive Australian marketing agreement held for its products by Mitsui Computer Products has been extended.

Mitsui will therefore be the people to talk to about the new Diablo 620 low-cost 20-25 cps printer, as well as the 630 API (All Purpose Interface) printer, which is designed to interface to most popular brands of personal computer. ■

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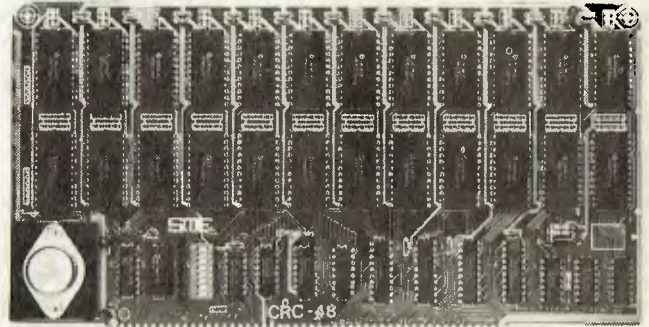
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Continued on page 15

**your computer needs • your computer**



### Fail Safe Memory

SME Systems of Mitcham in Victoria has launched a 48K CMOS static memory card designed as a fail safe memory system that retains data when power is removed from the board.

The board, the CRC-48, is designed for use in high speed 6-8 MHz computer systems.

With full S100 Bus compatibility the CRC-48 fits in with other SME Systems S100 products.

An on-board battery is used to retain power to the CMOS memory devices whenever the system is powered down for any reason.

A major feature of the CRC-48 board is its exceptionally low power consumption. In a power failure situation memory retention to a full complement of 6116 devices is typically around 250 hours on the inbuilt 30mA/hr battery.

For further information contact SME Systems at 22 Queen Street, Mitcham, 3132, phone (03) 874 3666.

### Gremlins Again!

WOW! THE gremlins really got to the listing of Steve Zanker's Apple Disk-to-Tape copy program last issue. The five pages of printout, it seems, were thrown up in the air and laid down as artwork in the order they fell...

Despite the 'incredible jumping line numbers', however, there is only one line

likely to cause problems — the third physical line of print-out in line number 10060 should actually be part of line 30640.

Otherwise, if you type the program in exactly as it appears it will work anyway, as BASIC will put our wrongs right by getting it back into order.

It was all the office idiot's fault, and he has been suitably chastised. We're very sorry....

### Little Big Board

AED Microcomputer Products has been made the sole NSW distributor for the Little Big Board manufactured in Melbourne by Pulsar Electronics.

This card implements all the electronics for a complete 64K disk-based microcomputer system. To implement a turnkey system all that is required is one of these cards, a power supply, a serial terminal, and a disk drive.

The Little Big Board provides a 4MHz Z80 CPU, 64K RAM, two serial ports, 20cm and 13cm double density disk controller, battery backed up real time clock calendar, interrupt tick clock for multi user and network systems, and complete implementation of the STD Bus signals.

The disk controller provided can offer up to 1.2 megabytes of storage per double sided 20cm drive.

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CP/M disk operating system is available for this card as well as MP/M. AED will soon be making its MULTI/OS multi-user operating system available for the card thus both CP/M and Cromemco CDOS compatibility will be offered in the multi user system while offering a CP/M transient program area of 56K which is able to run any CP/M program that will fit on a 64K CP/M single user system.

For complete technical information contact AED at 130 Military Road, Guildford 2161, telephone: (02) 681 4966.

### Learning Bee

APPLIED Technology was awarded a contract to supply the Microbee computer to NSW schools in April of this year.

The Microbee is now being offered to all schools with a unique purchasing opportunity called the 'Learning Bee'. The package consists of Microbee 16K computer, a black and white monitor, cassette recorder and Educational software pack of cassettes complete for \$399.

Applied Technology is currently mailing the offer to all schools with a limit of five systems per school. The offer closes in November.

The Microbee is manufactured by Applied Technology in Gosford, NSW, and over 2000 Microbees have been sold in Australia to date.

For more information about the Microbee or the 'Learning Bee' offer, contact: Tim Bennett, Educational

Products Manager, Applied Technology Pty Ltd, 35 Dickson Avenue, Artarmon NSW 2064, or phone (02) 439 2322. ■

### Computer Set The Biggest

THE largest computer installation in any school in Australia has recently been established at Broadmeadow High School, installed by Computer Cellar at the end of July.

The mathematics master at the school, Mr J McNally, said the 15 Apple II computers would be used in a number of areas including maths, science, commerce and industrial arts as well as for remedial teaching with slow learners.

The installation was made possible with a \$33,000 grant under the disadvantaged schools program.

Computer Cellar is at 136 Maitland Road, Mayfield. Phone 67 5700. ■

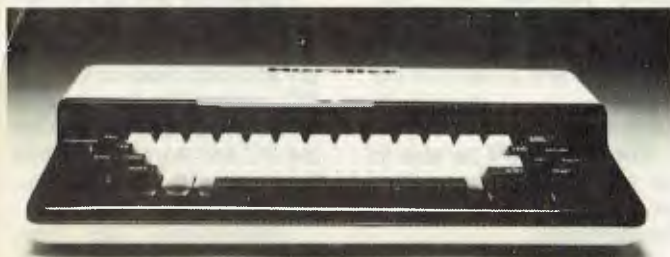
### Multi-Interface Printer

ALMER Distributors of Oakleigh has launched the Brother EM-1 electronic typewriter, which can be connected with most microcomputers.

The EM-1 can be linked to a processor through a standard RS-232S, Centronic or IEEE-488 interface.

This interface modification to the Brother is performed exclusively for Almer distributors.

The EM-1 can be used either as a letter quality printer or as a stand-alone electronic typewriter. ■



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## Sorcerer Upgrade

PJB Systems (Box 252, Forestville NSW 2087) has announced a new upgrade for the Exidy Sorcerer.

By replacing a ROM in the Sorcerer, the upgrade provides automatic disk boot on power up or reset, single key-stroke entry to monitor or BASIC ROMpac from monitor or disk or standard BASIC and full use of 48K of memory with the standard BASIC ROMpac.

The upgrade is available for both Micropolis and Exidy FDS drives; further details are available from PJB Systems, which also sells a large range of Sorcerer hardware and software. ■

## New Apple System

COMPUTER Galerie of North Sydney is expected to release a new Apple system, called the Apple GX.

This is intended to be an executive computer and is aimed specifically at the office market. The major benefit will be the provision of programs for immediate use in a single package.

Computer Galerie is currently finalising an agreement with one of the world's largest semiconductor manufacturers, to provide the integrated printer. The hardware will have 76K of CPU memory as a basic starting point.

A special rental arrangement has been reached with Australian Guarantee Corporation where by the Apple GX can be leased at \$236 per month with a 10 percent residual payment over four years. This arrangement allows full tax deductibility of payments and a claim for the federal investment allowance.

The system will be able to be expanded to four million words of storage with up to five terminals.

The release date of the Apple GX will be announced

soon. It will be exclusive to Computer Galerie at this stage.

For further information contact Computer Galerie at 66 Walker Street, North Sydney, 2060, or phone (02) 439 2557. ■

## Get All The Info

BRISBANE'S Archive Computer Services has the answer for anyone who wants to keep right up to date with the world of computers.

It has taken on Australian distribution for InfoWorld, the authoritative news weekly from the USA. Copies are air-freighted out here every week.

InfoWorld features numerous software reviews, trend-spotting and the kind of information only a news weekly dedicated to microcomputers can offer.

Get in touch with Archive to arrange your weekly update; it's at PO Box 13, Clayfield 4011, or phone (07) 262-2911. ■

## IBM Sues Employees

INTERNATIONAL Business Machines Corporation has dismissed three staff and sued them for stealing trade secrets. Two of the men were engineers who were heavily involved with the design of the IBM PC (personal computer).

IBM claims the three men had formed a company, Bridge Technology Inc, and attempted to sell designs related to undisclosed IBM personal computer products.

Apparently one of the men had approached Tecmar Inc, which makes add-on memory and hard disks for the IBM PC, and said he had designs for 40 peripheral devices for the PC and wanted to go into business with Tecmar to produce them.

Unfortunately for him, Tecmar was cooperating with IBM. ■





### Quiet Typist

A DESKTOP teleprinter with a memory "will revolutionise office communications and encourage executives to use a keyboard and computer," says a 3M Australia executive.

The company's Whisperwriter teleprinter, with a 4000 character memory, can transmit 300 words a minute over a telephone line and 'talk' to computers and word processors.

The national sales and marketing manager for business communications Mr David Judge, said the Whisperwriter would accelerate the trend to a paperless office.

The Whisperwriter uses a thermal printer without chemical or powder toners, to produce 40 column printouts (half the standard computer width) on plain paper.

The unit's keyboard was the same as a typewriter's and conformed to the American Standard Code for Information Interchange (ASCII).

Transmission over a telephone line, through a phone attachment plug or acoustic coupler, could reach a computer, another Whisperwriter or any ASCII keyboard unit, such as a word processor.

In the US, the machine was available with a telex keyboard for access to the telex network, but in Australia

Telecom prohibited telex access.

For further information contact 3M Australia, PO Box 99 Pymble, 2073. Or phone (02) 498 0033. ■

### Second Generation Drive

MICROPOLIS Corporation has commenced full-scale production and volume shipments of its new 1100 Series 13cm floppy disk drive, introduced at the 1982 NCC.

The 96/tpi drive incorporates all formats used in the company's 1015 Series, while offering a second generation solution to the problems of installation and reliability of double density drives, according to Dennis Resnik, Vice-President of Sales.

"The same three of four problems kept re-appearing wherever we saw 96 tpi drives being used by OEM customers, regardless of whose drive they were using," said Resnik. "The most common complaints were electrical pulse noise pick-up from video displays and switching power supplies, instability of track alignment, difficulty of track realignment, and in the case of stepper-band drives, irritating audible noise."

For further information contact Ampec Electronics at 114 Terry Street, Rozelle. Phone (02) 818 1166. ■

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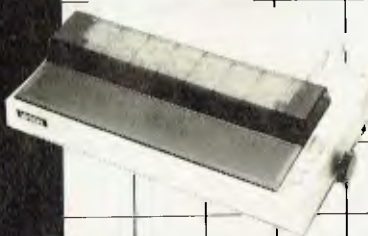
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### Typewriter Printer

CONSUMERS who own a personal computer and have found they need a high-quality yet inexpensive printer could find the Byte-writer the answer to their needs.

Retailing for only \$895, the Bytewriter is a modified high-quality Olivetti Praxis 30 electric typewriter that can be plugged directly into most major brands of small-business and personal computers.

Completely self-contained (no external circuit boards or boxes), the unit brings the personal computer user letter-quality printing at less than half the cost of previously-available comparable printers.

Praxis features include memory erase on any of the last ten characters; a built-in lift-off correction ribbon; auto-

matic repeat on any key; a switch-selected second keyboard with foreign-language characters; and switchable character density of 10, 12 and 15 characters per inch.

To the typewriter, Byte-writer has added an internal copyrighted circuit board that in no way interferes with the unit's operation as a standard typewriter. The connection is through a standard Centronics parallel input.

Bytewriter has cables available for the Apple, TRS-80, Osborne, IBM, and others. Under computer control, it prints at 8 to 12 characters a second and will underline.

The Bytewriter is warranted for 90 days, and service can be performed by any Olivetti dealer. It is available direct from Computer Edge at PO Box 44, Albert Park, 3206. Or phone (03) 690 1477.

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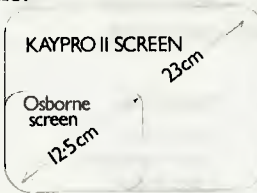
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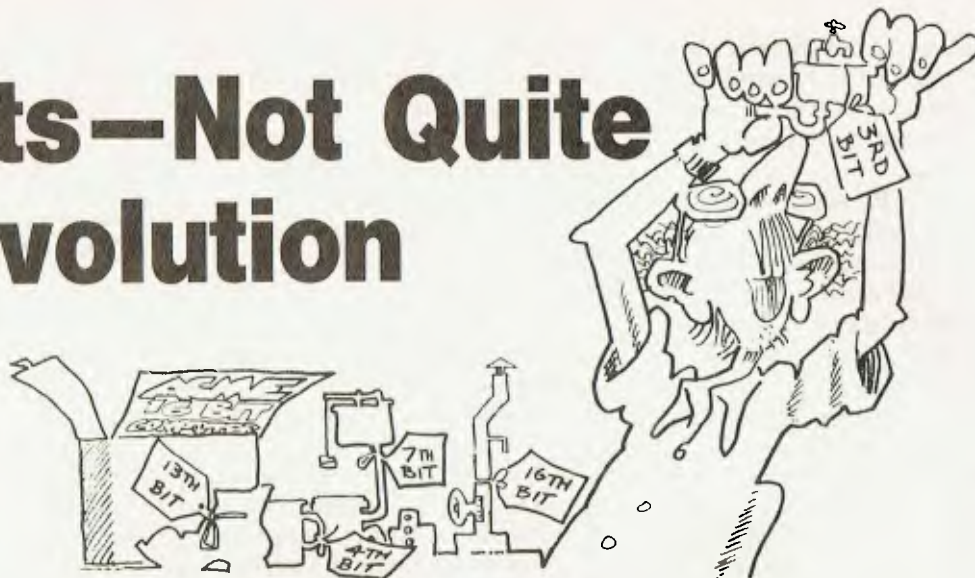
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# 16-Bits—Not Quite A Revolution



*Since 1975, when personal computers first appeared, they have generally been based on microprocessors which operate on an eight-bit word, while large main-frame computers have had 32 or up to 60 bits per word, with mini-computers somewhere in between. Les Bell asks (and answers himself) two things: why is word length a measure of computer performance, and will 16-biters rule the world (sooner or later)?*

WHEN MICROPROCESSORS first appeared back in the dim dark ages of 1970 (or thereabouts), they were four-bit machines which were used for general control and simple computation such as might be found in a calculator.

Four bits is a convenient word length in which to store a single decimal digit and, back in those days, the kinds of programs which were written for microprocessors were small and unsophisticated. We simply hadn't built up the great body of sophisticated technique which exists today.

In 1975, hobby (or personal) computers started to appear, and in 1978-1980, they really started to become popular. The reason for this is simple: the new 8-bit microprocessors had become available, and the 8-bit word length was ideal for storing a single character (such as a letter of the alphabet) in ASCII code.

More to the point, a word of eight bits can represent one of up to 256 different instructions, and with the far greater range of instructions now available more work could be done in a given time period.

These improvements, together with advances in semiconductor technology,

enabled high level languages such as BASIC to be implemented on these processors, with a more realistic level of performance. The microprocessors from this period are the 'brains' of the most popular personal computers, such as the Apple, TRS-80, PET and VIC.

As the chip manufacturers improved their ability to cram more and more on a single square of silicon, it was only a matter of time before they could build 12-bit (a la PDP-8) and 16-bit microprocessors.

As explained in an article in our very first issue, the use of 16-bit registers simplifies arithmetic, particularly arithmetic used in calculating the location of objects in memory, such as array members. It allows a greater range of instructions, each of which can be more powerful than those of

eight-bit machines.

There were several companies manufacturing 16-bit microprocessors by 1978, notably Texas Instruments and National Semiconductor, but the first one to really attract attention from microcomputer designers was Intel's 8086.

The 8086 was designed to maintain some degree of upward compatibility from its eight-bit predecessor the 8085, and so its register and instruction sets are reminiscent of earlier microprocessors. However, a study of the details will reveal that it is really quite different.

Soon after the release of the 8086, Zilog announced its Z-8000. Now the Z-8000 looks much more like a traditional minicomputer architecture, and in fact many of its instructions are reminiscent of







the IBM 370, although renamed. The result was to thoroughly confuse everyone who had been eyeing up the 8086, and make them wait to see the Z-8000.

Shortly before the Z-8000 was released, Motorola announced the forthcoming 68000 processor. Now here is a processor that is very mainframe-like, with special instructions which are privileged to the operating system, excellent memory management and other nice features.

This has confused everyone still further. The fence-sitters who were considering the Z-8000 now decided to wait for the 68000, while a few hardy individuals decided to get on with the job using the 8086.

Then Intel released the 8088, a version of the 8086 which works with 8-bit hardware, and that attracted more than a few designers who had existing 8-bit designs, as the pin-out of the 8088 and the 8085 are nearly identical.

The Z-8000 seems to have faded out of sight as far as the personal computer market is concerned. Only two major manufacturers adopted it, and Ithaca Intersystems has been very quiet on the subject of late, leaving Olivetti to go it alone.

Meanwhile, there are signs that the 68000 will in its turn be overtaken by the new National Semiconductor 16032, a virtual implementation of a VAX supermini on a chip. Such are the problems a microcomputer designer must contend with!

### What's Out There?

Enough of these technical discussions;

what's actually happening out there in 16-bit land?

A number of 16-bit machines have hit the market recently in Australia. What should the prospective purchaser consider when evaluating one of these machines?

The basic things to bear in mind are the same for the 16-bit machines as for the 8-bit machines. Such statistics as disk capacity, speed, screen dimensions, keyboard, and so on are much the same.

The first thing to consider is the availability of suitable software. This is the major difficulty with the new machines. The 8086/8088 based machines benefit to some degree from their similarity to previous 8-bit machines, but at the same time this can count as a disadvantage.

There are two predominant operating systems available for this type of computer — CP/M-86 and MS-DOS.

CP/M-86 is fundamentally similar to CP/M-80, particularly as far as the user is concerned. Apart from the addition of a help utility and new directory facilities, it is basically indistinguishable from CP/M-80 — even utilities such as PIP and STAT work the same way. To the programmer, there are obvious differences, but the BDOS function numbers are the same, and the functions work in the same way.

MS-DOS, on the other hand, is a somewhat simpler operating system, and for that reason runs noticeably faster. It offers a couple of significant advantages over CP/M-86: it date-stamps files and offers the ability to edit command lines — something that many a CP/M user would give an arm for!

On balance, however, my preference is for CP/M-86 as the operating system of choice for several reasons: it is compatible with MP/M-86; a multi-tasking version called Concurrent CP/M-86 (CCP/M-86) will shortly be available; and it offers much better memory and I/O management facilities, as an operating system should.

The availability of two operating systems for many machines has resulted in there being no clear standard with a majority of support from independent software vendors.

Microsoft has not made its BASIC interpreter available to run under CP/M-86, for example, obviously counting on this fact to attract users to MS-DOS (in fact, the company has stated publicly it will not support CP/M-86).

Digital Research for its part is working on a BASIC interpreter to replace Microsoft's, and my feeling is that DR will make a creditable job of it. It has acquired much more expertise in languages than Microsoft has in operating systems.

In the meantime, the would-be purchaser is missing out in the confusion.

The other major problem with software for the 8086/8088 family is that Intel very cleverly made up a program called CONV-86 which will translate 8080/8086 assembly language into 8086/8088 assembly language by rote.

This is a quick way of getting software up on the new processor, but it is definitely not a way of getting quick software up.

The translated code does not make use of the much more powerful addressing modes and instructions of the new processor, and consequently runs quite



slowly. This can be seen in such programs as Microsoft BASIC for the IBM PC, which is actually slower than the equivalent 8-bit software.

Other translation programs have been released, notably Sorcim's TRANS-86 and Digital Research's XLT-86. Although these provide a way of getting programs across for development purposes, they really should not be used for production programs. The results do not flatter the machines.

### The 68000 World

In the 68000 world, the results so far are not very encouraging either. Here, the operating system action centres around variants of UNIX, from the real thing to lookalikes.

Digital Research is working on a version of MP/M for the 68000 — whatever will they think of next — but that's not expected for quite some time.

Perhaps one of the most interesting efforts is that of Cromemco which, by providing a dual processor board with a 68000 and a Z-80, has ensured its users are not totally stranded away from the software oasis that CP/M can provide.

Perhaps the most amazing thing about the software already available for the 68000 is how fast it appeared! At least some manufacturers are actually offering conventional CP/M-80 programs which

are run on a 68000 emulating a Z-80. While this will work, it is also slower than a wet weekend, and misses the whole point of having a 68000.

Other manufacturers have a range of software which minicomputer manufacturers as big as DEC could not afford to produce in the timespan possible — typically hundreds of man-years of effort, from small companies little bigger than back-yard operations.

This phenomenon has mystified me more than a little; of course, the similarity between the 68000 and PDP-11 architectures goes some way to explaining how software could be transported off that minicomputer onto a micro.

So far, however, there is a selection of languages but not much apparent in the way of applications software. That situation is unlikely to change before the end of the year, at the earliest.

The machines themselves, however, are interesting. Here's a run-down on a few of them...

### Vector 4

The Vector 4 is a dual processor machine with both a Z-80 and an 8088 to run both CP/M-80 and CP/M-86 software.

Memory capacity is 128 Kbytes as standard, 256 Kbytes optional, and two types of disk drive are available — a 630 Kbyte

minifloppy or a 5 Megabyte Winchester.

Graphics capability is 640 by 312 in straight black and white, and resolution can be traded off against grey scale capability or colour on an external RGB monitor.

I/O is quite extensive, with two serial ports and two parallel printer ports. Further expansion is possible through the internal S-100 interface.

### Hitachi 'Success'

Following on the heels of IBM comes Hitachi, with a new computer which not only offers software compatibility with the IBM PC, but also hardware compatibility.

Standard features of the machine include 320 Kbytes of RAM, a single 320 Kbyte disk drive, Centronics and RS-232C interfaces, ten shiftable programmable function keys, six expansion slots, colour, monochrome and lightpen interface circuitry.

The Hitachi 'Success' supports high resolution graphics in sixteen colours, and the RGB monitor can display text to a maximum of 2000 characters with an interlaced resolution of 640 by 400.

A basic set-up of system box, keyboard, single disk drive, green screen, word processing software, spreadsheet calculator and games and utilities is priced at around \$4000.

Hitachi has also announced a 16-bit up-



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grade for the Peach, along the lines of the Metacard for the Apple.

### Panasonic JB-3000

Panasonic's JB-3000 has been discussed in these pages before. Designed to be software compatible with the IBM PC, the Panasonic runs MS-DOS and CP/M-86.

Various peripherals are available; as the brochure says, 'I/O ports allow to access to 5.25-inch diskette drive, 8-inch diskette drive, RS-232C and GP-IB interface by setting interface card'.

Graphics resolution is 640 by 400, and 8 colours are supported.

### DEC Rainbow

Digital Equipment Corporation's Rainbow 100 is another dual processor machine with both a Z-80 and an 8088.

Unlike the others, both processors can run at the same time, allowing much greater throughput in sections of the operating system and software that is specially written to take advantage of it.

DEC's version of CP/M for the machine will run both CP/M-80 and CP/M-86 programs providing a smooth upgrade path for the non-technical user.

By emulating the DEC VT-100 terminal in 132-column mode, the Rainbow 100 is particularly effective as a spreadsheet calculator.

Other nice facilities include optional col-



our graphics, asynchronous communications with other DEC machines and a very nice keyboard.

### IBM PC

We've spoken about the IBM PC before. Still not officially available in this country (my, how the time flies), but several dealers are not importing them from the States — and even going as far as upgrading the power supply to 240 V.

I guess if you want to have an IBM computer, it's going to have to say 'IBM' on the

front, and this is the only micro that has that.

Also this machine is the one that will get all the direct software support: incompatibility problems may crop up with others if you buy 'IBM' software.

### Godbout 8085/88, 8086

Elsewhere in this issue there's a review of the Godbout 8085/88 board, which was used by IBM (no less) in the development of the PC.

Also announced recently by Godbout is an 8086 CPU card, which carries the 8087 arithmetic coprocessor and the 80130 operating system kernel on a chip.

This CPU really does fly along, as it uses a true 16-bit bus — and with the 8087 installed, floating point is just obscenely fast.

### Empirical Research Group

SI Microcomputers has been handling this 68000-based board for some months now.

It's intended for use on the S-100 bus, and a lot of effort has been put into making it compatible with the IEEE 696 standard. A very interesting card indeed.

### NEC 'APC'

NEC's 'Advanced Personal Computer' is another 16-bit newcomer. It is reviewed in full elsewhere in this issue. ■

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# NEC's Headache Relief

*NEC has had a presence in Australia for the last year or so with the PC-8001 personal computer, sold through Hanimex and a chain of dealers. Matt Whelan took a look at its latest machine, the 'Advanced Personal Computer'...*

JUST AS NISSAN and Toyota have managed to carve out a large chunk of the automobile industry (not just in Australia — Detroit is feeling it too), so Japanese computer manufacturers seem likely to achieve considerable success as they master the art of making computers.

In a decade or so, Apple and IBM may still be at the top of the tree, but it's a safe bet that the other major manufacturers would be Japanese.

While software seems to be the major stumbling block for Japanese manufacturers, this has improved in recent years, particularly as they have introduced standard operating systems like CP/M. And, of course, Japanese engineering in both original design and production quality are as high as a Honda owner would expect.

The latest offering from the land of the cherry blossoms to the land of the meat pie is the 'Advanced Personal Computer' (not quite as bad as Cedric and Gloria, but

these Japanese still have funny names...) from NEC (Nippon Electric Company).

NEC is no stranger to personal computer design and manufacture. It has a wide range of small computers on the market in Japan, where it has almost 50 percent share of the market, Apple trailing along way behind. Its C-8001 has been on sale here for over a year now.

The new machine is very upmarket compared to previous models. Based on the 8086 processor, it comes in three basic versions, though all fit within the same case.

Consisting of a main enclosure with screen and floppy disk drive(s), and separate keyboard with coiled lead, the machine is no lightweight — nor is it small. Despite its bulk, the box is quite well styled, and will not dominate the office in quite the same way as, say, a large S-100 system.

To the left of the screen is either one or two disk drives — full size eight inch drives, with a capacity of just under a Mbyte per disk (double sided double density). At the rear, behind a door, are the keyboard, serial and parallel interface connectors.

The base model comes with green screen, 128 Kbytes of memory and a single disk drive — about enough to get by as an executive work station, particularly if the machine is connected to a network.

Alternatively, only one floppy drive will be required if a hard disk is attached to the machine.

The next model up has two drives, but is otherwise identical, while the top-level machine has a colour display, 256 Kbytes of memory, and two disk drives.

The model we saw initially was the middle-level one, and so most of our comments will apply to that machine.

The keyboard, which is common to all models, is a full qwerty type, with a numeric keypad and a number of additional keys for cursor control and the like.

Along the top of the keyboard is a row of 22 user-definable keys, which can provide 44 different functions when combined with a 'super-shift' key. A CP/M-86 utility program we saw allows the keys to be programmed by the user and the definitions are automatically loaded at power-up or under the user's control.

The keyboard is sculpted, and has a good feel. Optional audio feedback can be switched on or off, as the user decides, and like many Japanese machines, the system can be completely reset by pressing three keys at one (though not just any three keys, obviously!).

The 30cm screen was very good, utilising a high quality green phosphor tube (made by NEC, of course). The character set is easily distinguishable, and is based on an 8 by 19 dot matrix. 224 characters



make up the standard set in the character generator circuitry, but a further 256 characters can be defined by the user.

Again, a utility program allows the user to create and store these character sets, or retrieve them for later editing.

The display format is standard 80 by 24, with a 25th line to display status information, such as caps lock or selection of a graphics character set, as well as the date and time from the internal real time clock.

The disk drives are slim-line types, with a capacity of just under one megabyte each. The controller features automatic density selection, so that the user can insert standard CP/M SS/SD (single-sided single-density) disks into either drive and it will read and write them without any intervention by the user. This is, I believe, a first on a Japanese computer — previous attempts to provide SS/SD compatibility required the user to refer to drive B: as drive F: at best, or use a special program at worst.

Underneath the disk drives, under the 'lip' of the computer, are controls for CRT brightness and tone volume.

Inside, there is a card cage with at least two cards in a basic system, with room for three more. The cards are large, and carry several functions each.

The processor is an 8086, manufactured by NEC, and this is aided by a uPD 765 disk controller and a DMA controller which takes care of disk and screen transfers. The entire machine is interrupt driven, and capable of high performance when driven by an operating system which can take advantage of this.

Four Kbytes of CMOS memory are backed up by the same battery as the real-time clock/calendar. This RAM cannot be directly written into by the processor (avoiding power-fail glitches) but is instead accessed through the operating system. Related to this is the machine's unique ability to turn itself off under program control.

Sound-generation hardware can be used to play music. Again, this function is supported by additional functions in the CP/M-86 operating system, which has extended BIOS functions available through an extra interrupt location.

Optional hardware includes extra memory, monochrome and colour graphics subsystems, an arithmetic processing unit (based on the Intel 8231 or AMD 9511) and additional serial port.

### Stunning Colour Graphics

The colour graphics capability of the machine, some examples of which can be seen on this month's cover, is nothing short of superb.

The actual display screen has a resolution of 640 pixels by 475; but this is only a 'window' into a graphics memory which is actually 1024 by 1024. There is no trade

off between colours displayed and resolution — each pixel can be one of eight colours, and there is a full graphics plane for each of the primary colours.

The result is very high resolution colour graphics indeed. Furthermore, the graphics is smooth and fast in operation, since the machine's CRT controller is a processor in its own right, and can draw line segments, arcs, circles and boxes without any software assistance from the main processor. For this reason, circle drawing, for example, seems to be about six to ten times faster than the IBM PC.

Colour saturation is very strong, and when the machine first powers up, with the screen switched to green, a first-time viewer could be forgiven for thinking the screen is only a monochrome high-resolution green screen.

### The Software Story

At least until things get sorted out in the 16-bit market, NEC is playing it safe by supporting both the CP/M-86 and MS-DOS operating systems.

So far, only the CP/M-86 software has been shown in Australia, although MS-DOS is nearing completion.

The CP/M-86 implementation is quite well done, for a Japanese machine, as the automatic density selection shows. There are one or two strange 'features' such as a warning message that announces that a disk is read-only whenever it is read, screwing up a screen layout as it does it — particularly when you know damn well that the disk is R/O because you mean it to be...

Several software systems and packages will be supported under CP/M-86. The Benchmark word processor is a menu-driven system which has some nice features that WordStar, for instance, doesn't have — like automatic date stamping of document creation and revision, directory storage of the author's and operator's initials, and revision counting.

Selecting a word processor is pretty much a matter of personal taste, and it is perhaps a truism that the program one uses first becomes one's personal taste, so there isn't that much to be said about word processing packages in general. Benchmark has a few extra-nice features, however, such as mathematical functions available during editing, and communications with other word processors.

The primary language supported under CP/M-86 will be Ryan-McFarland's RM-COBOL, which is widely available on NCR and Texas Instruments minicomputers and has won considerable following in the micro community since its release.

For those who abhor COBOL, however, other languages will be available — remember that the machine reads standard CP/M disks, and NEC in Australia has already put CBASIC-86 and Pascal/MT+

86 onto the machine in this way; simply by buying them off the shelf. So there will be no shortage of suitable software, even if the current availability and performance of 16-bit programs leaves something to be desired.

Other NEC-supported software will include dBase II, for which the CP/M-86 version seems identical to the CP/M-80 one, and Micro-Plan, a large spreadsheet calculator system. NEC also has asynchronous communications packages, as well as several flavours of IBM communications — 3270, 2780 and 3780.

Under MS-DOS, obviously Microsoft BASIC will be supported, as well as the more popular programs such as Visicalc and others. NEC says it is also selecting an accounting package 'to suit Australian conditions', to coin a phrase.

Colour graphics support will conform to the ACM (Association for Computing Machinery) SIG-GRAPH (Special Interest Group on Graphics) CORE (don't know that one) standard. Thus, graphics software should be reasonably transportable. Incidentally, the screen emulates an ADM-3a terminal; another point to aid in bringing up new software.

Reading between the lines, it seems quite likely that Concurrent CP/M-86 will be supported on the machine. It could almost have been built with it in mind. Another possibility in the near future is

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UCSD Pascal. Evidently the US office of NEC Information Systems has been given a free hand to go out and acquire software for the machine, and is doing so with a vengeance.

A 10 Mbyte hard disk unit has been developed for the machine, and will be available early in the new year. The factory is also working on other options which will be extremely interesting to observe.

### A Clean Machine

Although we did not have an opportunity to benchmark it, there is no doubt the NEC machine is very quick, particularly in the graphics area. The graphics quality is outstanding.

Pricing is quite competitive, too. The

basic model with 128 Kbytes and one drive is just over \$4000 including sales tax, and the colour models start at just over \$6000 including tax. A fully optioned-up colour model with graphics, extra memory, arithmetic processor and additional serial interface would come to just over \$9000 including tax.

Overall, the new NEC offers generally superior performance to existing 8086/-8088-based machines such as the IBM PC and Panasonic JB-3000. It can run a huge range of software (by 16-bit standards), has standard 20cm disks, offers higher graphics resolution and has a true 16-bit data bus for faster throughput. It seems to be set for success.

It's a real pity its name is APC... ■

### Specifications and Report Card

<b>Unit:</b>	NEC Advanced Personal Computer			
<b>Made By:</b>	Nippon Electric Company, Japan			
<b>Processor:</b>	NEC uPD8086			
<b>Clock Speed:</b>	5 MHz			
<b>RAM:</b>	128 Kbytes			
<b>ROM:</b>	4 Kbytes			
<b>I/O:</b>	1 serial, 1 parallel port as standard			
<b>Languages:</b>	MBASIC, RM-COBOL, other CP/M-86 and MS-DOS tongues			
<b>Keyboard:</b>	Full qwerty with numeric pad, cursor functions and user-definable keys			
<b>Display:</b>	80 x 24 with 25th line for status and clock			
<b>Graphics:</b>	64 x 475 window on 1024 virtual graphics			
<b>Peripherals:</b>	NEC Spinwriter and dot matrix printers			
<b>Expansion:</b>	Internal bus, several options under development			
<b>Best Points:</b>	Hi-res colour graphics, 20cm drives			
<b>Worst Points:</b>	Bulky			
<b>Ratings:</b>	excellent	very good	good	poor
<b>Documentation:</b>		✓ (prelim)		
<b>Ease of Use:</b>			✓	
<b>Functionality:</b>	✓			
<b>Support:</b>		✓		
<b>Value-for-money:</b>		✓		
<b>Extras Included:</b>	2nd disk drive, colour graphics			
<b>Options:</b>	serial comms card, hard disk			
<b>Price:</b>	\$4000 to \$6000-plus			
<b>Review Unit from:</b>	NEC Information Systems Australia, 99 Nicholson Street, St Leonards, NSW 2065			

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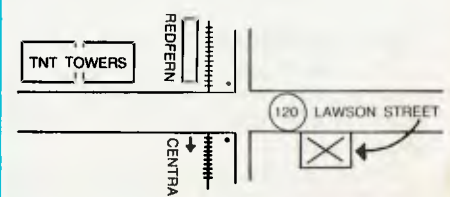
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## Communications SURVEY



### Part II

# In-House Communications

*As more and more companies contemplate the purchase of personal computers for executives, the DP manager's life gets harder and harder, writes Les Bell. The problem is simple: communications. The answer, unfortunately, is not.*

MANY LARGE companies are now considering the purchase of personal computers for a variety of functions. They may want to use them as word processors, they may wish to give executives access to financial modelling systems without tying up mainframe time, they may want to use them to maintain files of abstracts for fast research.

Many of these companies have IBM mainframe computers, and a question the DP manager will usually ask himself at some stage is: 'How can these be linked to the mainframe, and what will be the results if they are?'

The immediate result of this is that the aforesaid DP manager will start tearing his hair out in inverse proportion to his prior experience with micros. The truth is that for the average DP manager, who has spent his life working on fairly large mainframes, cushioned from the exigencies of communications and the like by an office-full of systems programmers and comms specialists, the world of microcomputers comes as a rude shock.

For a start, microcomputers use the ASCII code to represent characters, whereas great chunks of the IBM world still thinks in EBCDIC. Furthermore, most micros support asynchronous communications, while mainframers like synchronous transmission of great blocks of data at high speed — not that they ever consciously think about it that level.

Furthermore, micros have strange terminal characteristics, don't understand

communications protocols like HDLC, and... The whole thing's just too flamin' complicated!

Fortunately, there are solutions to this problem, and in this article I'll briefly outline them in the hope that it may comfort distraught DP managers, not to mention the users who are being frustrated by being perpetually told it can't be done.

#### Travelling First Class

First, there's the Pullman Coach method of data communications, which in my opinion is the best way to travel.

Some years back, IBM came up with what some people regard as the most fiendish IQ test ever devised, but is in fact a method of networking all kinds of de-

vices so that they can talk to a mainframe computer or computer centre. It's called SNA, for 'Systems Network Architecture' — pronounced like snap without the 'p'.

SNA relies upon a fairly sophisticated communications protocol called SDLC (Synchronous Data Link Control); the technical details aren't really all that important, so long as we know what can be achieved. Interestingly, Australia has more SNA per head of population than any other country in the world, indicating that we're not slow to pick up new technology.

A typical SNA connection would be between a terminal cluster controller (which concentrates data from maybe half a dozen terminals) to an IBM mainframe. The



COMMUNICATIONS MEANS  
GETTING THE MESSAGE  
ACROSS.....



question is, can a personal computer be connected into such a system. The answer is yes, and here's how it can be done.

Sydney company Systems Technology manufactures a small box called the 3703 Protocol Converter. This sits on the SNA network, and behaves just like a standard IBM box. Coming out of it are up to eight, or in certain circumstances, twelve, lines which can be used to attach almost anything onto the SNA line.

The downline devices can be anything from an auto-answer modem to an intelligent cluster controller, including teletypes and dumb terminals. Thus, using this box, it is possible to connect a personal computer to a SNA system and use it as a terminal.

The 3703 is cleverly designed. Based on an 8086 microprocessor, it is obviously software driven. However, its designers did not cast its software into ROMs, but instead took advantage of the fact that it is itself a communications device attached to an IBM system.

When the 3703 powers up, it has enough intelligence in ROM to download its 'operating system' over the SNA line from the host computer, after performing some self-test diagnostics, of course. This offers a couple of major advantages over schemes such as putting the software in ROM or booting from disk.

Firstly, the software is compiled on the

IBM mainframe, using software tools the system programmers are familiar with, rather than obscure microprocessor assembly language or such. The programmers can change the 3703's logical setup and definitions of the devices attached to it, and next time it resets, it will download the new version of the software.

Secondly, it gives control of software distribution to the central system operators. There is no possibility of anybody out there booting the system off an outdated version diskette.

Should there be any problem in the 3703, it will send a dump of error conditions back upline to the host mainframe, where the system programmers can examine it with familiar tools.

The 3703 fully implements SNA as a physical unit type 2, while the logical type can be almost anything from a banking terminal to a terminal cluster controller.

Using the 3703 to gain access to an IBM system, in conjunction with a simple asynchronous communications program running on his personal computer, a user could upload and download data such as consolidated budget data for use in a financial modelling application.

Future developments Systems Technology is working on include a plug in SDLC card for the IBM PC. This implements the basic functions of the 3703, using the intelligence of the personal

computer's own processor. The major drawback of the 3703 for this kind of application is its price — \$10,000 for a typical installation — and this will overcome that problem.

### Other Solutions

Several companies are offering software packages which will turn a CP/M-based microcomputer into an emulation of specific IBM terminals. For example, Sierra Data Sciences of California offer emulation of IBM 3275, 2780 and 3780 systems running with a variety of IBM software.

Winterhalter and Associates, a Michigan firm, offers a range of Bisync and SDLC packages, including SNA, as well as X.25 packet switching protocols. A number of other companies offer similar packages.

For non-IBM users, the problems are a bit greater to overcome. For example, for Honeywell protocols, suitable packages are rumoured to exist; they are just difficult to track down (if you know of one, tell me please!).


The message is basically that it is becoming easier to connect micros to mainframes. Suitable protocols exist to connect micros together, but mainframes haven't implemented them. Looks like it's up to us micro users to make the running. ■




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# Logic For Literati-Part The First



## Or, Quantum Mechanics For Plumbers

*From time to time, readers have asked us when we are going to do more on hardware. Our answer is simply that we won't tackle advanced hardware or constructional projects until the majority of our readers are ready for it — since many are newcomers to computing, that won't be for a while yet. But Les Bell is determined to help us on our way...*

DO YOU know anybody who has their computer wired up to turn their coffee pot on first thing in morning? I don't — and I'd guess Kambrook (the plug-in timer maker) isn't too worried at the prospect of thousands of Apples being bought to deter burglars, make the early-morning cuppa, and the rest.

Another myth exploded!

What I really want to ask is why you

haven't done it. Well, why haven't you? Or is your computer otherwise occupied between 3am (when you take the Wizardry disk out) and 7am (when She Who Must Be Obeyed kicks you out to earn a crust).

If you're like most of our readers, you are probably fairly new to computers, and have enough on your plate trying to sort out the vagaries of BASIC and DOS 3.3 (read TRSDOS, NEWDOS, CP/M or whatever), without having to worry about how on earth you could connect your coffee pot (lawn sprinkler) to the back of your Wonder Machine.

Well, all that is about to change. Together, you and I, we are going to learn all about the innards of computers, the chips that make it all happen, what's on that printed circuit board. It's not too difficult, really; and we're going to do it for real, by building up circuits and ripping them to pieces once they've proved the point.

The secret is a little gadget called a prototyping board; there are several mod-

els commercially available under a variety of names such as Bimboard, Protoboard and others. The board has a number of little holes which are connected internally, and by inserting components into the holes they are connected together to form circuits.

The hole spacing on the board corresponds exactly to the pins on the integrated circuit chips we'll be using. Some single-strand copper wire will do for the point-to-point wiring, and we're in business!

### Background Theory

The entire innards of any computer system depend on that marvellous invisible stuff electricity. This seems an appropriate time to discuss just what electricity is and how it does what it does.

This is complicated by the fact that you can't see it, hear it, smell it, taste it, or feel it, but have to rely upon its side effects to know that it's doing anything at all.



As most of us know (or are prepared to accept), all matter is made out of atoms, which in turn are made out of rather nebulous items called electrons, protons and neutrons. (We'll tackle quarks, pi-mesons and charm next month). The protons and neutrons form the central nucleus of each atom, while the electrons whiz around in elliptical orbits, rather after the fashion of planets around the Sun.

Every now and again, an electron will break out of its orbit and career around until it meets up with an atom which has space for another electron, in which case the electron will settle down for a while. They do this when their energy level is increased enough, by heating, for example. The trouble is that all this motion is random, and the sum total of it is zero for all practical purposes.

However, in certain circumstances, all the electrons get moving in the same direction (more or less), and this is called an electric current. You see, all electrons carry a slight electric charge, and as you may recall from your schooldays, like charges repel and opposite charges attract. An atom, being basically neutral, turns positive when missing an electron, so that free electrons around the place just naturally 'gravitate' for want of a better word, towards positively charged atoms.

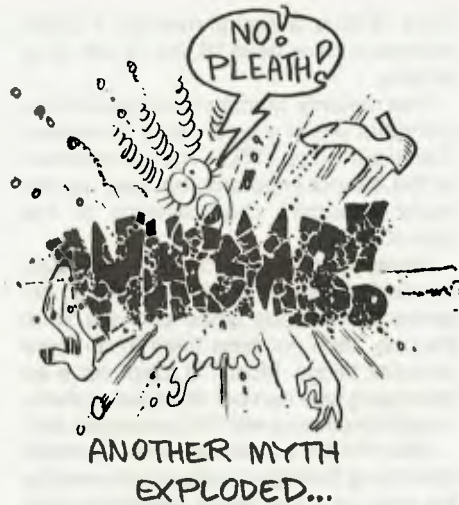
To appreciate how truly small an electron is, consider that it takes 6,241,418,000,000,000 electrons flowing past a point in one second to produce a current of one ampere (amp, A). Your car's starter motor will draw something of the order of 30 A when you start your average family car; that's 187,242,540,000,000,000 electrons being pushed past any particular point in the car wiring every second!

The force which pushes the electrons around the circuit (electro-motive force) is known as the voltage. An analogy is in order here. Consider a water pipe. The more water flows past a point per second, the greater the flow rate. This is analogous to current.

If the pipe is fed from a water tank on top of a hill, the drop in height from the top of the hill will provide a driving pressure behind the water. This 'aqua-motive force' is analogous to voltage. In this case it's measured in Newtons per square metre, or, for those of us who can cope with more sophisticated measurement units, pounds per square inch. For voltage, the unit of measurement is the Volt.

It is intuitively reasonable that the greater the height of the water tank on its tower, the greater the pressure, and the more water is going to flow through our pipe. So it is with electricity: for any given conductor, the greater the voltage applied across it, the more current will flow through it.

I say 'given' conductor; for not all con-



ductors are equal. Just as pipes come in different sizes, and a big pipe can obviously carry more water in a given time than a small one, so there are degrees of effectiveness as a conductor. Some types of material have heaps of spare electrons with nothing better to do than carry a current; others have very few to spare, and it takes a lot of voltage to get them moving along.

The electrical quantity that is analogous to the bore of a water pipe is **resistance**; as resistance increases, the bore decreases, metaphorically speaking. Obviously (what do you mean, not to you it isn't?), the higher the resistance, the less current will be produced by a given voltage.

Now that I've stretched the water analogy almost to breaking point, having taken a few liberties with it, it's time to drop it; but keep it in mind, as this kind of conceptualisation makes these things much easier to understand. Please realise, however, that if you should switch on an electric power outlet with nothing plugged into it, you will not be sprayed with water; if you are, it is pointless to ring either an electrician or a plumber, as this is what insurance companies call an 'Act of God'.

For the mathematically inclined, the quantities voltage (V), current (I — I don't know why) and resistance (R) are related



by the simple equation  $V=IR$ , where voltage is measured in Volts, current in Amps and resistance in Ohms. This, by the way, is the famous Ohms Law which you may have read about.

One final little point of basic electricity (and here I shall stretch the water-pipe analogy to its elastic limit): consider a junction of several water pipes. Since water pipes never leak, all the water that flows into the junction must be equal to the water that flows out. This is the infamous Kirchoff's Law (well, one of them) that gives first-year Uni Elec Eng students such a hard time.

## Signals and Meaning

While gold and copper are good conductors, and plastics, for example, are not, there are some materials that aren't quite so easy to categorise.

Two of them, germanium and silicon, are half-decent conductors, or in scientific lingo, semiconductors.

What makes them outstandingly interesting is that by tampering with a little chemistry and adding a pinch of such substances as indium, arsenic and gallium, we can make devices in which we can vary the resistance of the substance at will.

These devices are called **transistors**. Imagine them if you like, as water pipes which can be varied in diameter from inches to feet by remote control. Even more interesting is that the remote control device is itself a water pipe; some kind of mysterious hydraulic mechanism.

Now we can use one water pipe to control the flow of water in another; best of all, we can use small pressure changes in one pipe to control the water flow in a big pipe...we can use small voltage changes in an input circuit to control the current flowing through another circuit. And thus we have the principle of amplification.

This is (vastly over-simplified, to be sure) exactly how your hifi amplifier works: the flow of current through its output transistors, from the wall socket, via the power supply, to the loudspeakers, is controlled by the voltage signals fed from the pickup. Various other things are done to the signal by the tone control circuitry, for example; but these are, fortunately, beyond our plumbing skills.

Now, communicating information in this manner is quite difficult; measuring the flow rate in a pipe is not that easy, and nor is it easy to measure current or voltage accurately. If electricity had never been discovered, it is conceivable (if not probable) that we might have calculating or computing machines based on the kind of plumbing we've discussed.

I don't know about you, but I would much rather that my bank balance wasn't measured by the amount of water in a tank. Inflation wouldn't worry me so much



as evaporation; a hot summer could ruin the country! Not only that, but corrosion, lime deposits and the like could render such a hydraulic computer progressively more inaccurate.

There's another way of working, though, which doesn't rely on accurate measurement. We say, 'If the water in this pipe is barely moving, count that as a zero, and if it is a proverbial raging torrent, count that as a one'. Then we either fully open or close the valves in the system, and never leave them in between.

Systems that rely upon measurement are called analogue systems, and such analogue computers do exist, and while they do suffer from problems analogous (!) to evaporation and so on, they have their uses for specific types of problems. The on/off system is called:

### Digital Logic

Contrary to popular belief, digital logic is not figuring things out by counting on your fingers! Digital logic in fact is the type of circuitry used by the vast majority of computers in the world today.

If you look inside your computer, you will see one or more boards, usually green, covered with black rectangles and other funny coloured shapes. These boards, called printed circuit boards, are the actual electrics of the computer. Copper tracks on the surface of the boards carry signals from component to component, and link the entire system together.

The black rectangles do the actual work. These are integrated circuit packages — in fact, the integrated circuit is a small chip of silicon moulded into the black epoxy resin. Most packages have

14 or 16 pins, although memory, I/O and processor chips have 18, 20, 24, 28, 40 or 64 pins.

The majority of integrated circuits in a computer are of a type called Transistor-Transistor Logic (TTL). The exact details of this are not important, but here are the major important characteristics of this type of circuit.

Several types of circuit are available; the basic intention of this course is to examine the various types and see what they do, then combine them to do more complex things. Most TTL chips have an identifying type number stamped on them, usually beginning with 74 (sometimes 54).

After the 74 will either be the numbers identifying the logic function performed by the chip, or a few letters specifying what kind of circuit it is. The letters 'LS', for example, indicate that the chip is a 'Low Power Schottky' type, which consumes less power and operates faster than the standard series. In fact, LS type TTL is much more prevalent in microcomputers than standard TTL.

The numbers identify the logic function; for example, a 74LS90 is a decade counter, while a 7474 is a dual D-type flip-flop. These numbers generally apply regardless of the manufacturer, and their pinouts are the same also.

In order to help you to identify particular IC's and design with them, you should obtain one of the TTL Data Books published by the semiconductor manufacturers. These specify what each chip does, which pins are which, how much power the chip consumes, and how fast it does it.

Some data books also contain useful

design hints and background information. They are obtainable from integrated circuit manufacturers such as Texas Instruments and Fairchild (generally for a price — they're not small books). I use the Fairchild book; it's priceless to me.

Unlike MOS (Metal-Oxide Semiconductor) circuits such as microprocessor chips, which can be damaged by static discharge as they are handled, TTL chips are quite safe to handle. They run off a power supply of 5V (plus or minus 5 percent), and their inputs and outputs can only be in one of two states — close to either 0 V (usually within a few tenths of a volt but certainly less than 0.8 V) or 5 V (actually anything above 2.4 V is a logic one — generally it is 3.3 V).

There are a few other things you ought to know about TTL, but they can wait until you start using the stuff.

So much for the background. If you want to be ready for the action next month here's what you'll need: one 'breadboard', as they are known; proprietary names such as 'Protoboard' and 'Bimboard' are the kind you'll need. Check that it's the kind that accepts integrated circuits (0.1 inch pin spacing).

You'll also need the following items: 1 x 7400, 1 x 7402, 2 x 7404, 1 x 7408, 1 x 7432, 1 x 7486, 4 x red light emitting diodes, half a dozen 330 ohm resistors. Oh yes, you'll need a 5 V power supply. Some computers have spare 5 V outputs, and it may be possible to use one of these; alternatively, we are arranging for a simple el-cheapo 5 V power supply to be made available by one of our suppliers.

Next month, we shall start the practical experiments in earnest. □



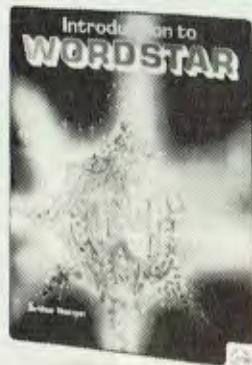




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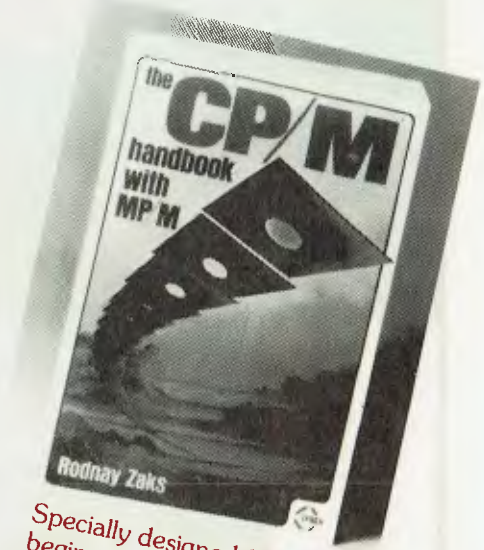
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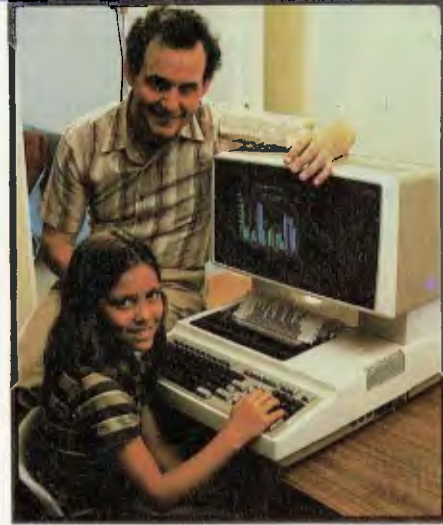
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# your computer text file

## Hopeful Advice

IN THE May 1982 issue Clinic Section, advice given to one Mr Haughton is, I feel, rather hopeful more than helpful.

First, if Mr Haughton's ZX81 is fitted with the British modulator, it is of the UHF variety — and whilst it can be used with a colour TV set that covers the necessary UHF band/channel, it cannot be used on a TV with only a VHF tuner. And substituting the locally made Dick Smith modulator will not solve the problem. Without going into the technical details, UHF cannot be made compatible with VHF just by wishing it to be so. What is required, if Mr Haughton's unit, as I suspect, has a UHF modulator, is a UHF to VHF converter — see Electronics Australia/Dick Smith kit, which gives exceptional results!

In the case of the Australian retailed ZX81 units, they are indeed fitted with VHF modulators — tuned to channel 0 frequency! This means that in states where channel 0 operates, interference means that the screen display of any TV set is seriously degraded.

If Mr CLINIC examines the Hong Kong modulator he will find it is physically much smaller than the Dick Smith unit. In fact, he would find that it is the same size as the original British unit — only on VHF not UHF. The Dick Smith unit though can be used. First you must trim the unit down until it will fit inside the case of the ZX81, then solder it in place of the channel 0 version. I have found that it gives better results if it is retuned to operate on channel 4 though this is not important if interference to another TV set operating on the lower channels will not occur.

If it is retuned to channel 4, interference to other TV in close proximity is lessened, but not totally excluded.

So there it is. I enjoy your magazine and await its appearance on the newsstands each month with eagerness.

W GILES  
Kingston, Qld

## Dick's Secret

THIS IS a letter to tell all your advertisers the big Dick's secret to getting bigger (sorry Dick, you don't carry enough Commodore products).

He advertises his prices and gives a good brief description of his chattels, has a telephone number with Bankcard

facilities and 99 percent of the time a mail order section in his ads.

Unfortunately, some of us do have to live outside the capital cities and even away from major regional towns and even more surprising we sometimes have the odd dollar to spend after being ripped off by freight and packaging charges!

Please Mr Advertiser, get your money out of those ads and give us country guys a go.

If you thought there were no computer bums out here, you have my sympathies, we don't all have TV, and we don't do all the time what you think we do.

David Allenburg  
West Mackay, Qld

## Sleazy Akhurst?

THANKS FOR an interesting, witty and informative magazine. Apart from B J Akhurst's brilliant (but sleazy) cartoons, I find the glossary of great assistance in handling the unavoidable jargon.

However, I think you should check out the definition of 'Write Protect', and I think it is poor form to explain Kilobaud when you have not explained Baud first.

I appreciate the tutorials, and the pieces on operating systems and languages. Can you include some about multi-user systems? When we approach dealers about multi-user CP/M they become very evasive. Many shudder at the mention of MP/M.

I could certainly use some of your fundamentalist insight into the UNIX-like operating systems for micros, and some words about the apparently super duper Discovery Multi-Processor, Cromemco and Cromix, and Morrow's Decision 1.

These hold quite a deal of promise for the slightly larger than personal user, wanting two or three workstations, and maybe 20 or so megabytes on line. I see potential for very cost-efficient computing solutions in many government bodies — maybe you could help to save us some tax.

MIKE JONES  
Balmain, NSW

**Our definition of write protect is entirely accurate — it specifies floppy disks...although perhaps we could accede to the changing times and include a definition for minifloppies too. Won-**

**der whose idea it was to reverse convention anyway?**

## Nice Book, But...

VIC REVEALED, by Nick Hampshire, is an excellent book, packed with useful information and routines. However, the proof reading has left a lot to be desired.

For those who have tried the joystick routine on page 218 and failed to get it up and running, the following amendments will make it work. Lines 30 and 40 should read:

```
30 S0 = ((SAND4)=0)
40 S1 = ((SAND8)=0)
```

Other shortcomings of the proof reading proliferate throughout the book. For example, on page 119: 20 PIKE 36879,Q+24; and 20 FORQ=-TO1000:NEXTQ.

One good effect of the errors in VIC Revealed is that the user has to investigate them and, by amending the routines, gets a more thorough understanding of how they work.

BILL FABIAN  
Regents Park, NSW

## Plotting Program Error

I WAS pleased to see my paper describing a general-purpose plotting program attractively set out and printed in the April 1982 copy of *Your Computer*, but was dismayed to see that I had omitted one up-arrow from line 8215 of Listing 2.

The second instruction in line 8215 should read:

```
STT-10 \INT(LOG(BSS)/LTR)).
```

Also the OPTION numbers (2) and (4) were omitted from the caption of Figure 2.

I regret the error, which occurred because my interfaced typewriter has no up-arrow. One was put in by hand in line 8395 but line 8215 was overlooked in the copy sent to *Your Computer*. The option numbers were omitted in typesetting but are not likely to confuse anybody.

D L HOLLWAY  
Gordon, NSW



# your computer text file

## The Perennial Question

I BECAME interested in microcomputers through a unit in computer maths at school. I have since decided that I would like to buy a microcomputer, but I am at a loss as to which one I should buy.

I was told to buy *Your Computer* which I did, and even after reading the magazine, I am still at a loss as to which one I should buy.

The Sinclair ZX81 is tempting as far as price goes, but as far as expansion goes, it leaves a bit to be desired. The Apple on the other hand seems a lot more versatile, but at this stage, I am not sure how far my interest in computers goes, and so buying the likes of an Apple could prove to be an expensive lesson.

In the February 1982 issue, I saw the Microbee. It seemed quite interesting, but with my soldering ability it could be a lot easier to set fire to \$400.

In a nutshell, what I am looking for is a computer that operates well in its basic form, yet can operate as the basis of a good system. I want something that has plenty of programs available at a reasonable price. I also want something which could be easily and inexpensively repaired if something went wrong. Keep up the good work on the magazine.

GRAEME WILLOX  
Jimboomba, Qld

**This is the question we never answer....we can't tell you what to buy without knowing you and your needs a whole lot better.**

**The good news, if you really did like the Microbee, is that it now comes assembled.**

## Let's Go Lotto...

I MUST comment on Rod Stevenson's columns (June and July 1982 *Your Computer*) in which he discusses the nature of random numbers in general and his application to generation of X-Lotto numbers in particular.

The subject of using a computer to generate X-Lotto numbers is, in itself, trivial: it only supplants any emotive battle that may arise in the selection of such numbers. It will not, as Rod asserts, increase the probability of obtaining a winning result.

However, here the triviality ends: the

function of problem analysis must be pursued as a matter of principle. Systems analysis is the backbone of computer programming and should be fully realised no matter how trivial the project.

Any program that seeks to emulate a 'real world function', as would be the case with a X-lotto emulator, must, as near as possible, follow the 'real world rules' of the function.

The function of 'drawing' the numbers can be described as follows:

- The numbered balls are loaded into the container.
- The position of the balls are randomised by the rotational action of the container. By reversing the direction of rotation, a ball is shunted to the outlet passage of the mechanism and deposited in the appropriate receptacle.
- The process of the previous paragraph is repeated until seven, six primary and one supplementary, balls have been selected.

Facts that can be assumed from the foregoing: the balls are randomised before each draw; once a ball has been drawn there is no way the same number can be reselected; with each draw, the number of balls that remain available to be drawn are reduced by one, but, the range (of numbers) can remain the same e.g. 1-40.

I would submit that the following program meets the conditions described.

```
100 'Program to emulate a X-Lotto draw
110 DIM BC(40)
120 FOR I=1 TO 40:BC(I)=I:NEXT I:R=40
130 FOR J=1 TO 7
140   RANDOM
150   D=RND(R):PRINT USING"####";BC(D);
160   FOR J=1 TO R-1:BC(J)=BC(J+1):NEXT
170   R=R-1
180 NEXT
```

Line 140 re-seeds the generator — as analysis required.

Line 160 ensures that the number in the range is only selected once by the compaction of elements.

Line 170 reduces the ball count.

To conclude: those among us that have been around computing for a time that enables us to write, either practically or philosophically, must, to the best of our abilities, ensure that we do not dismiss what, in our view, might be trivialities: we are the educators of the newcomers.

The Archer Bugtrap  
RD Greet

## Get It Straight!

I AM writing to express my disappointment in *Your Computer*, June 1982.

Being the proud owner of a VIC-20 I am constantly on the lookout for software, which is very rare. Imagine my delight in finding a magazine which features a program especially for the VIC-20. I quickly thumb through the magazine, read through the editorial (which tells me this is the best magazine out) and then buy it.

The VIC-20 combat program has apparently been printed out by computer so I think it must run okay.

Then comes the crunch!

After many hours of laborious typing and erasing I push the return button after typing run and all I get are error messages!

Line 340 should read POKE 7680+(22\*Y),103:POKE 7701+(22\*Y),101; the for..to values for drawing the walls are wrong, the variable 'A\$' is used at least three times during the program for different purposes, line 830 keeps throwing up a 'RETURN WITHOUT GOSUB' error, and to top it all off, no matter which set of keys are pressed, only the left tank moves, to name but a few!

I am at present a subscriber to an English magazine Micro Computer Printout which is a very 'friendly' magazine, very aware of VIC-20 users, but alas does not cater for Australia as far as software advertisements.

I am therefore looking for an Australian magazine to take its place, and will be looking critically at the next couple of issues of *Your Computer*.

I would appreciate your comments and a debugged printout.

Paul Turvey  
West Hobart, Tas

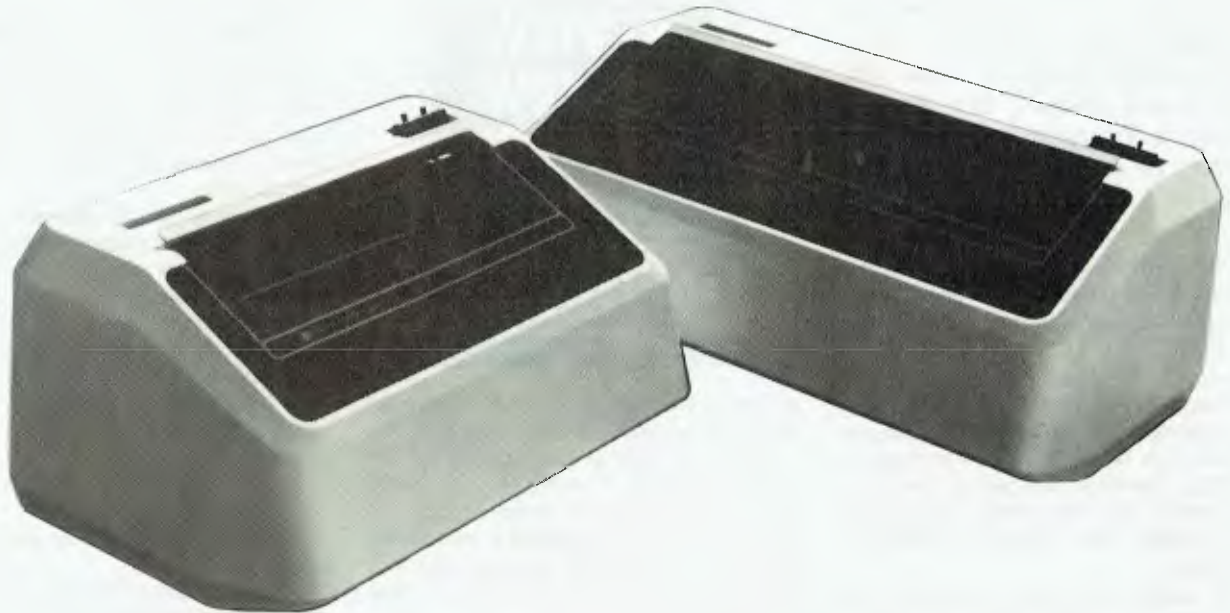
**That, unfortunately, is what happens when readers submit material in un-useable format — it gets re-typed, and something goes wrong. We try very hard to keep them accurate, but sometimes a 'dud' slips past.**

**Of course, we could always claim we slip a few in to give readers the extra satisfaction of discovering the bugs and getting it to run properly...you would believe us, wouldn't you...?**



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# Eight AND Sixteen

*Making the transition from an 8-bit system to a 16-bit system will be the logical next step for a lot of users whose systems have just grown and grown. But leaving behind a library of 8-bit software needn't be a problem, writes Les Bell.*

EVER SEEKING increased performance from my office computer, it's been growing as I've added more and more peripherals.

Recently, I've been loading more and more work on the poor machine, including a market research questionnaire analysis program that takes hours to run through the data. The result has been a desire — no, a need — for more power, particularly more speed and possibly multi-user operation.

The result was a plan to upgrade the system to a new, faster processor, more memory, hard disk, and so on. Although this is a long term plan, and not all of it has been implemented, the first steps have been taken, and the system has been slowly metamorphosing.

After considering a lot of the S-100 systems on the market, I finally decided on the Compupro range of boards, by Godbout Electronics. In the range, which is designed to meet the IEEE 696 standard for the S-100 bus, are memory boards up to 128 Kbyte in size, disk controllers (both hard and floppy), I/O boards, special purpose boards like the Multiplexer, and processors.

With a special interest in 16-bit systems, I was particularly drawn by the CPU 8085/88, which has both an 8-bit 8085 processor and a 16-bit 8088 processor on it.

In this way, it is possible for me to run all my existing 8-bit software, as well as having CP/M-86 and other 16-bit software available to me.

Incidentally, it might be of interest to know that this same Godbout dual processor system was used in the development of the IBM Personal Computer, and in fact, with the addition of an extra disk controller, it can read and write disks in IBM PC format!

The pin-outs of the 8085 and 8088 chips are sufficiently close that it is almost possible to unplug one and replace it with the other, and it was undoubtedly this

## Your computer



similarity that led the Godbout designers to try putting both on the same board.

When the board first powers up, the 8085 processor is enabled. The board does have power-on jump circuitry, so that it can jump immediately to a bootstrap program in ROM, for example, but normally the 8085 will start execution at location zero.

### Put It To Sleep

Once the system is running, the processors can be swapped by performing an input from the memory management port (of which more later). When this port is read, the running processor is put to sleep, and the sleeping processor wakes up.

Depending on the switch settings on the board, the wakening processor can either continue exactly as it was before being put to sleep, or it can be reset when it comes on line.

In this mode, the 8085 will either restart at location 0 or perform a power-on jump, while the 8088 will start execution at location 0FFFF0H. This mode is not normally used, and the processors generally just suspend current operations on switching out and resume them on awakening.

The S-100 bus now allows for a maximum of 16 Megabytes of memory through its new, extended, 24-bit address bus. Obviously, the 8085 only directly addresses a maximum of 64K of memory, since it only has 16 address lines.

Therefore, the board is provided with an 8-bit output port (latch) which actually puts its contents on the upper 8 bits of the address bus. By this means, which is identical to bank select schemes from a software point of view, the 8085 can address the full 16 Mbytes.

The 8088 has 20 bits of address, allowing direct addressing of up to 1 Mbyte. The

memory management control circuitry knows which CPU is running, and when the 8088 is in control, only puts the top four bits of its contents onto the bus — the lower four bits of the extended address lines come directly from the 8088. In this way, the circuitry accommodates the different addressing ranges of the two processors.

On power-up the extended address register is always cleared to zero, while on reset, it may or may not be cleared, depending on a switch setting. The power-on jump circuitry allows the 8085 processor to jump to any 256-byte boundary in the lowest 64 Kbyte address space.

Thus a typical program flow for a program using both processors might look something like this:

- Computer powers up.
- 8085 does a power-on jump, program begins to execute.
- Time to swap processors.
- Load in object module for 8088.
- Set up jump to 8088 code at 0FFFF0H
- Push A register
- INput from port 0FDH
- On-board hardware puts 8085 to sleep and wakes 8088 up.
- 8088 now on line, begins execution at 0FFFF0H,
- Jump to object module.
- Perform task.
- Time to swap processors (e.g. need something from disk).
- Put info to be passed in RAM (e.g. drive number, sector, and so on).
- Push A register,
- INput from port 0FDH.
- 8085 back on line.
- POP A register,
- perform task
- Push A register
- INput from port 0FDH
- 8088 back on line

### Watch The Stack

Notice that the switching is done by performing an input from a 'fictitious' input port, and so after it is done, the processor's accumulator will contain garbage (FFH). Therefore, if the accumulator contents are important, they should be placed on the stack.

Another important point is that the programmer should be careful to keep each processor from modifying the other's code, data or (especially) stack spaces.

Using this scheme, it is possible to run 8088 16-bit code under conventional



CP/M-80, by making the 8085 a kind of disk server. Godbout can supply a special 8088 debugger which operates under CP/M, allowing this kind of software to be worked on, although most 8088 users are now moving to CP/M-86.

In fact, the Godbout M-Drive, a high speed replacement for disk drive storage, actually is an extension of the standard CP/M BIOS which uses the high-speed string (block) move instructions of the 8088, combined with its 1 Mbyte addressing, to do some of the work for the 8085.

It is possible to write a CP/M-80 BIOS for a standard 64 K system, in which most of the code is actually run by the 8088 — and more efficiently than the 8085 could do it!

CP/M-86, running on this board with the Compupro Disk 1 controller, actually uses the 8085 to perform the initial bootstrap, and then hands control over to the 8088.

Also on the subject of dual processor operation, Godbout Electronics now has a special version of the MP/M-86 Version 2.0 operating system, called MP/M 8-16, specifically for this board. As well as working like a conventional MP/M-86 system, this piece of software will allow the user to run existing 8-bit CP/M programs in a multi-user environment.

It works like this:

Suppose a user types in WS, in order to run WordStar. The operating system will first search for the file WS.COM, which is the 16-bit version of the program under CP/M-86. If it fails to find that file, it will then search for WS.COM, the 8-bit version of the program. Should it find that program, it will then load it into memory, and set up a fake CP/M-80 BDOS and BIOS in the same area of memory. It will then switch processors, allowing the 8085 to run the program.

In the meantime, the 8088 is still time-slicing, allowing multiple users of 16-bit software; the 8085 can also be time-sliced, so that multiple 8-bit programs can also be run.

From these notes, it can be seen that there is no shortage of software to take advantage of the dual processor system!

### Other Features

The CPU 8085/88 conforms to the IEEE 696 standard for the S-100 bus, and will work with the latest in memory and peripheral boards. In particular, it implements the correct protocols for DMA transfers by other bus masters — in fact, its companion disk controller, the Disk 1, is a DMA device.

Despite the attention paid to state-of-the-art design, the board will also work with older boards, provided they are conservatively and correctly designed. For example, a socket is provided for the connection of an Imsai front panel (although

you don't see too many of those these days!).

Speed? Ah, yes, speed. Well, the assembled and tested version of the CPU 8085/88 is provided with 6 MHz versions of both processors as standard, and the result is a fast system. There is a switch on the top of the board to reduce the 8085 clock speed to 2 MHz, for those systems which have slow memory or peripherals, or perhaps use software timing loops in the disk controller.

The presence of a large finned heat sink on top of the 8088 surprises many people, but the fins really are necessary, as that processor really does get hot, particularly at speed.

Running at 6 MHz, the system is about twice the speed of the IBM Personal Computer, as our recent benchmarks show: using Microsoft BASIC-80, the system generates the prime numbers up to 1000 in 45.7 seconds.

For those who really want their system to fly, an 8 MHz version of the board is also available. Beware, however, because you're gonna need some pretty hot mem-

ory to run at that speed! Incidentally, the board does have a wait state generator on board to slow it up when accessing slow memory, but that negates the whole point of running with a high speed processor.

The board is built to extremely high standards; it really is a lovely job, and will be appreciated by printed circuit board connoisseurs.

Possibly the only thing that could have made it better would have been a Z-80B processor in place of the 8085 — but then, there's not that much Z-80 software around, and it would have unnecessarily complicated the board.

In short then, the CPU 8085/88 is a unique board which is able to take advantage of a wide range of software and give the user a gentle entree into the 16-bit world. It provides plenty of raw speed to turn an S-100 bus into a really 'hot' box, and supports some very advanced concepts in operating systems.

The 6 MHz version of the board sells for \$425 plus tax, while the 8 MHz version is \$525 plus tax. I got mine from Automation Statham, 49 Birch Street, Bankstown NSW 2200. Tel (02) 709 4144. □

### Specifications and Report Card

<b>Unit:</b>	CPU 8085/88
<b>Made By:</b>	Godbout Electronics
<b>Processor:</b>	8085, 8088
<b>Clock Speed:</b>	2 MHz / 5 MHz, 2 MHz / 6 MHz (switch selectable)
<b>RAM:</b>	N/A
<b>ROM:</b>	N/A
<b>I/O:</b>	N/A
<b>Languages:</b>	You name it
<b>Expansion:</b>	S-100 IEEE 696
<b>Best Points:</b>	Dual processor, excellent software support, high quality construction
<b>Worst Points:</b>	No failings

Ratings:	excellent	vgood	good	poor
<b>Documentation:</b>		✓		
<b>Ease of Use:</b>			✓	
<b>Functionality</b>	✓			
<b>Support:</b>		✓		
<b>Value-for-money:</b>		✓		
<b>Price:</b>	\$495			
<b>Review Unit from:</b>	Automation Statham, 47 Birch Street, Bankstown 2200			



# SUPERVYZ Your Office

*Trying to make a CP/M system more comprehensible to the people in your office? While CP/M offers some you-beaut word processing and database packages, the system itself can be a nightmare for the novice. Les Bell reports here on one solution...*

OPERATING SYSTEMS, historically, have been designed to be used by the cognoscenti of the computer world; the systems programmers and others possessed of 'inside knowledge'.

The uninitiated find it well nigh impossible to make a computer do what they want without hours of training, and even then are unable to reason out why a particular command works this way with one option and that way with another.

There's a reason for this, of course; the operating system has to be able to make the machine do anything that may be required of it, and so it has to be a particularly complex piece of software with so many bells and whistles.

And, of course, applications programs like accounting packages can be designed with one type of user in mind, while the OS has to be all things to all people.

CP/M is a good example of this dichotomy. As operating systems go, it is fairly basic (which is why it is so transportable) but no-one could really describe it as 'user friendly'.

On the other hand, the range of programs available to run under it includes some extremely sophisticated, yet friendly, office applications software. The operating system itself is the major barrier to placing such software in an office with untrained users.

Supervyz is designed to remove that barrier. It is a 'shell' program which hides the operating system from the user. With Supervyz installed in a system, from the moment of power-up, the user is able to select the activity to be performed from a series of menus.

If Supervyz has been completely and correctly installed, it will install itself in memory immediately after the operating system loads, and will then take over system operation. After a few seconds, the Supervyz main menu will appear.

The menu screen is divided into three areas. At the top is a menu of the various options available to the user. Up to 10 different functions can be displayed in this space, and the user makes a selection by pressing the associated number.

The bottom area is devoted to the Volume Table of Contents, which is simply a disk directory listing, a list of the names of the files on the disk.

The middle third of the screen is where it all happens, the area where Supervyz prompts the user to select an action. At the main menu, the prompt line here will read 'Please enter the number of the desired function (0 if none, ? for help) [ ]'. The user can then enter the appropriate number and hit return, which will either cause the selected action to be performed or drop the user to the next level menu.

The menu structure is hierarchical, so that the top-level menu can deal with overall office activities, while each lower order deals with successively lower functions such as word processing, accounting, or communications at the next level, document printing, editing or document copying at the next again.

The heart of Supervyz is SUPERCCP.COM, a program which relocates itself in memory to overlay the standard

allows the user to set it up for any one of a number of terminals and integrated screens, and then optionally offers a list of disk controllers for which it is able to patch the BIOS so as to autoloading SUPERCCP, which will then chain to Supervyz proper.

In many cases, if a disk drive is not specified, the user will still be able to make the appropriate patches if he has access to the BIOS source code (all users should have free access to the BIOS source!). In any case, system houses and OEMs should certainly be able to supply 'turnkey' systems which present the Supervyz menu on power-up.

Each menu can be set up by the user; a program is supplied which allows the user to set up individual menu entries. Basically each menu entry consists of a title and an optional series of prompts; the answers to the prompts are substituted into a command line which is sent to SUPERCCP in exactly the same fashion as a SUBMIT file is processed.

Thus, a menu entry might look like this: a title of 'Word Process a Document', and prompt for 'Name of Document'; the command line will look like 'A:WS B:\$1', but will be expanded when submitted to include the answer to the prompt, so that it looks like 'A:WS B:SUPERVYZ.DOC' or similar.

Supervyz command lines can be significantly more sophisticated than with standard CP/M; for example the vertical bar symbol can be used to chain multiple commands on a single line, allowing, for example, FORMAT to be run, followed immediately by SYSGEN.

Control characters can be embedded in text, written as a caret followed by a letter, rather than the actual control code. Comments can be displayed on the screen, using a semicolon.

The Supervyz menu also contains details of the allowable field lengths, and it will display square brackets about the entry area, so:

Name of file [                    ]

Thus entries are restricted to the appropriate size. As well as this, each Supervyz menu entry allows the user to specify the default disk drive and user area which it will operate on. Furthermore, the user can specify any files (particularly .COM files) which are required; Supervyz will check that they are present and will display an error message if any are missing.

## Help Features

It can be seen that Supervyz allows the construction of quite sophisticated menu structures, and allows complex sequ-

## your computer



## SOFTWARE REVIEW

CP/M CCP (Console Command Processor). SUPERCCP has several extensions over the standard CCP, notably the resident commands GET (load program but don't execute), GO (execute memory-resident program), LOG (change logged drive) and WAIT (wait for a key-press).

SUPERCCP is larger than the standard CCP; it leaves the same size TPA (transient program area) as a standard system with XSUB active. SUPERCCP also supports the MP/M XDOS call 155 and will return the time and date in standard MP/M 1.1 format. Obviously in a system without a real-time clock this is not the real time, but is set by the user using a program supplied.

SUPERCCP can be run automatically on many CP/M systems; the installation



ences of operations to be carried out, after the fashion of SUBMIT files, without the operator being aware of what is happening.

However, it is unlikely that even the most experienced user can create a system, the operation of which will be immediately obvious to a new user. For this reason, one of the standard prompts on each Supervyz menu allows a user to press the '?' key to obtain a 'HELP' file.

Pressing '?' will load and run the HELP.COM utility supplied with Supervyz. The function of this program is to load and display a help text file (\*.HLP) with name corresponding to the menu from which it was invoked. The user is presented with a menu and can select the function(s) for which he/she desires assistance.

This is fairly straightforward stuff; there are apparently similar programs in the public domain. What really makes this one different is that HELP.COM is actually an implementation of Dr John Starkweather's PILOT (Programmed Instruction, Learning Or Teaching) language. Thus .HLP files are not just straight text, but are rather programs.

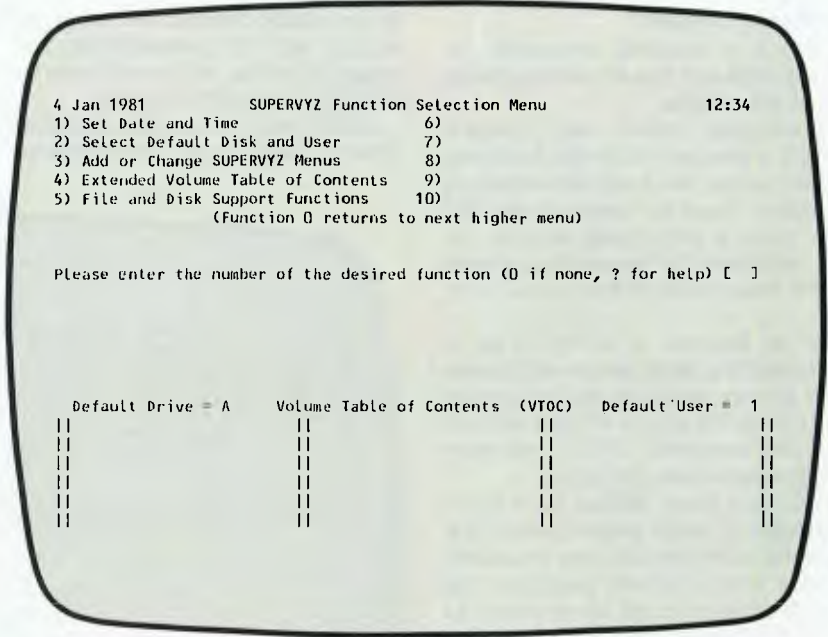
Using this facility, it is possible to construct interactive teaching sessions which not only present instructions, but ask the user questions. In fact, the principal documentation for the HELP program is in fact a .HLP file itself, which presents examples

of the kinds of things it can do, ending up by listing itself to reveal all!

The Supervyz disk contains sample .MNU and .HLP files, so that the user has plenty of examples to follow. On most installations these will require customising.

For example, to edit a .HLP file from within Supervyz, the standard system will

try to invoke ED, the standard CP/M editor. Now, while I have a certain nostalgia for ED, I would no more use it than appear naked in 'Cleopatra', preferring WordStar; since the only copy of ED.COM I have is on my master disk, Supervyz would not let me edit a .HLP file until I'd changed the menu.



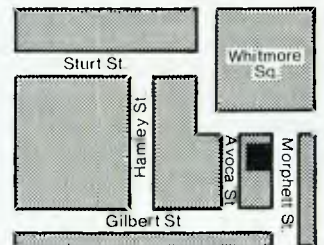
Supervyz Function Selection Menu.

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## Interesting Utilities

Supervyz is supplied with some interesting utilities on the disk which provide some of its functions.

For example, there's Sam Singer's DUMP22, a program which can dump any track and sector, edit it and write it back to disk again. Used by experienced CP/M'ers, this is a very handy program indeed, especially for recovering erased files, but in the hands of the novice — oh, boy!

Also on the disk is DIR22.COM, a sorted directory utility which will display files in all user areas, as well as system files; these do not appear with the conventional DIR command. DIR22 also tells whether a file is read-only or not.

While both these utilities have been superseded by newer versions which are also in the public domain, they are useful for those who otherwise would not be aware of them or don't know where to obtain CP/M User Group software.

## Any Problems?

The major problem, for me at least, is the speed of the system.

Because it works in much the same way as SUBMIT, Supervyz is heavily disk-bound, and climbing up and down the menu 'tree' between operations is very time-consuming, especially when I know I could do things so much quicker from the command line. But then, I'm an experienced user, and Supervyz isn't really much benefit to me. A complete neophyte would probably see things rather differently.

There are some problems with Supervyz particularly when it is trying to provide input to a program such as WordStar which does direct console I/O via the BIOS, not the BDOS. It just can't do it, so that a command line which tries to chain commands (say, running WordStar to edit a document, then deleting the backup file after exiting WordStar) will not work.

Early versions of Microsoft BASIC-80 will suffer from the same problem. In fact the current version (5.2) will sometimes drop characters which have been 'XSUB-bed' (so to speak) by Supervyz.

These comments apart, the system seems to work well. The documentation is aimed at the end user of a ready-installed Supervyz system; this is the way it should be, but I felt that there could have been more assistance for the installer, particularly on how to write .HLP files.

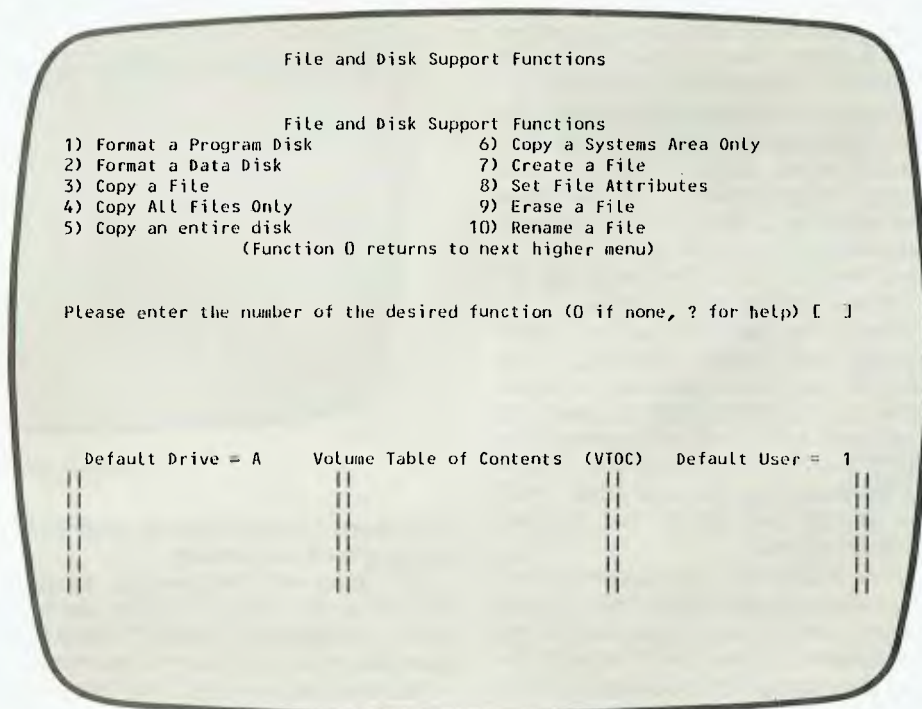
Once adapted to a specific system, Supervyz certainly helps to 'tie it all together' and relieve the operator of specific details such as how to format and syngen disks.

There's quite a deep philosophical argument about whether it is better to completely cocoon the user from the operating system, at the cost of inflexibil-

ity, or expose the user to the raw system, so that with the understanding that will (must!) develop, he/she will have access to the full power of the system.

Whilst I tend to lean towards the second point of view ("If you can create a fool-

proof system, then only a fool will want to use it!" — Anon), I do have sympathy for those who have no need or desire to master the intricacies of CP/M. For such users, Supervyz will prove an excellent relief. □



File and Disk Support Function Menu

## Software Report Card

<b>Program:</b>	Supervyz			
<b>Made By:</b>	Epic Software, California			
<b>Useful for:</b>	Idiots who can't understand a simple thing like CP/M (Bell's Biased Opinion!)			
<b>Hardware Req'd:</b>	Any CP/M system with adequate disk space			
<b>Ratings:</b>	excellent	very good	good	poor
<b>Documentation</b>		✓		
<b>Ease of Use</b>	✓			
<b>Speed</b>				✓
<b>Functionality</b>		✓		
<b>Support</b>			✓	
<b>Value-for-money</b>		✓		
<b>Extras included:</b>	Disk maintenance & directory utilities			
<b>Price:</b>	\$125			
<b>Review copy from:</b>	Cycorn Computer Systems, 178 High Street, Windsor 3181			



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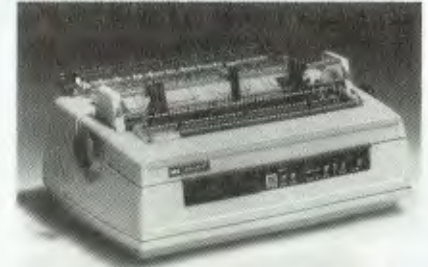
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SILVER NEC 506

# Multiplan

## - The New Generation

*Author Peter Sandys, a VisiCalc fan from way back, says a little time spent reviewing Microsoft's Multiplan gave him weird visions...of groups of Apple dealers standing in front of a Multiplan display while John Cleese, a copy of VisiCalc clutched in his left hand, was clobbering them on the head and muttering Multiplan, Bah and Humbug!*

MULTIPLAN, the newest spreadsheet calculator in the VisiCalc mould, represents a third generation in visual calculators — a true third generation, not a blue label overprint.

Multiplan is a product of Microsoft, the company which wrote — surprisingly enough — Microsoft Basic.

If you have gained immense value out of programs like VisiCalc or Supercalc then it is possible that, like me, you have been frustrated by the lack of some features, like: variable width for individual columns, file consolidation, 80-column width (on the Apple), the use of English formulas, limited display windows and alpha/numeric sorting.

Multiplan has these, plus further capabilities I'll discuss later.

### The First Try

The first version I had to review was a dealer demonstration copy for the Apple computer.

It was set up with the Videx 80 column board. The demonstration diskette had a series of utilities, including one for configuring the program for other 80 column cards. These included the Vision 80 but, although the configuration was allowed for, the actual driver was not on the disk.

I was not fortunate enough to have a manual to work with because of the rush to get the program out to Australia. The rush was because we had an opportunity to demonstrate the Apple on the Don Lane show and it was felt that Multiplan would have been ideal. With Linda Graham from Wiser Microsoft and Ian (Zardax) Phillips' Videx card we blundered our way through the dealer demonstration.

Now normally this would really put me 44

your computer



## SOFTWARE REVIEW

off, but the program was so amazing that I was determined to get into learning it without the manual. To me this would be one good test of the error trapping and user friendliness of the program.

All is not lost if you don't have the manual. There are 50 pages of help commands on the disk which can be called up at any time. This means that the inexperienced operator can ask the program for assistance without having to go to the manual for reference. Without this feature I would never have been able to work the program.

Wiser-Microsoft did manage to have a Vision 80 version of the program shipped from the US so I could start this review in earnest. I was glad of this because there were three things that were concerning me with the program.

With the Videx card there was an annoying flicker on the screen when the program was calculating, like electrical interference. Also the cursor was slow in responding. Finally the cursor was in underline mode not reverse field.

The Vision 80 card did not have these problems.

### What You Get

Multiplan comes with two disks for about \$340 including tax, compared with VisiCalc at \$380.

The program has two disks, a boot disk and a system disk. If you boot the system disk a message comes back telling you to insert the correct disk. On booting the correct disk the first message you receive is

an option to choose the program or the utility functions.

The utility options are disk initialisation, system configuration, and disk copy routine (yes, disk copy routine you can back up your disks yourself). System configuration lets you choose between 6 different 80 column boards and the normal 40 column video.

To get into the program you change disks and press return; within seconds you and Multiplan are together.

The most immediate difference that you see to VisiCalc is the alpha prompt line at the bottom of the screen. The columns are also numeric values rather than alpha. This is something that I personally feel would have been best left as in VisiCalc.

Because of space limitations I have had to assume that the reader is aware of VisiCalc or Supercalc, and how they operate. For those who are not familiar I have included a small synopsis at the end.

### Vive La Difference...

The hardest thing for me to do was to decide where to start. One thing I used to find extremely annoying with VisiCalc was the inability to set variable column widths for individual columns.

With Multiplan I can have one column of say 4 characters while the preceding column could be 20 characters. In true financial modelling this is essential for presentation.

Also this means that you can include the maximum amount of information on the screen without having to waste blank spaces.

Another feature is the ability to bracket negative numbers and also include commas: for example, — \$245000.00 would appear as (\$245,000.00).

The program will also allow you to set headings which are continuous. This means that if you have to reset the width of one or more windows the headings will be adjusted. There is no need to go back to each window display to change the words which under other spreadsheets would lose characters when the width is reduced or add blanks if it was expanded.

In what other ways is the display different? You can set up to eight windows, and these can be synchronised to move together. The windows can have a border placed around each or all. This has a limitation as the border takes up space which



reduces the amount of information available to you on the screen. It is possible to have some windows with borders to highlight them and others without.

It is possible with the 80-column card to have upper and lower case text.

### Editing And Cursor Control

The numerous keys available are somewhat bewildering at first. However, as you work more with Multiplan you see the advantages they have to offer you as an operator.

Firstly there is a simple diamond set of cursor control keys. These are used in conjunction with the control key to move the cursor anywhere over the screen. They follow the WordStar (CP/M) convention: control-E is up, control-D right, control-X down, Control-S left.

Control Q goes to the top of your sheet, Z to the bottom, W to the next window. By pressing Control R and then the direction keys you will jump one screen display in the selected direction.

Control keys are available to use in the edit mode, giving you word left, right and so on, facilities not found on VisiCalc. Naturally the cursor movement keys are still available.

It is possible to ask Multiplan to print out all the formulas used both to the printer and also to the screen.

You can name cells. For example you can set all cells in row 5 between columns 8 to 15 to be called sales figures. Then the next row can be called costs, and finally the answer can be called gross profits. You then use SALES-COSTS = GROSS PROFITS, as your formula.

This use of English names in formulas is very convenient. It is possible for you to replicate cells or rows by the use of words.

Cell referencing can be done by three different methods. Naming, Relative reference, and Absolute reference.

### More Neat Tricks...

Multiplan gives you the ability to sort columns alphabetically or numerically.

The sorting is limited to either greater than or less than; while this is limiting it is a step in the right direction.

Naturally in two or three years time software reviewers will be able to criticise the lack of foresight by the authors of Multiplan in not giving this sorting ability greater power, but presently it is a very powerful addition. It further highlights another feature, that of being able to selectively issue commands for a small section of the work sheet.

Multiplan has the power to limit commands to a specific area of the work sheet. I can delete rows 3 through 10 between columns 34 to 45. Figures in these rows but outside the parameters will not be affected. The blank command can be also used in this way.

Memory size is the weakest point of

Multiplan. The program does not take advantage of the extra memory cards available for the Apple.

The amount of memory available with the standard Apple and the 16K ram card is between 15 and 30K. The reason I can't pinpoint it closer than that is that of two VisiCalc models I loaded, a 10K program gave me 33 percent memory remaining while a 15K program gave me 48 percent.

The reason there is a difference is that Multiplan does not use as much memory to store some of its information as VisiCalc. The major saving is Multiplan's unique memory-saving technique when it stores formulas which have been replicated.

Okay, so Multiplan can reach up to 30K in some situations while with VisiCalc you can have 32K with a 16K card. This is a limitation, or so it seems until you look closer.

With Multiplan you can permanently link files so that a worksheet can be split between two or more files. In fact you can link up to eight sheets to any one sheet.

It is also possible to fool it to link to more. This gives you virtual memory. While this isn't as convenient as having the extra memory directly available it does work extremely well and is much more cost-efficient than having to spend \$700 or more on extra memory cards.

Recently I was working with a major corporation which was considering purchasing the Apple III with VisiCalc and 254K of memory, only because the model the staff wanted to work with was too small for the Apple II and they also wanted 80-column display with upper/lower case

facilities. They also liked some of the formatting features Multiplan offered which VisiCalc did not.

What we did was to split up the model with totals at the bottom of the first split. We gave these totals the glorious name of 'carried forward'. We then loaded the second half and included a b/fwd column which was linked to the figures from the first sheet.

The linking was done from the second sheet by instructing Multiplan to look for all the figures referred to as carried forward on the first sheet and take those figures and insert them into the second sheet. We further asked Multiplan to make that link permanent so that whenever the figures of the first sheet were changed the second sheet would reflect that change in its figures.

This feature could be carried on ad infinitum until we ran out of space on the disk; and even this is not totally accurate — if you have more than one disk drive you can access linked sheets in other drives. And, to extend the possibilities even further, Multiplan will ask you if you want to retry if it cannot find a file on a disk — so you can change a disk if the file you want to link to is on another disk.

This feature is also invaluable for those corporations who want to be able to merge figures from different regions or branches and make a consolidated report for the company as a whole. Also it is a very powerful feature when, for example, you compile weekly figures which in turn are totalled to give monthly figures and then your annual report.

### Software Report Card

<b>Program:</b>	Multiplan			
<b>Made By:</b>	Microsoft			
<b>Useful for:</b>	Financial Planning			
<b>Hardware Req'd:</b>	Apple II (also available for CP/M and MS-DOS)			
<b>Ratings:</b>	<b>excellent</b>	<b>very good</b>	<b>good</b>	<b>poor</b>
<b>Documentation</b>	✓			
<b>Ease of Use</b>	✓			
<b>Speed</b>		✓		
<b>Functionality</b>	✓			
<b>Support</b>	✓			
<b>Value-for-money</b>	✓			
<b>Extras included:</b>	N/A			
<b>Price:</b>	\$312			
<b>Review copy from:</b>	Wiser-Microsoft, Forestville, NSW			

## Arithmetic Functions

Multiplan has 16 arithmetic functions including sum, average, logarithm (natural and base 10) and square root. It also figures Pi to 13 decimal locations.

It has four trigonometric functions including sine and cosine (VisiCalc has six). Both programs have eight conditional functions and each has two table functions including look-up. Multiplan has standard deviation.

Features that only are available in Multiplan are the string functions such as string length, mid string, fixed, (the text containing N in fixed format with M decimals), integer format, and dollar (the text string showing the value N in dollar format).

Row and column functions are also unique; you can select and display the current row or current column number in a cell.

There are three ways to reference a cell. The first by naming it (for example, Sales), the second by its row and column number, and the third by relative reference within a formula. In this way you can say that you want to add the figure of a cell five rows above or below — you do not need to identify the actual cell number.

## Help And Error Messages

The propaganda sheet says there is only one error message available while

the help command in Multiplan says there are 7. These seven are #N/A, #NAME?, #NUM! (overflow), #DIV/0, #REF!, #NULL!, #VALUE!.

Actually I did find some irregularities in the help function. The text says that you use the control T key to obtain upper/lower case on the Apple with 80 columns while I had to use control A to achieve that effect with the Vision 80 card.

You can format all cells individually, in a group or in total. The formatting options include:

Alignment: In this option you can centre, left justify, right justify, or have the text left justified and the figures right

justified.

Format: Continuous, for headings; exponential, to the power of 10 and user specified decimal places; Decimal place, to the user's choice; Generally, to the most appropriate considering the size of the cell; Integer; Dollar, 2 decimals with negative numbers in brackets; Bar graph, using asterisks; Percentage, number times 100 with a percent sign.

Finally the width of any column can be between three and 32 while the program will display 14 precision digits with a decimal exponent from -64 to +62.

Multiplan has the ability to lock cells selectively so that it is impossible for you





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to enter figures over a formula or heading.

Deletion or insertion of rows can be done on a multiple basis. You can insert 1 or 50 lines between any select group of lines. The same with columns and deletion. As mentioned earlier you can also do this selectively by deleting part of a line or part of a group of lines.

### Getting The Reports

When it comes to printing out the report then Multiplan makes it easy for you. You tell the program what size paper you have, what length you want the report to fill that sheet, whether or not it is a single sheet and it will work it out when to stop printing. When all the rows are printed it will print the leftover columns.

Options available are the choice of a specific group of cells to be printed if you don't want to print the whole sheet, the printing of formulas instead of figures and the requesting or supression of the printing of row and column numbers.

You can also print to a disk file which can then be used in a word processor.

Multiplan is available under CP/M and Apple DOS. CP/M versions available now or in the near future are for 20 cm disk or 13 cm for SuperBrain, Xerox 820, Osborne 1, and Apple III (with CP/M). Also available will be MS-Dos versions.

## The Financial Modellers...

PROGRAMS like VisiCalc, Supercalc, Calcstar, and Multiplan are based on the spreadsheet calculator principle. They give the user an easy way to develop mathematical and hence financial models.

These worksheets replace old fashioned methods of figuring worksheets: pencil, rubbers, ledger paper, adding machine and a lot of time and patience, not to mention the sleepless nights.

You set up a worksheet on the computer in rows and columns, just the way you want it. You enter the formulas you want to use such as profit=sales-costs — this can be done in different ways depending on the program you are using.

You then enter the data. After that you do the brain work and the computer will do all the tedious calculations. You can manipulate figures to play the what-if game: 'what if tax rises by 2.5 percent?' and so on. The program will recalculate all costs affected by the tax change and reflect the new profit level of the

company.

One of the nice feature of spreadsheet programs is that, if you need a report or presentation, the computer can print it out from the actual worksheet you were working on. If you need a few reports which each reflect changes in situations the model can produce these with little work on your behalf.

Not only can these worksheets be used for financial modelling they can also be used to set up quotes, asset analysis, cash requirements, tax planning, and lease/buy comparison calculations.


In the marketing field they can assist by deciding branch profitability, pricing analysis, new product introduction, and rate justifications.

Engineering applications are formula analysis, liquid flow analysis, project cost estimation, project tracking and project scheduling.

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BRUER PYM 229B

# Teaching Your Computer To Teach



Education writer Dr John Barrett — joined this time by his student son Jon — presents a program which illustrates the use of a computer to promote inductive learning from simulation. Rather than using it to test or reinforce current knowledge, this method allows you to use the computer to make new discoveries...

MOST COMPUTER-based instructional programs fall into the CAI category of either drill-and-practice or tutorial modes.

There are also a few truly instruction games available with an individual competing against 'the machine' or another person. Beyond these categories is the instructional use of simulation where a learner may gain knowledge and/or manipulative skills by interaction with a representation of real world events.

The program presented this month is closely related to simulation. A mathematical model is developed and presented on the screen with the learner having the ability to alter input data and note the effects of such manipulation.

## Two Approaches

One form of classifying the learning process is to view it as either inductive or deductive.

This simply means the learner is pro-

vided with instruction first and applies this knowledge later (deductive method) or the learner goes through an experience before arriving at a solution of the problem and an understanding of the topic (inductive method).

As those of you who have studied clas-

sical logic may recall, there are two forms of inference — deduction begins with established truth(s) whereas induction begins with fact or observation.

In CAI the format is essentially deductive — rules are usually presented first then some examples are worked through.

<u>TABLE OF CONSTANTS AND VARIABLES</u>		
<u>CONSTANTS</u>		
<u>NAME</u>	<u>STANDS FOR/IS</u>	<u>VALUE</u>
CF	<u>CONVERSION FACTOR</u>	.0174533
VE	<u>VERTICAL EXAGGERATION</u>	
<u>VARIABLES</u>		
<u>NAME</u>	<u>STANDS FOR/IS</u>	<u>TYPE</u>
SK, CK	Sin and Cos Amplitude	Real
SC, CC	Sin and Cos Magnified Amp (SC = SK*VE, CC = SK*VE)	Real
SX, CX	Sin and Cos X values (frequency)	Real
DOMAIN	<u>Domain</u> choice input	Real
DF	<u>Domain</u> mult. factor	Real
N	Stepping value in for-next loop (HGR-Set up)	Integer
A, B	Positioning Graphics	Integer
XØ, YØ X1, Y1 X2, Y2 X3, Y3	Used for plotting, plotting calculations	
SPACE\$	Getting <u>Space</u> Bar Variable	String
MENU	<u>Menu</u> choice value	Real
T	'Time' variable for delay in for-next loop	Integer
P	Variable Used to <u>Print</u> or not to Print text on colour graphics screen	Integer

Table 1.



This is followed by practice, possible some guidance in the tutorial mode which usually culminates in an assessment of achievement.

In contrast simulation (and games, where so designed) allows the learner to arrive at his/her own solution or to 'discover' the appropriate facts, concepts or rules.

### Instructional Purpose

We decided when designing the accompanying program that it should meet the following demands:

- be able to be used by a teacher for demonstration purposes to introduce the ideas, to illustrate or explain the concepts or to summarise previously learnt material.
- be fully self contained so that individual students could explore or practice manipulating variables.
- allow for various changes to be made under the control of the user (teacher or student).

The program is suitable for use in mathematics or physics in Years 11 or 12. It could be appropriately used in lower grades to illustrate different wave shapes.

In the area of computer literacy, a demonstration of the calculating and plotting capabilities could be made and some analysis of the program as well as an examination of the area of simulation could add to classroom discussion.

### Program Design

The actual program evolved over a number of versions and a number of months.

Our goal in presenting this program is to encourage microcomputer users to develop their own courseware but two points must be kept in mind.

First, the program presented is not the only nor possibly the best solution. It is an example of what can be done. We have kept to simple instructional design and straight-forward programming in BASIC — the kind of programming that can be done without complex skills.

Second, it should be understood that the design, programming, debugging, correction and re-design is a time consuming process.

The program plots the sine curve, the cosine curve and the additive curve from different input data.

Users are able to set different values in the formulae  $A \sin(BX)$  and  $C \cos(DX)$  and have these plotted over different domains.

Having seen the sine curve plotted in green and the cosine curve plotted in orange, a blue curve representing their addition is plotted.

After the first run a number of options are presented — starting again with or

"SINE AND COSINE" - FLOW DIAGRAM

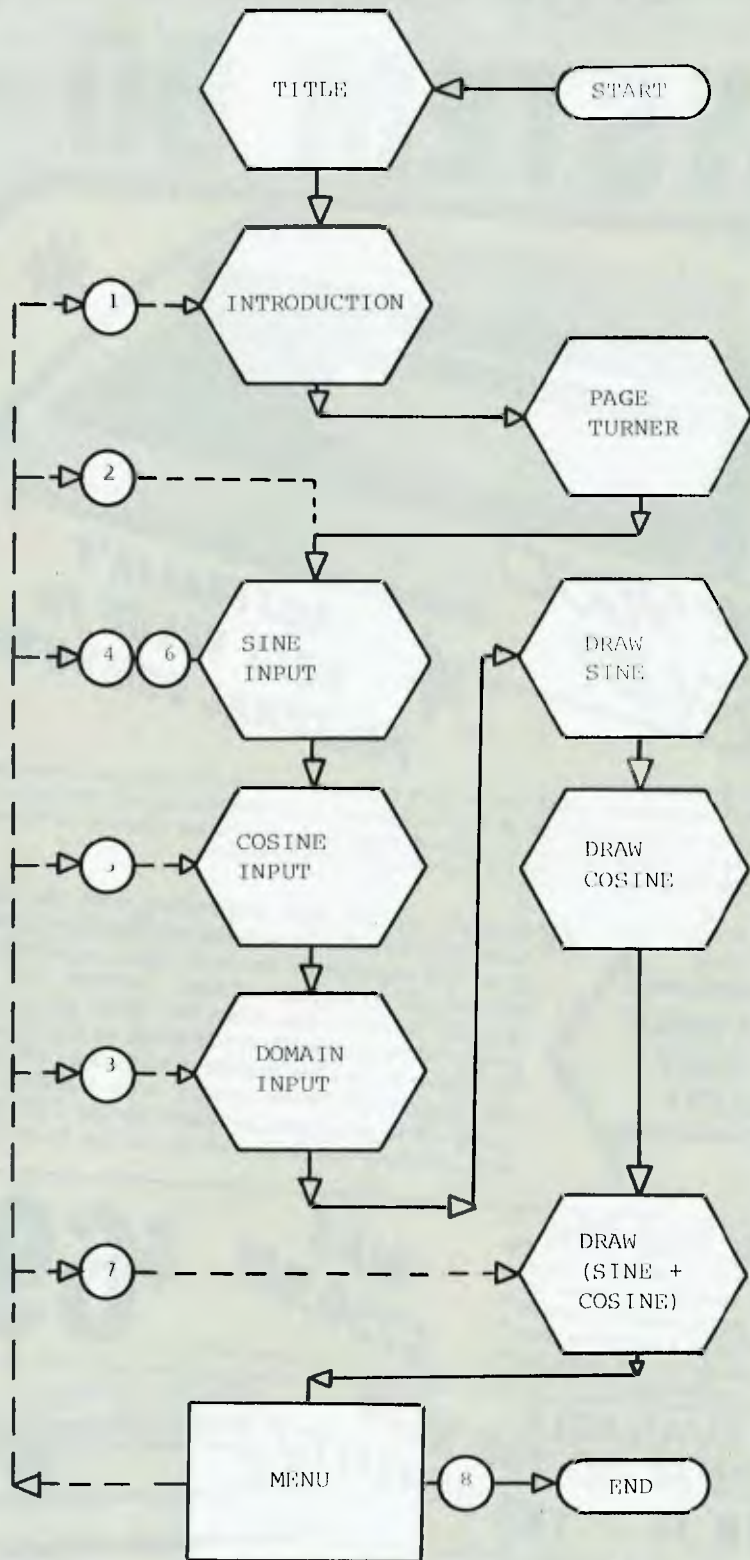


Figure 1.

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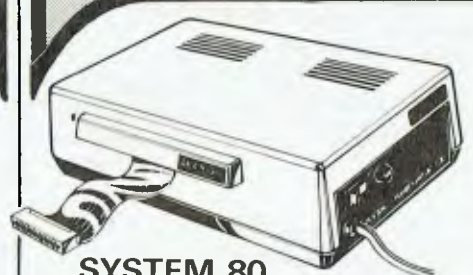
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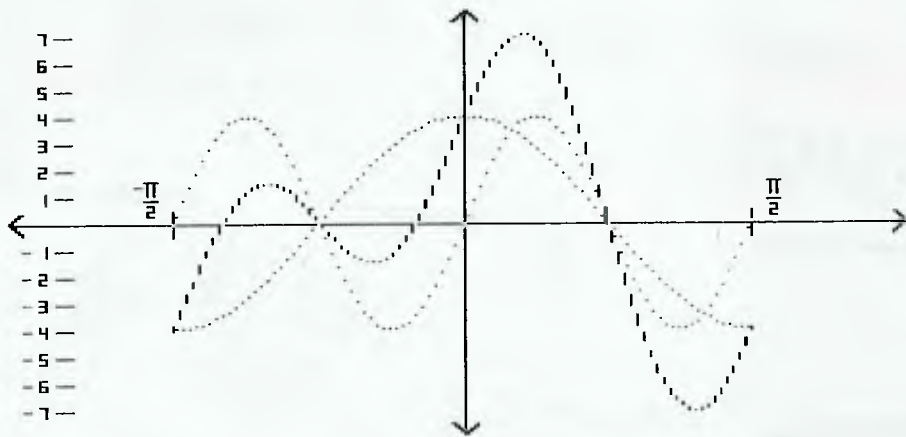


Figure 2.

without introductory instructions or altering values for the sine plotting or the cosine plotting or both or the domain may be changed.

One option provides repetition of the plotting of curves to consolidate or review the current values.

### Program Structure

The program has been written in a number of blocks as indicated in the flowchart.

Each of the main blocks is in the form of a subroutine. This enables each module to be constructed and modified separately as well as having a clear advantage for programming. The structure of the program can be seen between lines 500 and 700.

These are some of the features built in to the program:

- Title page — indicates the name of the program. Authors and date of production and an example of output.
- Page Turner — this is a natural situation for subroutine and allows separation of text into presentable pages under the control of the user; a contrast with page presentation 'time delays' of unknown interval.
- Speed of output — (see line 1510) is set to a "suitable" pace to enable sentences

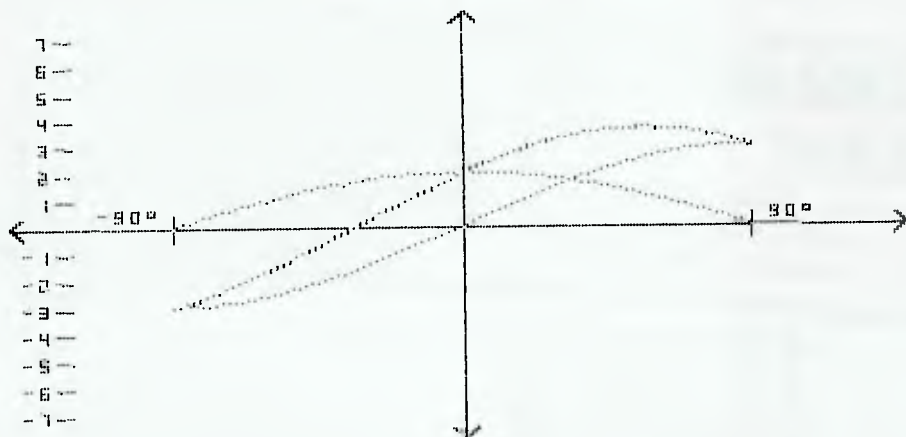
to be read while being presented rather than the 'dumping' of a full page at once. This speed can be altered for different reading abilities.

- Text — spacing should be used liberally; avoid excessive 'flashing' (!). Inverse is particularly suitable for headings or main points.
- Number subroutines or sections in reserved units of 500s or 1000. Work within these blocks which can be developed independently and merged to the main program at a later time.
- Requires 48K of memory to run and written in Applesoft BASIC.
- Name variables appropriately; for example in line 690 the variable MENU is treated by BASIC as ME and in this case has a range of 1 to 8 for menu alternatives.
- Graphics presentation — all axes and diagrams should be labeled appropriately (see subroutines 4000 and 4500 used to set up the graphics display and the 'character set', respectively).

### Other Characteristics

Some of the subroutines such as the Page Turner (line 6500) and character set (line 4500) may be easily transferred to another program.

Modification or additions are easily made; for example, in line 4090 changing 'A = 10' to 'A = 133' will move the range



markers to the centre of the screen. Similarly changing 'VE' in line 550 within the range 6-11 inclusive will adjust the maximum amount of amplitudes without difficulties.

Information is given at the appropriate time only — that is, current values of curve variable are only given when not on a first or new run.

The sine and cosine resultant curve is plotted in dashes rather than dots used for the sine curve and the cosine curve which enables distinctions to be made on non-colour screens.

### Summary, Expansion

A table of constants and variables is presented as a desirable documentation procedure. Also included is a listing of the program and a sample of output.

There are a number of ways this program could be expanded — the plotting of other equations or the addition of CAI. We would be very interested in your suggestion or the publication of other programs which allow for the exploration of data manipulation and the investigation of cause and effect relationships. □

```

500 REM **** MAIN PROGRAM ****
510 LOHEM: 24576
520 GOSUB 1000: REM TITLE
530 GOSUB 1500: REM INTRO
540 GOSUB 6500: REM PAGE
550 CLEAR:VE = 10:CF = .0174533
560 GOSUB 2000: REM SIN INPUT
570 GOSUB 6500
580 IF MENU = 4 THEN 630
590 GOSUB 2500: REM COS INPUT
600 GOSUB 6500
610 IF MENU = 3 THEN 630
620 GOSUB 3500: REM DOM INPUT
630 GOSUB 4000: REM HGA LAYOUT
640 GOSUB 5000: REM DRAW SIN
650 GOSUB 5500: REM DRAW COS
660 GOSUB 6000: REM DRAW S+C
670 GOSUB 6500
680 GOSUB 7000: REM MENU
690 ON MENU GOTO 530,550,620,560,590,560,630,700
700 SPEED= 255: HOME : END
710 REM COMPUTER TAKES RADIAN
720 REM RAD = DEG*PI/180 = DEG*.0174533
730 REM *****
1000 REM TITLE
1010 VE = 10:SK = 4:SA = 1:CK = 3:CI = 3:DF = 1:
CF = .0174533
1020 HOME : HGR : HCOLOR= 6:P * 1
1030 HPLOT 0,0 TO 0,150 TO 278,150 TO 278,0 TO 0,0
1040 GOSUB 5000: GOSUB 5500
1050 VTAB 21
1060 INVERSE : PRINT
      SINE + COSINE
1070 PRINT CHR$( 7)
1080 PRINT * BY JOHN F. & JON D. BARRETT 1982 *
1090 FOR I = 1 TO 3000: NEXT I
1100 RETURN
1500 REM INTRODUCTION
1510 SPEED= 150
1520 TEXT = HOME
1530 INVERSE : PRINT *WELCOME TO SINE + COSINE.*
1540 PRINT
1550 NORMAL
1560 PRINT *IN THIS PROGRAM YOU WILL BE ABLE TO*
1570 PRINT
1580 PRINT *PUT INTO PRACTICE WHAT YOU KNOW*
1590 PRINT
1600 PRINT *ABOUT SINE AND COSINE CURVES.*
1610 PRINT
1620 PRINT *FIRST YOU WILL BE ASKED TO SUPPLY SOME*
1630 PRINT
1640 PRINT *VARIABLES.*
1650 PRINT : PRINT
1660 PRINT *THE COMPUTER WILL THEN DRAW ON YOUR*
1670 PRINT
1680 PRINT *MONITOR THE THREE CURVES.*

```



```

1690 GBSUB 6500
1700 PRINT : PRINT : PRINT
1710 PRINT "THE CURVES ARE IN THE FORM"
1720 PRINT
1730 PRINT TAB(10)"A SIN (BX)"
1740 PRINT
1750 PRINT TAB(10)"C COS (DX)"
1760 PRINT : PRINT TAB(10)"A SIN (BX) + C COS (DX)"
1770 PRINT
1780 PRINT : PRINT "YOU CAN SELECT ANY VALUE FOR B AND D"
1790 PRINT : PRINT "BUT ABS(A)+ABS(C) MUST NOT EXCEED *BO / VE"
1800 PRINT : PRINT : PRINT "WHERE ABS IS THE ABSOLUTE"
1810 PRINT : PRINT "(*POSITIVE) VALUE OF THE NUMBER."
1820 RETURN
2000 HOME : INVERSE : PRINT "FIRST, THE SINE CURVE"
2010 IF I = 6 THEN SK = 0:CK = 0
2020 PRINT
2030 NORMAL : PRINT "INPUT VALUES FOR 'A' AND 'B'"
2040 PRINT "IN THE FORMULA:"
2050 PRINT : PRINT
2060 PRINT TAB(10)"A SIN (BX)"
2070 PRINT : PRINT
2080 IF (MENU = 0) THEN 2110
2090 PRINT "PRESENT VALUES:": PRINT
2100 PRINT SK * SIN ("SX") AND "CK * COS ("CX")"
2110 PRINT
2120 PRINT : INPUT "WHAT VALUE FOR A ":SK
2130 IF (ABS (SK) + ABS (CK)) > BO / VE THEN GOSUB 3000:
GOTO 2000
2140 PRINT : INPUT "WHAT VALUE FOR B ":SK
2150 RETURN
2500 HOME
2510 INVERSE : PRINT "SECOND, THE COSINE CURVE": PRINT
2520 NORMAL
2530 PRINT "INPUT VALUES FOR 'C' AND 'D' IN:"
2540 PRINT : PRINT
2550 PRINT : PRINT TAB(10)"C COS (DX)"
2560 PRINT : PRINT
2570 IF (MENU = 0) THEN 2600
2580 PRINT "PRESENT VALUES:": PRINT
2590 PRINT SK * SIN ("SX") AND "CK * COS ("CX")"
2600 PRINT
2610 PRINT : INPUT "WHAT VALUE FOR C ":CK
2620 PRINT
2630 IF (ABS (SK) + ABS (CK)) > BO / VE THEN GOSUB 3000:
GOTO 2500
2640 PRINT : INPUT "WHAT VALUE FOR D ":C: RETURN
3000 HOME
3010 PRINT "REMEMBER: ABS(A)+ABS(C) CANNOT EXCEED *BO / VE: PRINT
3020 PRINT "YOUR VALUE FOR ABS(A)+ABS(C) IS * ABS (SK) +
ABS (CK): PRINT : PRINT
3030 PRINT "*****"
3040 PRINT ".....LET'S TRY AGAIN"
3050 PRINT
3060 PRINT "*****"
3070 PRINT
3080 GOSUB 6500
3090 RETURN
3500 REM DOMAIN INPUT
3510 HOME : INVERSE
3520 PRINT "THIRD, THE DOMAIN": NORMAL : PRINT
3530 PRINT "YOU HAVE A CHOICE OF 3 DOMAIN SIZES AND"
3540 PRINT "2 TYPES OF ANGULAR MEASURE (DEGREES OR RADIANS):-"
3550 PRINT TAB(10)"GIVING 6 CHOICES:": PRINT : PRINT
3560 PRINT " (1) - 90 DEG < X < 90 DEG"
3570 PRINT
3580 PRINT " (2) -PI/2 RAD < X < PI/2 RAD"
3590 PRINT : PRINT
3600 PRINT " (3) -180 DEG < X < 180 DEG"
3610 PRINT
3620 PRINT " (4) -PI RAD < X < PI RAD"
3630 PRINT : PRINT
3640 PRINT " (5) -360 DEG < X < 360 DEG"
3650 PRINT
3660 PRINT " (6) -2PI RAD < X < 2PI RAD"
3670 PRINT : PRINT
3680 INPUT "ENTER THE NUMBER OF YOUR CHOICE:":DOMAIN
3690 DOMAIN = INT (DOMAIN)
3700 IF (DOMAIN < 1) OR (DOMAIN > 6) THEN 3680
3710 IF DOMAIN = 3 THEN OF = 1: RETURN
3720 IF DOMAIN = 5 THEN OF = 2: RETURN
3730 OF = 4: RETURN
4000 REM AXES
4010 HOME : HGR : HCOLOR = 3
4020 HPLT 140,0 TB 140,159
4030 HPLT 0,80 TO 279,80
4040 HPLT 4,76 TB 0,80 TB 4,84: HPLT 275,76 TB 279,80 TB
275,84: HPLT 136,4 TB 140,0 TB 144,4: HPLT 136,155 TO
140,159 TB 144,155
4050 REM DOMAIN LIMITS
4060 HPLT 50,75 TO 50,85
4070 HPLT 230,75 TO 230,85
4080 REM RANGE MARKERS
4090 A = 10
4100 FOR N = 1 TO 7: B = BO - (N * VE)
4110 ON N GOSUB 4570,4580,4590,4600,4610,4620,4630: NEXT N
4120 FOR N = 1 TO 7: B = BO + (N * VE)
4130 ON N GOSUB 4570,4580,4590,4600,4610,4620,4630: NEXT N
4140 A = A - 5
4150 FOR B = (BO + VE) TO (BO + 7 * VE) STEP VE: GOSUB 4550:
NEXT B
4160 FOR B = (BO - 7 * VE) TO (BO - 7 * VE) STEP VE
4170 HPLT A + 9,B TO A + 15,B: NEXT B
4180 HCOLOR = 3
4190 ON DOMAIN GOTO 4200,4270,4230,4350,4250,4400
4200 B = 75:A = 28: GOSUB 4550:A = 33: GOSUB 4650:A = 38:
GOSUB 4560:A = 43: GOSUB 4540
4210 A = 237: GOSUB 4650:A = 242: GOSUB 4560:A = 247:
GOSUB 4540: GOTO 4450
4220 GOTO 4450
4230 B = 75:A = 23: GOSUB 4550:A = 28: GOSUB 4570:A = 33:
GOSUB 4640:A = 38: GOSUB 4560:A = 43: GOSUB 4540
4240 A = 237: GOSUB 4570:A = 242: GOSUB 4640:A = 247:
GOSUB 4560:A = 252: GOSUB 4540: GOTO 4450
4250 B = 75:A = 23: GOSUB 4550:A = 28: GOSUB 4590:A = 33:
GOSUB 4620:A = 38: GOSUB 4560:A = 43: GOSUB 4540
4260 A = 237: GOSUB 4590:A = 242: GOSUB 4620:A = 247:
GOSUB 4560:A = 252: GOSUB 4540: GOTO 4450
4270 B = 66
4280 A = 43: GOSUB 4500
4290 A = 237: GOSUB 4500
4300 HPLT 41,71 TO 45,71
4310 HPLT 235,71 TO 239,71
4320 B = 75:A = 43: GOSUB 4580:A = 237: GOSUB 4580
4330 HPLT 38,66 TB 40,66
4340 GOTO 4450
4350 B = 74
4360 A = 43: GOSUB 4500
4370 A = 237: GOSUB 4500
4380 HPLT 38,74 TO 40,74
4390 GOTO 4450
4400 B = 75:A = 37: GOSUB 4580:A = 237: GOSUB 4580
4410 A = 43: GOSUB 4500
4420 A = 243: GOSUB 4500
4430 HPLT 32,74 TO 34,74
4440 GOTO 4450
4450 RETURN
4500 HPLT A - 2,B - 2 TO A + 2,B - 2
4510 HPLT A - 1,B - 1 TO A + 1,B + 3
4520 HPLT A + 1,B - 1 TO A + 1,B + 3
4530 RETURN
4540 HPLT A - 1,0 - 2 TO A + 1,B - 2 TO A + 1,B TO A - 1,0
TO A + 1,B - 1: RETURN : REM DEGREE
4550 HPLT A - 1,B TB A + 1,B: RETURN : REM DEG
4560 HPLT A - 1,B - 2 TO A - 1,B + 2 TB A + 1,B + 2
TO A + 1,B - 2 TB A,B = 2: RETURN : REM ZERO
4570 HPLT A + 1,B - 2 TO A + 1,B + 2: RETURN : REM ONE
4580 HPLT A - 1,B - 2 TO A + 1,B - 2 TO A + 1,B TO A - 1,B
TO A - 1,B + 2 TB A + 1,B + 2: RETURN : REM TWO
4590 HPLT A - 1,B - 2 TO A + 1,B - 2 TO A + 1,B + 2 TO
A - 1,B + 2: HPLT A - 1,B TO A + 1,B: RETURN : REM THREE
4600 HPLT A - 1,B - 2 TB A - 1,B TO A + 1,B: HPLT A + 1,B - 2
TO A + 1,B + 2: RETURN : REM FOUR
4610 HPLT A + 1,B - 2 TB A - 1,B - 2 TO A - 1,B TO A + 1,B TB
A + 1,B + 2 TO A - 1,B + 2: RETURN : REM FIVE
4620 HPLT A + 1,0 - 2 TO A + 1,0 - 2 TO A - 1,B + 2 TO A + 1,
B + 2 TO A + 1,B TO A - 1,B: RETURN : REM SIX
4630 HPLT A - 1,B - 2 TO A + 1,B - 2 TO A + 1,B + 2:
RETURN : REM SEVEN
4640 HPLT A - 1,B - 2 TO A - 1,B + 2 TO A + 1,B + 2 TO
A + 1,B - 2 TO A,B = 2: HPLT A,B: RETURN : REM EIGHT
4650 HPLT A - 1,B + 2 TO A + 1,B + 2 TB A + 1,B - 2 TO
A - 1,B - 2 TO A - 1,B TO A + 1,B: RETURN : REM NINE
5000 REM *** Y = SK * SIN (SX)
5010 IF P = 1 THEN SPEED = 255: GOTO 5040
5020 VTAB 21
5030 PRINT "GREEN CURVE...Y = "SK" SIN ("SX")"
5040 HCOLOR = 1:SC = SK * VE
5050 FOR X = 50 TO 230
5060 I1 = (X - 140) * CF * SX * DF
5070 Y0 = BO - (SC * SIN (X1))
5080 HPLT X0,Y0: NEXT X0: RETURN
5500 REM *** Y = CK * COS (CX)
5510 IF P = 1 THEN 5530
5520 PRINT "ORANGE CURVE...Y = "CK" COS ("CX")"
5530 HCOLOR = 5:CC = CK * VE
5540 FOR X = 50 TO 230
5550 I1 = (X - 140) * CF * CX * DF
5560 Y0 = BO - (CC * COS (X1))
5570 HPLT X0,Y0: NEXT X0: RETURN
6000 REM *** ADD TWO CURVES
6010 PRINT "BLUE CURVE...Y = "SK"SIN("SX")+CK"COS("CX")"
6020 HCOLOR = 6
6030 X = 50
6040 I1 = (X - 140) * CF
6050 Y0 = (SC * SIN (X1 * SX * DF)) + (CC * COS (X1 * CX * DF))
6060 Y0 = BO - Y0
6070 FOR X2 = 51 TO 230
6080 X3 = (X2 - 140) * CF
6090 Y2 = (SC * SIN (X3 * SX * DF)) + (CC * COS (X3 * CX * DF))
6100 Y2 = BO - Y2
6110 HPLT X0,Y0 TO X2,Y2
6120 X0 = X2:Y0 = Y2
6130 NEXT X2
6140 RETURN
6500 VTAB 24
6510 INVERSE
6520 PRINT " PRESS SPACE BAR TO CONTINUE "": GET SPACE#
6530 IF SPACE# = CHR4 (32) THEN GOTO 6550
6540 GOTO 6500
6550 TEXT : HOME : NORMAL : RETURN
7000 PRINT "WHAT WOULD YOU LIKE TO DO NOW?"
7010 PRINT : PRINT
7020 PRINT "<1> NEW RUN (WITH INTRODUCTION)": PRINT
7030 PRINT "<2> NEW RUN (NO INTRODUCTION)": PRINT
7040 PRINT "<3> CHANGE DOMAIN ONLY": PRINT
7050 PRINT "<4> CHANGE SINE VALUES ONLY": PRINT
7060 PRINT "<5> CHANGE COSINE VALUES ONLY": PRINT
7070 PRINT "<6> CHANGE BOTH SINE AND COSINE VALUES": PRINT
7080 PRINT "<7> RE-DRAW SAME GRAPH": PRINT
7090 PRINT "<8> EXIT PROGRAM": PRINT
7100 PRINT : INPUT "ENTER THE NUMBER OF YOUR CHOICE:":MENU
7110 MENU = INT (MENU)
7120 IF (MENU < 1) OR (MENU > 7) THEN MENU = 8
7130 RETURN

```

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# Basic For Speed Freaks

We mentioned this story on the cover last month, but it was squeezed out at the last minute . . . sorry about that. Reader I. D. Reid, a self-confessed 'speed freak', presents his reasons, and methods, for efficient BASIC programming.

FOR THE past few years I have been interested, perhaps to the point of obsession, with efficient computer programming.

I have been prompted to this fanaticism after encountering several obviously inefficient programs, and by the intransigence of their authors who have refused to accept that their brain-children could be less than perfect.

I shall give some examples later, but suffice to say at this stage that I see few programs both in my work as a research physicist and in my leisure as a computer hobbyist that I cannot improve upon by significant factors in execution speed or memory utilisation.

First, however, let's define what I mean by efficient.

There are many ways to write a program to achieve a desired end. Some may be easier to follow, others may execute faster, yet more may take up less memory space, and so on. In most of my scientific work, execution speed is of primary importance and this is one factor that I personally give much weight to.

I often work on large time-sharing systems with pooled resources and thus I owe it to other users to limit my monopolisation of processor time, I/O effort, and so on to a minimum. However, even when I have a real (as on my own Sorcerer) or virtual (as on our IBM in the wee small hours) monopoly on the system, it is to my own benefit to try to be time-efficient — if I can double the speed of a long program then I can get twice as much work done!

Another problem of efficiency arises when you come up against a limit of available memory.

This can happen on your personal system (though perhaps to a lesser extent with the current cheap prices of memory chips) or on larger systems where the size of programs that are allowed to be run is usually restricted in times of highest workload. In these cases efficiency means squeezing the most performance out of a limited resource...memory space.

Yet another area where efficiency

your computer



tutorial

should be considered is that of documentation. Documenting programs seems to be a bit like the weather — everybody talks about it but few people do anything about it.

I admit it, I'm guilty of not documenting programs as thoroughly as I should, falling back on the rationale that "the program isn't finished yet so any documentation will become out of date". But, let's face it, no program is ever complete.

The problem arises when the original programmer moves on to other places and someone new has to take over the project, or when you buy a program only to find that it doesn't quite work on your system.

In these cases you can easily spend at least as much time on the program as the originator, trying to work out what exactly is going on. So efficiency also includes ease of maintaining and transporting the developed code.

In this article I shall largely restrict myself to talking about BASIC, because of its almost universal use, but the principals can often be extended to other languages. Because of the way BASIC operates, improvements designed to optimise operating speed often reduce memory usage, and vice versa. This is not, however, a universal truth and we shall see how to increase speed by increasing the program size.

The general inter-linking of execution speed and memory usage in BASIC arises because it is an interpreted language.

This means that instead of reading through the source code once and deciding (and storing) what operations are to be made at each stage of the program as a compiler such as FORTRAN does, the BASIC interpreter reads and translates each statement every time it is to be executed. Obviously if there is less to be

read, the program will execute faster as well as occupying less of your often precious memory.

Here are some rules and suggestions you may use to help make your BASIC programs run faster, or in less memory, or possibly both. I've tried to include reasons for most suggestions so you can see why they enhance efficiency.

- Delete all unnecessary spaces and REMarks. The interpreter reads them and then ignores them, so you can save time by omitting them. This is a case of sacrificing legibility for speed and memory.

If you like fully documented programs but need speed you can do one of two things. Either put all REMarks at the end of the program where the interpreter never sees them, or maintain two programs, one with remarks, the other without.

The second approach can also be used where memory usage is important (for example, when large arrays are used at execution time). Several programs to perform such compression have appeared in magazines recently (for example, CRAMP by G Lawrence, *Your Computer*, May 1982).

- Use variables instead of constants. It takes time for the interpreter to convert from the source code (usually in ASCII) to its internal floating-point or integer representation. This time is often greater than that required to search for a variable and fetch its value from the variable table.

Another trick is if you use, for example, 32768 as a constant several times within a program then defining  $K=32768$  early in the program means that every time you use 'K' in the program you save 4 bytes over the explicit form. A corollary of this is never to use expressions for constants (except perhaps at definition time).

- Order variable definitions carefully. Variables are usually placed in the variable table in the order that they are first encountered. Each time a variable is referenced the table is searched from the beginning until it is found. If it is not found, a new entry is created for it.

If most-referenced variables are defined near the beginning of the table then less time will be spent looking for them. Use the shortest variable name you can — most BASICs ignore anything over two characters so the excess just means extra reading time for the interpreter.

- Put often-used lines near the start of the program. Lines referenced in GOTOS or GOSUBs are searched for from the beginning of the source code, so search time for these lines can be shortened by



this rule. Obviously you must have a GOTO early in the program to jump over your carefully placed subroutines!

- Wherever possible, use multiple statements on each line. There is a memory overhead associated with each line (commonly 2 bytes pointing to the next line, 2 bytes for the line number, and the null byte to indicate the end of the line) so this overhead is reduced, as is the time required to process the information contained in the extra bytes.

- Unless necessary (such as if you jump out of FOR..NEXT loops) drop the variable from NEXT statements ('NEXT' instead of 'NEXT I'). This is slightly faster, as the interpreter assumes the associated variable is that in the most recent uncompleted FOR statement. Also, it is often permissible to use the statement 'NEXT K,J,I...' where several loops terminate at the same point.

- Re-use variables holding temporary results. If A is used in one routine to save an interim result or as a loop counter, it can be used for the same purpose elsewhere when its previous currency has terminated. This saves the time and memory overhead of defining a new variable.

- Don't use variables unnecessarily:

```
10 X=INP(Y):IFX>KTHEN100
```

is slower and uses more memory than

```
10 IFINP(Y)>KTHEN100
```

for reasons which should be obvious if you've stuck with me this far.

- Try to avoid the use of conditional jumps. In my experience, a multitude of conditional jumps usually means an inefficient algorithm.

When you have to include them, use the slightly more efficient constructs IF (condition) THEN (line number) or IF (cond.) GOTO (l.n.) rather than IF (cond) THEN GOTO (l.n.).

Try working your conditional statements to minimise their expense, especially that of GOTOs. For example, a common routine is

```
100 IF (cond) THEN 120
105 (1st set of commands)
110 GOTO 130
120 (2nd set of commands)
130 ....
```

which can often be rewritten

```
100 IF (cond) THEN (second set of
      commands): GOTO 130
110 (1st set of commands)
130 ....
```

This is especially advantageous if the condition is expected to be infrequently met. If the command sequences are merely setting the value of the variable, then the remaining GOTO can be eliminated in this manner:

```
100 X=0:IF (cond) THEN X=1
130 ....
```

Let's look for a moment at the condition in the IF statement. This is in fact a logic expression, and thus takes on the logical values TRUE or FALSE after evaluation.

In my interpreter and most others I've come across, FALSE=0 and TRUE=-1. Thus, PRINT 5=6 returns 0, and PRINT 5<6 gives -1. Perhaps you can see now how we can write our last example to avoid completely the IF statement.

```
100 X=- (cond)
```

will do it! Judicious use of such expressions can allow conditional evaluation of expressions without the use of the IF statement.

Logical expressions within arithmetic expression should always be parenthesised to ensure correct evaluation. Note too that careless use of this technique can

result in an unreadable program.

The operation of the IF statement should now be clear. If evaluation of the logical expression results in zero, then the program skips to the next line. If the result is non-zero, then execution of the next statement follows. This means that these statements are equivalent:

```
100 IF X<>0 THEN .....; and
100 IF X THEN .....
```

but the second is more efficient.

- Study the article 'Low Level Program Optimization' by James Lewis in the October 1979 Byte. Some of the techniques can be applied to BASIC. For example, use

```
...GOTO1000      instead of
...GOSUB1000:RETURN
```

- Use 'look-up tables', especially in loops, to store results which can naturally be put in an indexed form.

This is especially efficient when the tabulated variable is complex or slowly evaluated. For example, if the following loop is executed several times

```
100 FORI=ATOB:Y(1)=X*SIN(I*PI/P2):NEXT
```

it is more time-efficient to generate an array holding the values of SIN(I\*PI/P2) early in the program:

```
5 DIMA(B):P=PI/P2:FORI=ATOB:
  A(1)=SIN(I*P):NEXT
```

and our loop becomes

```
100 FORI=ATOB:Y(1)=X*A(1):NEXT
```

- Generate variables in multiple loops at the outermost level possible to reduce execution time. For





```
100FORI=ATOB:FORJ=CTOB:FORK=ETOF
110X(I,J,K)=R*100*(J-1)+K:NEXTK,J,I
```

**use**

```
100FORI=ATOB:RI=R*I:FORJ=CTOD:
SJ=RI+SA*(J-1)
110FORK=ETOF:X(I,J,K)=SJ+K:
NEXTK,J,I
```

This is a particular example of a more general rule — don't perform unnecessary calculations.

- Carefully consider the problem in hand to see if more efficient algorithms can be used. A striking example of this is the shuffling routine below — a better method contributed to a better than tenfold increase in execution speed!

- For experienced or adventurous programmers only: use machine language subroutines (if you code enough subroutines in assembler, eventually you have no BASIC statements left).

One of the first programs I tried on my Sorcerer was Conway's game of Life. On a 64 by 29 toroidal universe the best I could get out of BASIC was about 90 seconds per generation. Replacing the main routines by assembly code increased the speed to almost five generations per second!

Now that I know the Z80 codes more intimately I could probably improve upon this figure too — my current 128 by 58 universe runs at 130 generations per minute.

Note that the performance improvements given above should not be taken as a general figure for the superiority of the

compiled code over BASIC. This particular BASIC program used a lot of PEEKs and POKEs and I strongly suspect that my interpreter waits for a video retrace before executing these, to minimise screen interference.

- Study the features available to you in your dialect of BASIC. For each keyword, try to write a short program to test its possibilities, and thus see if there are more efficient ways of performing various functions.

Dissect other peoples' programs looking for tricks, and subscribe to user groups to see if any undocumented features have been found. I discovered via the local Sorcerer group that the CLEAR command had a further extension not mentioned in the handbook.

As well as CLEAR to clear variables and CLEAR K to clear variables and reserve K bytes of string space, CLEAR K.J. is also supported. This sets the top-of-ram to J, useful if you want a safe area to locate a machine language subroutine.

One often over-looked capability in BASIC is the user-defined function. I have come to use these a lot lately, not because of any benefit to execution speed (in fact they would be detrimental) but to avoid re-typing frequently used expressions.

Look at the following method for performing different functions depending on which number key is pressed (for example, a game response, or to choose from a menu). Line 5 modifies the

Sorcerer INP function to simulate an INKEY or GET function.

```
5 POKE318,195:POKE320,224:C=9:
  [=255:D=48:REM 48=ASC("0")
10 DEFUNC(X)=(INP(X)-D)ANDE:
  REM get k/b response and subtract "0"
11 REM then AND with 255 to map
  into [0,255]
...
100 ONENC(C)GOSUB1100,1200,1300,1400,
  1500,1600,1700,1800,1900
110 REM control continues here after
  subroutine or if no key or a
111 REM key other than 1-9 is pressed
```

If menu choices are used several times in the program, this method becomes attractive to maintain legibility — the reader need only remember that FNC(C) gets a key 1-9 from the keyboard.

Turning for the moment to a machine-language example of the benefits of knowing the complete instruction set, consider the two following methods of clearing the registers of a Z80:

```
a)
3E 20 LD A,00H ;2 bytes, 1.75uS
01 00 00 LD BC,00H ;3 bytes, 2.5uS
11 00 00 LD DE,00H ;3 bytes, 2.5uS
21 00 00 LD HL,00H ;3 bytes, 2.5uS

;Total 11 bytes, 9.25uS
```

```
b)
AF XOR A ;1 byte, 1uS @ 4 MHz
47 LD B,A ;
4F LD C,A ;
57 LD D,A ;
5F LD E,A ;
67 LD H,A ;
6F LD L,A ;

;Total 7 bytes, 7.00uS
```

Which one would you use?

**Applying The Rules**

Of course all this theory is okay, but you're probably wanting some concrete examples to see how well these rules work. Here are two programs I ran on my Sorcerer to generate 1000 random numbers and print all those less than 0.001.

First, using an open legible style:

```
10 FOR N=1 TO 100
20 X = RND(1)
30 IF X<1.0E-03 THEN PRINT X
40 NEXT N
```

Next, using some of the rules given above:

```
10 N=1:J=N:X=0:Y=1E-3:M=1000
20 FORN=JTOTM:X=RND(J):IFX<YTHENPRINTX
30 NEXT
```

How did these two programs compare for efficiency? Obviously the first is much easier to read and follow than the second but I find you soon get used to reading the compressed text.

As far as memory usage goes, the first program took 16 bytes less to execute. The extra overhead of the fourth line was compensated for by the extra definitions in the second program and the extra space taken up in its variable table at execution time.



The striking difference between the two programs, however, was the execution speed. The first took 26 seconds to execute, the second took eight!

This is just one illustration of the trade-offs you can make by juggling the parameters. Sacrifice legibility for speed, or be profligate with run-time memory to get your program out in a fraction of the time, or vice-versa.

A further note on the two programs: changing the constant in the first program to '1E-3 dropped the execution time to 21 seconds, illustrating the point made earlier.

I also promised an example where an improved algorithm can bring a significant increase in execution speed. The example is a commonly-used method for scrambling a list of objects, typically a deck of cards (see *BASIC, Pascal, or Tiny-c, A Simple Benchmarking Comparison* by Phil Highes, BYTE, October 1981).

Listing 1 is a reproduction of Highes' BASIC benchmarking program. The only difference is that my Sorcerer uses a positive argument in RND to generate the next number in the sequence, so line 1010 has been modified accordingly. The results of six runs are shown, with an average execution speed of 34.5 seconds. Listing 2 shows the program after I had applied several of my rules to it. The result? An average execution time for six runs of 35.7 seconds.

Well, that didn't show any improvement, did it? But wait a minute — why am I giving average execution times?

Look at the times given. They show large variations. This is a simple operation, after all we're only shuffling a deck of cards, so why the variation? Let's have a look at the algorithm.

The method used seems simple: generate a random number in the range [0, -fi] and if we have not already selected that number, put it in a list; continue until we have all 52 numbers in the list.

Okay, that's fine for the first number, and for the second number there's not much chance (1 in 52) that we'll select the same number, and so on. Now what happens when we have 51 numbers in the list? Obviously there is one chance in 52 that we'll select the right number so on average we'll have to generate 51 numbers before we get the right one.

That's where the variable run-time comes in — we're wasting time generating numbers we are discarding. In fact, after N numbers have been put in the list, we have to generate an average of  $52/(52-N)$  numbers before we get the (N+1)th number. That means an average of  $52 \cdot (1 + 1/2 + 1/3 + 1/4 + \dots + 1/52)$  numbers to generate our list. You may recall from your high-school maths that the sum of the series of reciprocals does not

converge. Rather than work it out analytically, I've used the program in Listing 3 to evaluate the sum.

As you can see we would expect to generate 236 random numbers to shuffle our 52 cards. By putting a counter in Highes' program and running it 30 times, I was able to confirm this figure. Now, if you think about it, shuffling 52 objects is the same as picking 51 numbers out of 52 — the position of the 52nd is then determined.

Perhaps we can come up with an algorithm that only uses 51 calls to the random number generator. All things being equal we could look forward to a fivefold speed increase. What we really want to do is to pick one card out of our deck of 52, put it aside, then pick another out of those remaining, and so on until we have only two cards left. Selecting one of these then determine the order of the last two.

By now I hope a few thoughts are springing to your mind as to how we should accomplish this. My method of doing it is illustrated in Listing 4. As each card is selected from a sub-array of those remaining it is placed at the end of the sub-array and the range of the selection process is decreased.

Note also that I have modified the output routine to avoid conditional testing and the INT function — this speeds the output routine from several seconds to about 0.8 seconds. My BASIC interpreter automatically truncates array dimensions and other integer function arguments so that I have avoided using INT in the subroutine as well.

Now look at the execution time — almost constant at 2.74 seconds, and the small variability is a consequence of slight changes in my response time in operating my stopwatch. That's a reduction in execution time by a factor of almost 13!

Just after the above was written, I received the February 1982 BYTE and found two algorithms for shuffling a deck of cards in the Letters column. That given by David Berger is identical to the one above.

His ultimate increase in execution speed is greater than mine because of the more-efficient integer variables, a facility not provided by my interpreter.

I'm sure you will find some or all of the above suggestions of use in your BASIC programming. Are you feeling the urge to go away and apply them to that nice games program that you have written, the one with the unbearably slow response?

Go to it! You'll find that the thrill of speeding it up nearly matches the thrill you'll get when playing it at closer to real-time speeds. □

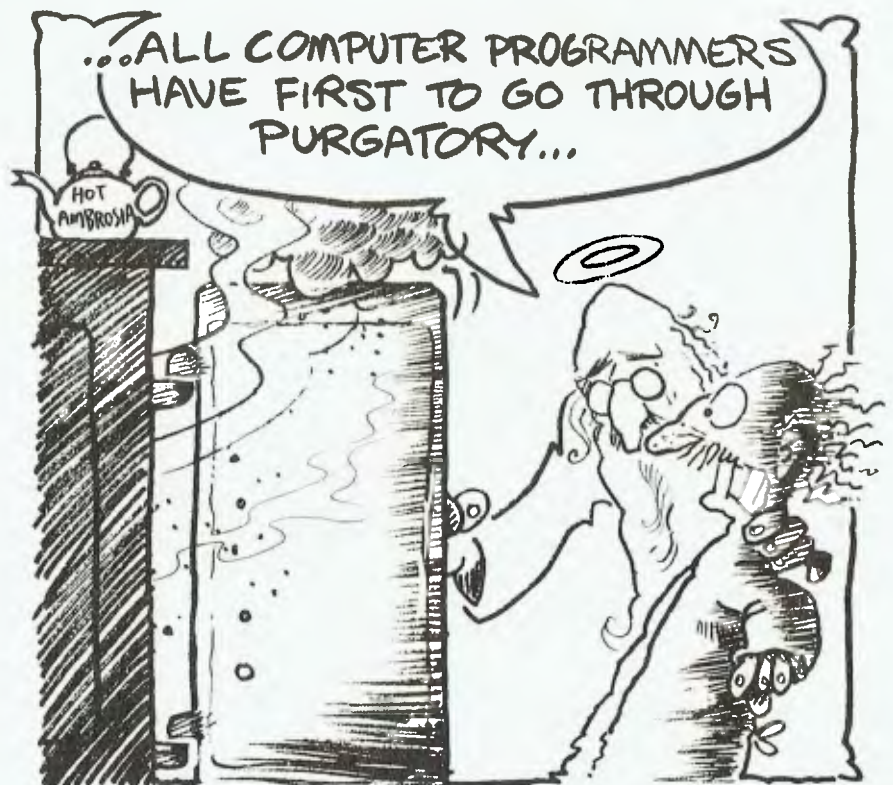
#### Listing 1

```

APP
READY
LISTT
?SN ERROR
READY
LIST

50 DIM C(51)
100 GOSUB 1000
200 FOR I=0 TO 51
210 PRINT C(I):

```



```

220 IF INT((I+1)/10)=(I+1)/10 THEN PRINT
230 NEXT I
240 PRINT
250 PRINT "ALL DONE!"
260 END
1000 J=0
1010 T=INT(RND(1)*52)
1020 IF J=0 THEN 1050
1030 FOR I=0 TO J-1
1040 IF C(I)=0 THEN 1010
1050 NEXT I
1060 C(J)=T
1070 J=J+1
1080 IF J<52 THEN 1010
1090 RETURN

```

```

READY
RUN
 51 29 20 3 48 44 28 4 31 22
 30 16 15 24 49 9 32 7 11 14
 47 8 37 5 39 45 10 36 43 19
 0 34 33 12 13 6 41 46 25 40
 17 2 43 42 1 38 50 26 18 35
 27 21

```

```

ALL DONE!
READY
TIME=32.90 SECS@

```

```

RUN
 13 32 36 8 11 51 1 4 43 23
 30 0 35 21 15 26 27 29 16 18
 49 30 5 9 25 14 19 44 34 10
 24 37 12 3 45 38 20 31 22 33
 2 46 41 5 47 48 42 39 7 17
 40 28

```

```

ALL DONE!
READY
TIME=40.08 SECS@

```

```

RUN
 0 37 36 44 30 38 42 22 1 11
 35 25 50 40 33 46 5 14 31 21
 8 38 18 18 2 47 12 29 15 45
 19 23 32 13 51 43 16 9 41 49
 6 26 3 27 10 34 17 21 7 4
 20 39

```

```

ALL DONE!
READY
TIME=44.75 SECS@

```

```

RUN
 0 49 51 46 45 4 37 50 29 33
 38 7 25 2 6 41 17 14 19 8
 47 1 22 24 36 13 18 34 21 40
 26 27 12 48 10 5 42 11 32 23
 35 30 43 31 15 3 39 44 28 16
 20 9

```

```

ALL DONE!
READY
TIME=27.33 SECS@

```

```

RUN
 3 30 0 12 42 46 22 48 39 44
 4 2 19 29 51 20 14 6 47 34
 8 21 45 24 35 15 37 50 31 7
 40 17 38 13 43 49 5 18 16 25
 9 33 26 41 10 27 36 23 11 1
 32 28

```

```

ALL DONE!
READY
TIME=31.62 SECS
?SN ERROR

```

```

READY
RUN
 13 15 9 50 29 37 6 40 33 1
 22 25 23 12 45 48 18 16 38 14
 51 0 16 13 21 8 34 35 5 32
 28 17 2 42 36 44 31 41 46 20
 19 27 39 21 11 3 4 30 49 47
 10 7

```

```

ALL DONE!
READY
TIME=30 SECS@
BYE

```

```

)SE 0=V
58

```

Listing 2

```

)PP
READY
LIST
5 DIMC(51):C=52:D=1
10 A=51:B=0::GOSUB1000:FORI=BTOA:PRINTC(I);
:IFINT((I+1)/10)=(I+1)/10THENPRINT
230 NEXT I:PRINT:PRINT"ALL DONE!":END
1000 J=0
1010 T=INT(RND(1)*C):IFJ=0THEN1060
1030 FORI=BTOJ-1:IFC(I)=TTHEN1010
1050 NEXT
1060 C(J)=T:J=J+D:IFJ<CTHEN1010
1070 RETURN

```

```

READY
RUN
 0 37 36 44 30 38 42 22 1 11
 35 25 50 40 33 46 5 14 31 21
 8 28 48 18 2 47 12 29 15 45
 19 23 32 13 51 43 16 9 41 49
 6 26 3 27 10 34 17 24 7 4
 20 39

```

```

ALL DONE!
READY
T=14.6@

```

```

RUN
 0 49 51 46 45 4 37 50 29 33
 38 7 25 2 6 41 17 14 19 8
 47 1 22 24 36 13 18 34 21 40
 26 27 12 48 10 5 42 11 32 23
 35 30 43 31 15 3 39 44 28 16
 20 9

```

```

ALL DONE!
READY
T=27.2@

```

```

RUN
 3 30 0 12 42 46 22 48 39 44
 4 2 19 29 51 20 14 6 47 34
 8 21 45 24 35 15 37 50 31 7
 40 17 38 13 43 49 5 18 16 25
 9 33 26 41 10 27 36 23 11 1
 32 28

```

```

ALL DONE!
READY
T=31.8@

```

```

13 15 9 50 29 37 6 40 33 1
22 25 23 12 45 48 18 16 38 14
51 0 16 13 21 8 34 35 5 32
28 17 2 42 36 44 31 41 46 20
19 27 39 21 11 3 4 30 49 47
10 7

```

```

ALL DONE!
READY
T=30.4@

```

```

RUN
 44 41 34 26 13 14 49 28 8 47
 46 6 30 21 42 20 15 27 9 0
 40 23 33 2 12 37 38 31 7 39
 10 50 3 32 24 48 11 17 5 36
 25 45 1 35 4 19 22 29 43 16
 18 51

```

```

ALL DONE!
READY

```

```

T=28.6@
RUN
 3 10 40 20 50 38 30 11 35 32
 41 26 0 13 25 12 48 21 34 45
 4 44 2 7 8 1 19 9 22 51
 24 17 36 18 42 6 28 39 47 14
 16 37 27 23 15 5 49 33 43 29
 31 46

```

```

ALL DONE!
READY
T=51.4 SECONDS! @
BYE

```

```

)SE 0=V

```



Listing 3

```
>PP
READY
LIST
10 S=0:FOR I=1 TO 52:S=S+1/I:NEXT I:PRINT S
READY
RUN
4.53804
READY
?52*SS
235.978
READY
BYE
>SE U=V
```

Listing 4

```
>PP
READY
LIST
50 DIM C(51):GOSUB 1000:FOR I=0 TO 39 STEP 13:FOR J=0 TO 12:
PRINT C(I+J):NEXT J:PRINT:NEXT I
100 PRINT "ALL DONE!":END
1000 K=51:L=1:M=-1:FOR J=0 TO K:C(J)=J:NEXT J
1010 FOR J=RTOL STEP M:T=RND(L)*(J+L):X=C(T):C(T)=C(J):
C(J)=X:NEXT J:RETURN
READY
RUN
12 28 37 49 1 13 35 5 15 21 41 27 18
43 2 16 50 38 32 51 45 24 44 31 8 33
11 29 46 34 42 17 39 23 40 36 19 3 22
10 25 9 7 0 4 26 14 30 6 20 47 48
ALL DONE!
READY
T=2.72 SECS @
RUN
46 23 47 11 15 33 13 0 12 49 28 30 3
38 16 19 6 48 25 45 36 42 27 31 21 32
41 17 37 51 14 39 50 44 24 22 5 26 29
```

```
1 4 40 35 43 18 7 8 2 20 10 34 9
ALL DONE!
READY
```

```
T=2.73 SECS @
RUN
22 35 6 8 24 14 47 25 33 40 32 29 51
16 5 19 18 48 0 44 23 38 9 26 30 31
11 17 2 37 27 46 15 21 4 36 34 18 7
42 10 39 20 1 49 3 45 13 50 41 12 43
```

```
ALL DONE!
READY
T=2.74 SECS @
RUN
39 24 3 29 45 31 42 17 33 15 36 44 9
43 26 28 49 25 40 2 21 27 35 51 16 20
6 37 5 47 14 34 46 30 48 22 38 11 13
12 41 8 18 7 4 23 1 32 19 50 10 0
ALL DONE!
```

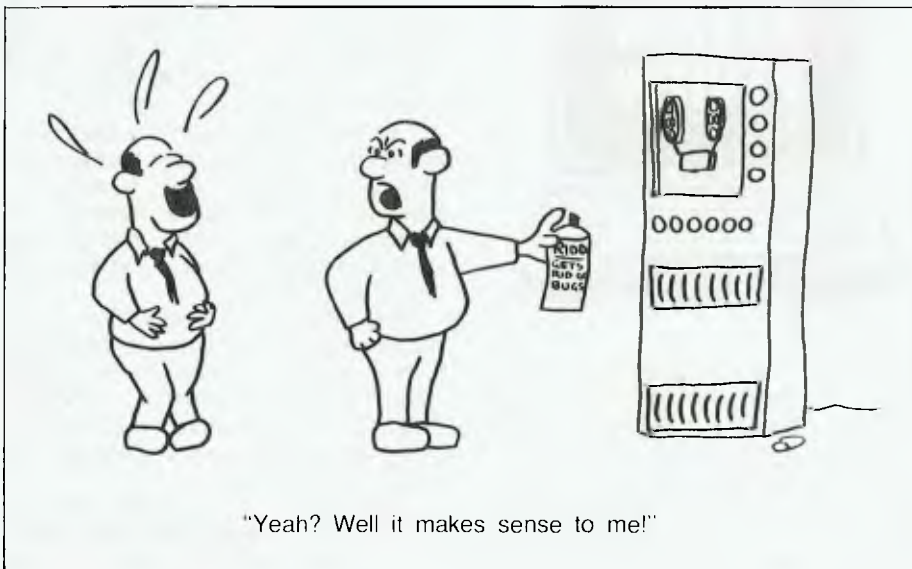
```
READY
T=2.73 SECS @
RUN
0 16 23 1 49 6 11 34 36 42 27 45 28
26 20 39 14 18 47 12 7 3 29 24 8 2
22 21 17 5 30 35 4 32 46 48 33 10 25
44 31 43 41 50 13 9 51 38 40 37 15 19
ALL DONE!
READY
T=2.76 SECS @
```

```
RUN
22 8 0 26 13 14 45 24 47 43 48 21 28
27 16 19 39 18 30 32 12 31 6 34 46 38
7 23 12 17 5 50 44 25 9 36 1 20 27
15 37 10 51 41 35 40 4 11 2 3 49 33
ALL DONE!
READY
T=2.75 SECS @
BYE
>SE D=V
```

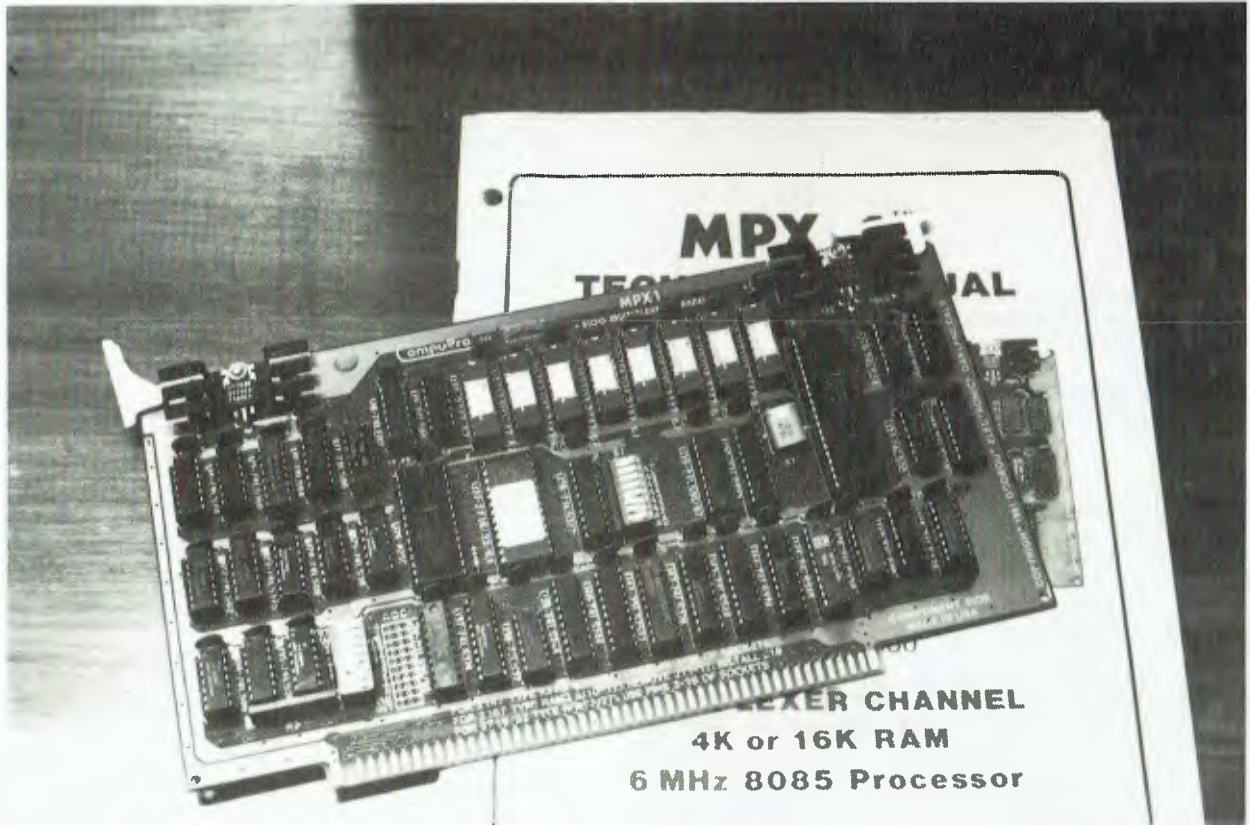
# READER'S CARTOONS



Cartoons by Craig Delahoy



# Complex Multiplex



*You may have realised by now that a significant part of a processor's life is spent looping around, waiting for a keystroke. That wasted time could be put to good use, with a Godbout MPX-1, writes Les Bell...*

OVER THE last few months, I've gradually been upgrading my personal system to get a bit more performance out of it, with the ultimate aim of installing a multi-user operating system and some more terminals.

In particular, I've had as a target the ability to develop and run software for the Intel 8086 family of microprocessors, and that led fairly naturally to my choice of a Godbout 8085/88 dual processor CPU board, which in turn suggested the selection of other high-performance Godbout boards.

The system is now gradually coming together, with a Godbout DISK-1 disk con-

**your computer**



troller, RAM 17 high speed static RAM card, System Support 1 multi-function card and others. The Godbout hardware is generally excellent, with lots of attention given to complying with IEEE 696-1 specifications for the S-100 bus, and with features that put other systems to shame.

One interesting problem arises with the

8085/88 CPU board, however. Most modern systems, including Godbout's, are moving towards being interrupt driven for high performance.

On the 8085/88 CPU, there is no way of telling which processor will be running when an interrupt arrives — yet they respond to interrupts in different ways. Looks like a recipe for disaster.

The solution proposed by Godbout's designers is simplicity itself. Instead of directing interrupts to the main processor, their solution dedicates a separate processor, with its own RAM, ROM and bus control circuitry, to handling all the interrupt driven I/O.

That processor is the MPX-1 multi-plexer channel. On a single S-100 board, it carries a 6 MHz 8085 processor, either 4K or 16K of RAM, up to 8K of EPROM/ROM, an 8-level vectored interrupt controller and special circuitry to handle TMA control and arbitration.

'TMA what?', I hear you ask. In the old days, back in the distant primordial past of the S-100 bus, its original designers made



provision for what was called direct memory access (DMA).

Think about how most input/output devices work — typically, the processor inputs a byte from a port to the accumulator, and then stores it back to memory, increments a pointer and repeats the process.

This two-step method is rather inefficient. Why not let the I/O device store its input directly into memory? Provided it can drive the address, data and control lines, there's no reason why it shouldn't.

### Cutting Off The Processor

And so, from the earliest days of the bus, control lines were defined which would allow a DMA controller device to 'tri-state' the processor, effectively disconnecting it from the bus, so that it would be driven by the DMA device.

Sound confusing? It's not. Here's what happens. Suppose a disk controller on the S-100 bus is a DMA device. The processor sets up its control registers, ready to transfer a sector off disk and into memory. The disk controller knows where it's got to go; all it has to do is wait for the sector to come round to the read head, and it can then perform the transfer.

The processor can now go about its business, either performing some other task in the same program or switching to service another task or user. Eventually (measured in microseconds), the read head passes over the sector, and the disk controller is ready to transfer data into memory.

The DMA controller now checks to see if it can take control of the bus — the exact details of this vary from bus to bus and are not vitally important for our purposes. If it can, it will then assert the various signals which put the processor into a hold state, and tri-state the processor board off the bus.

Once this has been done, the DMA device can drive the bus in place of the processor. As long as it maintains the same timing, no device on the bus will ever know the difference. The DMA controller can now proceed to write the data coming off the disk drive into successive locations in memory, driving it just like the processor would.

Once the transfer is complete, the DMA controller relinquishes the bus back to the processor, which can continue from where it was so rudely...well, not interrupted...held up.

This idea of letting other devices have access to the memory and other devices on the bus, without going through the processor, is quite a common one on mainframes and is very much more general in application. For example, multiple processors can share memory, with special processors to handle system tasks such as file handling, communications, and so on.

### Remember The MPX-1?

For this reason, the process of kicking the master processor off the bus has become known as Temporary Master Access (TMA) — which is where we came in with the MPX-1 board (remember the MPX-1?).

The MPX-1 processor can quite happily execute programs from its own EPROM or RAM without accessing the bus at all. However, when it wants to read an input port, it must do that over the bus, and its special circuitry will enable it to do this without interfering with the operation of the permanent master processor.

Similarly, the MPX-1 can read the main system memory, in order to communicate with the main processor. It does this by requesting the bus from the master on a cycle-by-cycle basis.

When an interrupt request occurs on one of the bus's vectored interrupt lines, the MPX-1 responds to it. Normally it will be sitting in a loop, or perhaps halted, and the on-board 8259A interrupt controller will vector it to the interrupt service routine.

Now the MPX-1 will typically read or write an I/O port or some such interrupt service task. However, having performed such a task, say read an input port, there is no point in the MPX-1 keeping its newly acquired data to itself. Its next move will typically be to place the input byte into a buffer and update the buffer pointers so that the master processor can access the 'input'.

### Processor — Processor Communication

The MPX-1 can access any location in the system's main memory. It does this by addressing locations C000H — FFFFH, which form a 'window' to the system bus. Only the least significant eight bits of address are gated onto the bus; the upper 16 bits (S-100 is 24-bit, remember?) are generated by two latches on the board.

On power-up the MPX-1 does very little apart from initialisation; it must wait until it is told what it is to do. The main processor gets the MPX-1's attention by outputting to an ATTN port, which causes an RST 7.5 interrupt on the MPX-1's 8085 processor. This will cause it to jump to the appropriate program section.

The MPX-1 may need to signal back to the main CPU. There are two ways of doing this; either through the SOD (Serial Output Data) pin on the 8085, or by setting a one-bit latch. When the main processor executes an interrupt acknowledge cycle, the MPX-1 can respond by placing a vector information byte on the bus, causing the main processor to jump to the appropriate interrupt handling routine.

Some standard software is supplied with the MPX-1, in the on-board EPROM. Apart from being useful in its own right,

this also serves as an illustration of how the board can be programmed.

In this scheme, the MPX-1 masks all its interrupt inputs on power-up, and then waits for the main processor to grab its ATTN. When it receives the ATTN signal it will read in 16 bytes from the system memory, beginning at 50H. These bytes form an instruction as follows:

Byte 0: Opcode byte  
Byte 1: Status Indication byte  
Byte 2: General Purpose Parameter byte 0

Byte 10: General Purpose Parameter Byte 8  
Byte 11: Link Address (least significant byte)  
Byte 12: Link Address  
Byte 13: Link Address (most significant byte)  
Byte 14: Result 1 byte  
Byte 15: Result 2 byte

The least significant five bits of the opcode byte form the opcode proper — thus there are a possible 31 commands (one is reserved as a NOP). Ten of these commands have been implemented in the standard software and the rest can be implemented by the user.

Bit 6 of the opcode is the interrupt enable bit, which if set, will cause the MPX-1 to generate an interrupt when it has finished the command. Bit 7, the CONT bit, will cause the board to automatically look for its next instruction at the link address given in the command. Using this feature, a sequence of commands can be set up through memory, and the MPX-1 will follow them, generating an interrupt when they are all done, if required.

The status byte is used by the MPX-1 to indicate completion of an instruction in a non-interrupt environment. The general purpose parameter bytes are used to pass data, addresses, and so on to the multiplexer channel.

There are 9 bytes, which will allow passing of up to three addresses (remember, S-100 is 24-bit now), such as the start, end and destination bytes of a block move.

Finally, the result bytes allow the MPX-1 to return a result to the caller. Curiously, there are only two bytes, so that an address cannot be returned, although the caller could specify the address of a table in memory where results could be left.

### Interesting Commands

The commands implemented in the standard software are interesting. There's a NOP (no operation) instruction, RESET, SET MASK, which masks or un masks the interrupt inputs to the MPX-1, and other commands which set up the on-board interrupt controller.

As mentioned above, the MPX-1 can put an 8-bit value on the data bus during an interrupt acknowledge cycle, and a command allows this byte to be set. Two commands allow the MPX-1 to load its local RAM from system RAM, and execute a program in local RAM. There is also a command which returns the memory size of the MPX-1 — whether it is a 4K or 16K model.

Two other commands are of general use in any system. They are block move (BLKMOV) which will move a block of memory of any length from any source to any destination anywhere in a 16 Megabyte system. This is particularly useful for normal 8-bit processor systems, where the processor cannot address more than 64K without bank select switching. Such processors can execute code out of bank-selected pages easily enough, but cannot block move between pages without a lot of effort.

The FASTMOV command is similar, except that the block must be a multiple of 256 bytes, and begin on a 256-byte boundary. This enables a much faster move.

The MPX-1 manual gives complete source code for the standard software, which is extensively commented. Thus the user can model his own routines along the same lines. Although this is not necessarily the most efficient way to use the

board, it is a good general purpose model and is quite versatile.

Various applications for the MPX-1 come to mind immediately. For example, it is an ideal I/O channel processor for a multi-user system, and in MP/M-II systems, would be invaluable for its block move abilities alone. On dual (or more) processor systems, it will provide an interrupt handler independent of the main processor.

### Print Spooling Potential

An unusual possibility is its use as a print spooler — just dump a file into system memory somewhere and let the MPX-1 spool it out, without the main processor getting involved. Using the DISK-1 DMA disk controller, the main processor need only set the job up, and the MPX-1 could manage everything else.

Another application might be managing communications ports, particularly those using complex protocols such as IBM's SNA. With a dedicated protocol controller, the process could be transparent to the main processor.

Memory-mapped video boards typically require a lot of intervention by the host processor — which slows them down and makes them unsuitable for multi-user environments. An MPX-1 dedicated to this task would make memory-mapped video

a possibility in these systems. And on the subject of video, an MPX-1 could make an interesting graphics controller.

The MPX-1, as you may have gathered, is intended for sophisticated users only. Most end users buying a system with an MPX-1 in it should find the supplier has done all the tricky work of integrating the MPX-1 into the operating system.

The best example of this is the special version of the MP/M-86 operating system, now being supplied by Godbout for 8085/88 based systems. MP/M-8-16 runs both CP/M-80, CP/M-86 and MP/M-86 software, using both processors on the CPU card. The MPX-1 which handles all terminal I/O is an integral part of this system.

Being such a sophisticated board, the manual is written with experienced system designers and integrators in mind. For all that, it is well written, and is a good starting point for those who want to experiment with the board to see what it can do (lots!).

Although not cheap, the MPX-1 is the key to offloading a system and obtaining high throughput. In the coming months, we can expect to see this kind of board appearing in more and more high performance systems. We obtained our board from Automation Statham, 47 Birch Street, Bankstown 2200. Telephone (02) 709 4144. □

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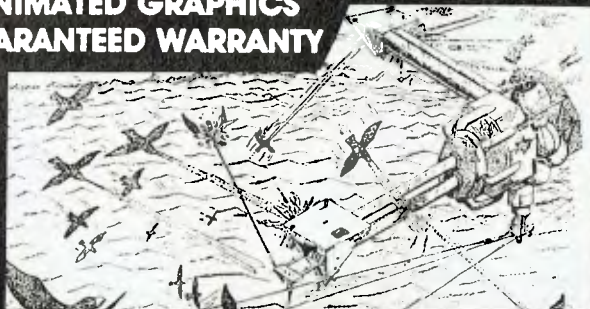
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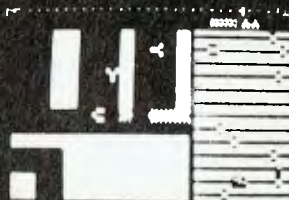
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METEORS!!

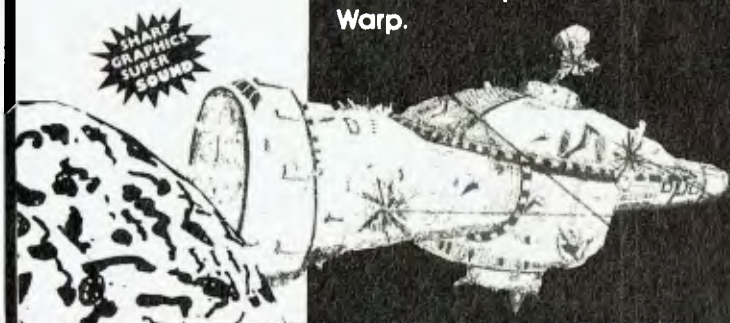
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# MicroBee BASIC



By Eric Lindsay

I'D LIKE TO start off by looking at how the MicroBee stores its BASIC programs.

They are stored in your computer's memory in a compressed form. In most popular micro computers the BASIC used is provided by Microsoft, and its methods of storing programs will be well known to many owners of TRS80, System 80, Apple, Pet and OSI computers.

BASIC keywords, the terms that appear after the line numbers, are tokenised. That means each BASIC word, such as LET or READ, is reduced to a single number. This obviously saves an enormous amount of space, compared to storing each word letter by letter.

You can see this tokenising at work, by writing a short program to display the contents of your memory, starting wherever your program is stored, so that the program displays itself. If you have an Apple, your program will start at memory location 2049. OSI owners start at 769. TRS80 and System 80 programs start at location 17129. Listing 1 provides a short viewing program.

You will notice that the first program location is filled with a 0, that the next two contain the location of the following line, and the following two contain the line number of the present line. After that comes the tokens, and letters and numbers in ASCII form.

Each line ends with a 0, which indicates to the BASIC interpreter that it has reached the end of a line. If you find two 0s, it means you have reached the end of the program. If you have not reached the end of the program, the whole process continues through the next lot of memory locations, starting with the pointer to the next line, and then the line number.

Those who have run Listing 1 may be about to object that they could not find the line number or the pointer to the next line. These are a bit tricky, because the BASIC is trying to store numbers from 0 to 255. This is why PEEK(M) never returns a number greater than 255, and why you cannot POKE a value greater than 255 into a memory location.

```
00100 FOR K = 2300 TO 2360 STEP 10
00110 PRINT K;
00120 FOR X = K TO K+9
00130 PRINT PEEK(X);
00140 NEXT X:PRINT
00150 NEXT K
```

## LISTING 1

```
0
2300 0 0 0 201 0 100 25 32 136 32
2310 75 32 61 32 50 51 48 46 32 153
2320 32 50 51 54 48 32 154 32 49 48
2330 13 0 110 7 32 131 32 75 59 13
2340 0 120 16 32 158 32 88 32 61 32
2350 75 32 153 32 75 43 57 13 0 130
2360 10 32 131 32 190 40 88 41 59 13
>
```

## Output from Listing 1

Also, in most microcomputers, it is easier to store numbers with the low byte first, followed by the high byte. To convert, you take the second line byte or pointer byte, convert it to hexadecimal, then convert the first byte to hexadecimal to give a four digit hexadecimal number. If this is converted back to decimal, you will find that it is the memory location of the start of the next line or the line number for which you were looking.

The similarity between the various versions of Microsoft BASIC makes it probable that Microsoft actually wrote it on a mainframe computer, probably using some high level language such as PL/M,

```
00130 REM      leave some spaces here
00120 FOR I = 129 TO 223:REM This covers all MicroBee tokens
00130 FOR E = 2300,1:REM This is the memory location of Rem in line 100
00140 PRINT "token ";I;"    ";LISTI00:REM List may not work on all micros
00150 A$=KEY$:IF A$="" THEN 150:REM This line stops printing until key is pressed
00160 NEXT I
```

## LISTING 2

modified it as appropriate to each microcomputer, and then used a cross compiler to produce the version sold to each manufacturer.

This idea is not original, and several people have produced lists of differences between various Microsoft BASICs as an aid to programmers wishing to write conversion programs to automatically convert programs from one machine to another. I have not, as yet, heard of any such program that actually works.

The BASIC used in Applied Technology's kit computer is not Microsoft. It is a Microworld BASIC, developed by John Arnold and Dick Whipple, who wrote one of the first 'tiny BASICs'.

Applied Technology bought this BASIC for its DGZ80 S100 systems, and it was rewritten by Matthew Starr and Ron Harris. It was also expanded considerably. There are advantages and disadvantages to this situation. The disadvantage is that Microsoft BASIC has become the standard BASIC, and most programs are written to run using it. This means that you have to change your programs to allow them to run on the Microworld BASIC.

The advantages are considerable. Since Applied Technology owns the BASIC, it is able to supply it at a very cheap price, whereas Microsoft BASIC tends to be expensive. It can also change the BASIC to suit its customers.

You will notice Microworld BASIC contains an automatic renumber, a plot command, a global search and exchange command, and several other features not usually found in small computers. However, the user who is unfamiliar with



Microworld BASIC does have some re-learning to do.

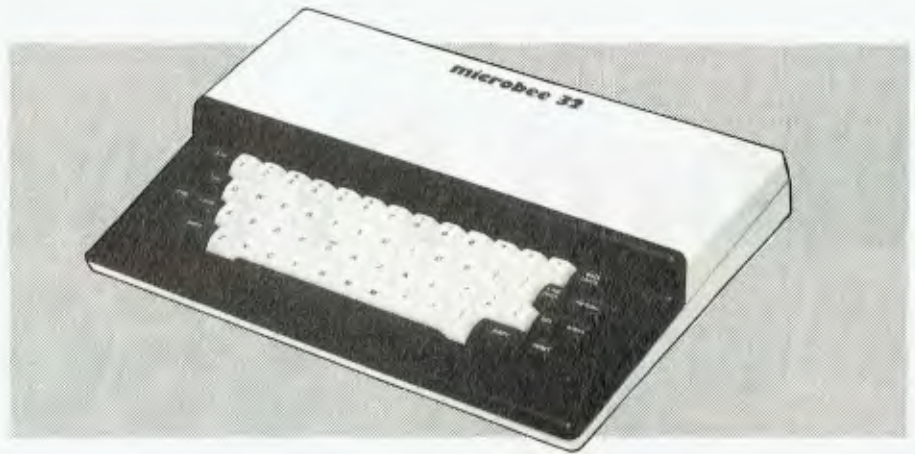
In the MicroBee, the BASIC program starts at memory location 2304, which always seems to contain 201, rather than the 0 used in Microsoft. The line number comes next, and in this you multiply the first byte by 256, and then you add the

```
token 129
00100 LIT
token 130
00100 LPI:IN1
token 131
00100 PRINT
token 132
00100 IF
token 133
00100 NEW
token 134
00100 LLIST
```

Partial Output from Listing 2

value of the next byte to get the line number in decimal (a bit easier than all the hexadecimal conversions needed for the Microsoft version).

Next is a single byte which is the number of spaces to the start of the next line. The end of each line of BASIC is



indicated by a RETURN and this is stored as ASCII value 13. BASIC keywords are all tokenised, with values between 129 and 223. Listing 2 provides a simple method of seeing all the token meanings, for a MicroBee.

You will notice that there are a few BASIC keywords that are not mentioned in the BASIC guide provided by Applied Technology. There is a MEM, which may be a substitute for FRE(0) as it is on the TRS80, or may be reserved for some other function (bank select of memory perhaps).

EDASM will obviously actuate the editor/assembler that Applied Technology has available as a plug-in option, while NET will probably access the

networking or smart terminal EPROM that I have not yet seen.

Apart from the BASIC stored as tokens, everything else in the MicroBee is stored as ASCII, without compression. Variables are also stored as individual characters. That is, variable A1\$ is stored as 65 49 36.

I was rather disappointed with that, as there are more memory efficient methods. However, it does make it very easy to search memory, or list programs to printers.

Considering the price of the Microworld BASIC, and the MicroBee on which it runs, I think it is a real bargain. You can pay the same amount for some versions of Microsoft, and then have to buy a computer on which to run it. □

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# Word Processing - For \$50 ...!

By Garnett Znidaric

ONE OF the most common uses of small computers is in the field of word processing — something I had considered, but for some time only pondered because of the dollars involved.

The problem was, most of the packages available started at around the \$200 mark.

Then one day I heard some people talking about the 'cheap' WP6502 word processing package which, as can be guessed, was designed to run on 6502-based systems.

I bought it, and I'm glad I did.

My WP6502 runs quite happily on my Superboard II, occupying the bottom 4K of RAM. The early versions of the WP6502 were written in BASIC and used to take more than six minutes to load. The version I run was written in machine code and takes less than half the original time.

The system is available on disk for a few more dollars, but as a result it also offers such extras as being able to output to various printers, and being able to access files.

As this package is more for the 'amateur' dabbler with words, I have found that letter writing and short article writing is a breeze and the joy of it really comes from reading a nice error-free collection of well-constructed sentences.

The use of the system is fairly simple and would be easy to learn if it wasn't for the poor manual that accompanies the tape. Once learnt, though, there is little need to ever pick up the manual again. My first night with the system saw me using two hours thumbing through the 'booklet' with a biro creating a cross reference index.

Having praised the system and canned the documentation, let's see how the whole lot works.

## What's On The Menu?

The first thing that comes onto the screen when the package is loaded is the menu, which offers the user a choice of functions: Type; View; Blk view; G/Edit;

L/Edit; Move; Zap; R/Tape; and W/Tape.

Type allows the user to type as though it was a normal typewriter. View allows you to view the text as it would be formatted in the final printout (it is also through this function that the printer is first given the instructions, and then told to print).

Block View allows you to pre-type and store, on tape, passages which may be used on a recurring basis as is often the case in business letters. These 'blocks'



can be arranged in any order and are accessed simply by calling up their appropriate numbers.

A lot of my typing involves writing dialogue, and this is where the G/Edit (Global Edit) can be used. For example, during the initial writing, only a letter need be used to signify a person's name. Then in the final printout, using the G/Edit, this letter can be changed to the person's name in full throughout the text.

L/Edit (Line Edit) is possibly the most useful function as it allows the user to scroll through the text either by letter or by line, correcting any spelling or construction errors that may have occurred. While in this function passages can be deleted by the letter, word or sentence.

It is also from the L/Edit function that we can use the Insert command which allows anything to be inserted into the text up to the length of the remaining memory.

A nice point is that in either of the Type or Insert modes, the available memory is displayed so that you know how much room is left.

The Move command allows you to move sections of text to and fro throughout the text, while the Zap command wipes the slate clean so that you can start again.

R/Tape and W/Tape refer to reading and writing to the tape recorder so that manuscripts can be stored for later use. This recall function is the one used in conjunction with the Block View for the reloading of blocks of recorded text.

## Embedded Commands

Throughout the system, embedded commands are used to identify print formatting. With the WP6502, this is basically the typing of the '#' symbol followed by a letter such as P denoting the beginning of a new paragraph.

By using other letters and numbers, tabulation systems can be easily formatted, not to mention combining this with a Global Edit to make listing blocks of information neat and fast.

In conclusion, I feel this word processing package can be compared to its larger brothers with quite favourable results.

Sure, it doesn't have a lot of those functions that are 'nice' to have, but on the other hand it does have what it takes to make it a very useful tool. All it needs is a manual that is easy to follow and it would not only be excellent value for money, but fast and easy to learn and use.

Naturally, before you buy anything your needs must be analysed — if WordStar is what you need then buy it. But for letter-writing and other 'light' word processing, the WP6502 is great and should not be considered a poor relation. □



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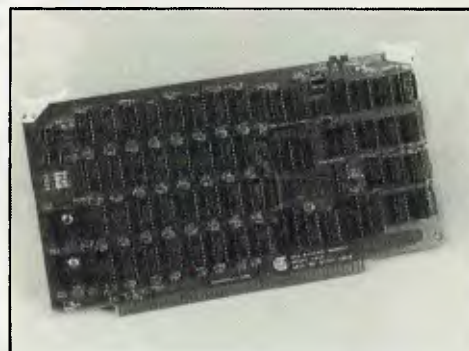
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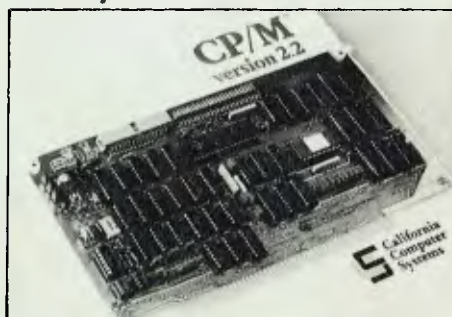
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# HEARD ON THE BUS

By LEON YENDOR

WILL SOMEONE please explain to me just what is meant by 'Software Maintenance'? You'd think my years of experience in this business including working with equipment from IBM, Honeywell and Hewlett-Packard would have given me some idea but the reality is that more experience just adds to the confusion!

If you think it means that, say, a payroll program will be updated for you when the tax rules change then you may be right although I prefer to think of such services more as modifications to suit changed environments. In any case this kind of maintenance is only applicable to applications programs.

What has me puzzled is the idea of maintenance for such things as compilers, interpreters and operating systems. I may well wear out my disks or drives running them but surely not the software itself.

The suggestion that it is the provision of updates is a bit more acceptable although fees running at rates of 25 percent of the purchase price per annum are not considered outrageous by the vendors. At this level I'd really expect some mighty improvements in the four years it takes to offset the cost of just waiting and buying the latest version at list price.

If what is really meant is an automatic supply of bug fixes then the whole thing stinks and it is about time we users told such suppliers so. I think that some fee to remain on a mailing list, and low-cost copies of the less bugged versions are justified but charging a quarter of the initial cost each year to fix bugs that at times are so obvious they should never have gotten out the front door is close to extortion.

Some of these people are justly complaining about software piracy but they had better put their own house in order pretty soon if they want my continued sympathy on that score.

In case you think I am steamed up about some minor bug in a nice cheap package I'll give you a hint. The example I use is a compiler costing close to \$1000; it will not produce a runnable program if the source code uses any of the supplied transcendental functions.

The compile fails at the link stage due to the absence of necessary support library modules. I probably should also add that I wrote these modules myself to allow testing of the mathematical functions only to find that they are so slow in execution that I will probably throw out the whole transcendental package and substitute my own for that too.

Anyone with a copy of an elementary text on computing mathematical functions



could have done as well but would consider it only a worthy first try. Oh how the mighty...

## Men Of Letters

I had hoped that the September issue would have had a reply from the Australian Computer Society to the August editorial.

As no such letter appeared we can conclude that either they have no answer or they are pretending that micros really aren't computers at all and what we think or say doesn't matter.

Well, don't worry too much about it because if you don't qualify for their exalted ranks you can do quite well. For example I've checked with some very well paid and highly experienced programmers I know and only one is a member and he got in on the basis of the now inadmissible experience qualification method.

It made me think back a few years to when our editor lectured to a meeting of that body on the subject of microcomputers and, to put it mildly, they sat there like a bunch of stunned mullet.

This is not to say that some academic qualification is a handicap but those of you who make a good job of learning to program on your own computer, who can look at examples of well written code by others and learn to apply the techniques to your future work, will succeed. And as long as there is no enforcement of an artificial standard of professionalism as a prerequisite for employment you'll do well financially too.

Some examples are probably in order.

An electronics technician whose experience prior to micros was in the repair of calculators and cash registers has successfully supported himself for the past three years as an independent designer with such projects as an industrial control system with no less than seventeen microprocessors on the one bus. He designed all of the modules and wrote all of the software. The system has been installed in several overseas factories and is now a major product of his customer.

Our resident CP/M expert, Bill Bolton, is quite well qualified thank you, but not officially in software. When I first met Bill he was getting the hang of micros with Northstar Basic and dos. He sure has applied himself in the intervening period and I'd say that he'd be in the top ten people I know whom I'd put in a list of CP/M programmers and he hasn't even had the benefit of working for a company with a copy of the source code for the system.

So I've made it back to one of my old hobby horses.

Microcomputers can be one of the greatest ways for an individual to have a more satisfying life. As long as you can somehow get onto a keyboard for the learning period you can virtually bootstrap yourself to a better job or even your own software house.

The only limit is your own drive and ability unless some robed priesthood manages to have legislated rules to protect their own and if we let that happen we will all deserve the consequences. ■

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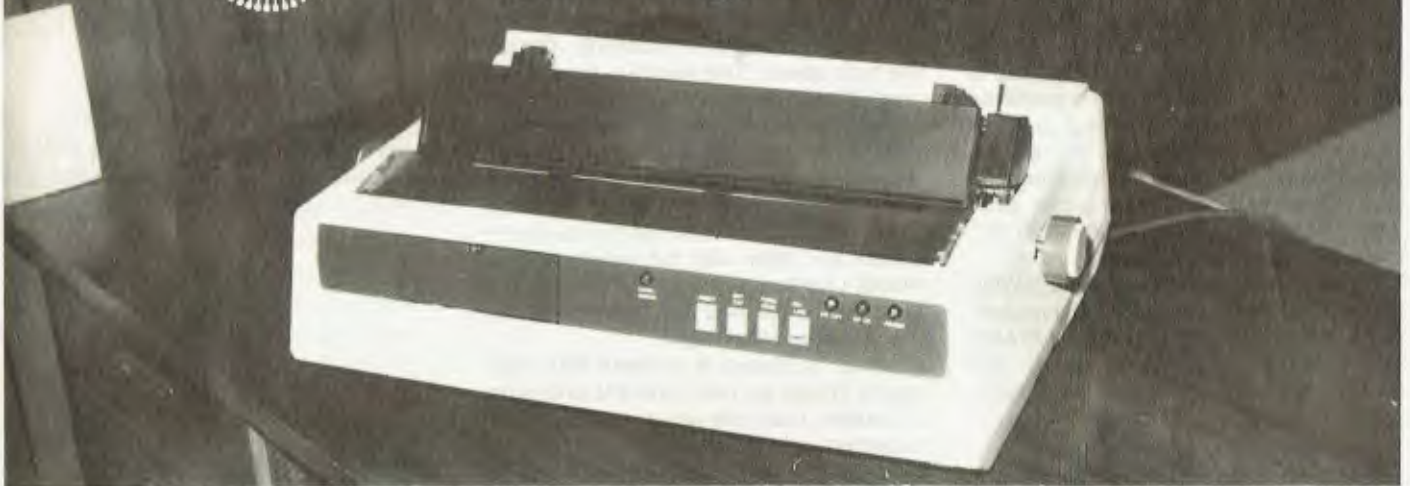
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# Flying Fujitsu



*Looking for a fast, high speed daisy wheel printer? Les Bell reckons the answer could be this flash Fujitsu...*

FOR SOME months I'd heard good reports from the States and around that there was a good daisy wheel printer being put out by Fujitsu. People reckoned it was the greatest thing since sliced bread

— fast, almost silent, super-reliable, and so on.

When I heard Ampec Electronics would be handling the machine I was on the blower straight away and soon had one in the office to take a good look at.

The initial impression, to be honest, was not good. The cabinet of the printer was made of fairly light plastic. The lid, when lifted, wobbled and twisted from side to side alarmingly and the impres-

sion, from the outside at least, was not good.

The inside is something else again. There's a solid cast aluminium chassis, and once you see the printer in action, you realise why it has to be so solid. That printer is fast!

It's rated at 80 characters a second. Now, the Epson MX-80 is an 80 cps printer, but the Fujitsu just leaves it for dead. Either Epson is being optimistic or

## OVERVIEW OF WordStar

WordStar is a screen oriented, CP/M compatible, integrated word processing system specifically designed for non-technical personnel. Text and command functions are fully prompted (4 help levels) and, performed on-screen with complete cursor tracking of all functions. Concurrent printing while editing improves operator productivity.

- \* **Cursor-tracked Screen Display:** Under user control, the CRT screen acts as a moveable "window" into the text; all key strokes receive immediate visual updating.
- \* **Automatic Disk Buffering:** Text is moved between disk and CPU memory with no user intervention. Thus, file size is limited only by disk capacity.

**On-Screen Printer-Image Text Formatting:** Using the default margins or user-set margins, entered text is automatically formed into right and left justified lines. Ragged-right is a user settable option. The **Word-Wrap** feature means that as you type past the right margin, the word being typed is moved to the left margin on the next line. The previous line is redisplayed, justified. You can change the margin settings (i.e. redisplay all or part of the text in the Settings). Partial remargination allows cutting text and an illustration or for any other purpose within a paragraph.

**Split-Screen Help Memos:** Four user-settable levels provide the learning operator with comprehensive prompting instructions without the need to refer to a manual. Help levels may be changed at any time to allow full screen utilization.

**Status Line:** Constantly updated, the status line displays page number, cursor line and column, name of file under edit, and command(s), if any, in current operation.

**Powerful Editing Commands:** include delete character, word, line or block; set/clear variable tab stop; block move, copy, delete and output to disk; find/replace; write/read from/to additional files; set/return to place markers; on-screen insert toggle; and more.

**Dynamic Page Break Display:** A horizontal dotted line, not part of the text, is shown on the screen at the point a printer page break would occur. The page break line is dynamically repositioned when text entry or deletion affects page size. Visual edits of a print image allow even an inexperienced operator to perform sophisticated text composition.

## WordStar Overview (continued)

**Concurrent Print Function:** Editing and printing simultaneously.

**Pagination and Formatting:**

- \* User override of default top/bottom margins.
- \* User override of page length default.
- \* Variable heading/footer texts and page number locations.
- \* Conditional and absolute pagination directives.

**Printer Support:** A wide range of letter quality and line printers are supported including Diablo, Nec, and Gume, as well as teletype compatible printers. Features supported include: **bidirectional printing, Underline, Double Strike, Boldface, and Strikethru.**

**Subscripts, Superscripts, Variable Character Pitch:** (pica, elite, or your choice of number of characters per inch), **Variable Line Height** (6, 8, or your choice of lines per inch) **Variable Ribbon Color** are fully supported on Diablo, Nec, and Gume printers. Print enhancements may be used in all combinations. For example, underlined and boldfaced subscripts are supported.

- \* **Microspace Justification:** When printing justified text on a daisy wheel printer, the white space in each line is evenly distributed.

WordStar is compatible with a wide variety of hardware, and can share files with other software:

**CRT Compatibility:** WordStar's video edit function will operate, after suitable installation, on any CRT or video board 16 x 64, 24 x 80, or larger that has cursor positioning functions and that is accessible as a CP/M console device.

**New Features include:**

- \* **Directory display:** Using a triple split screen WordStar allows scrolling text, and CP/M file directory independently on screen.
- \* **Install Program:** generates a version of WordStar for use on most popular terminals and printers without the need for any "patching". Allows full speed, 1200 baud, printer operation.
- \* **Foreign Language:** As WordStars' menus and messages are mostly external to the operating program they lend themselves to translated versions.

Fujitsu is being conservative — either way, the difference is staggering.

The Fujitsu is available in two basic versions, with either a serial or a parallel interface. The parallel version is priced at \$4060 plus tax, while the serial version is \$4275. Options include a tractor feed and cut sheet feeder.

I had the serial version, so I wired it up to a serial port on my system and prepared myself for a long session trying to install WordStar to drive the beast. My experience hitherto has been that anything that doesn't specifically conform to the letter with the daisies on the WordStar INSTALL menu will be a heap of trouble.

This time it was different. The SP830 thinks it's a Diablo 1620 and behaves correctly. Installed as a Diablo with ETX/ACK protocol and using the WordStar port driver, it was up and running — without the printer manual — in under 15 minutes.

This printer should be mounted on a good solid table or desk. In normal bidirectional printing, there aren't too many impacts or sudden changes of direction, and that runs quite smoothly. However, when the printer tabs across spaces, the resultant jolting can shake even a fair-sized desk.

Also, the paper feed must be quite free and clear of obstructions. When doing form-feeds, the printer virtually fires the paper out, and is liable to tear the perforations if the paper is caught!

The biggest difficulty I experienced was in inserting single sheets of paper into the

printer. Because of the platten construction, I found it quite difficult to insert paper straight first time, and generally had to roll it in, release the platten and then straighten it. Quite a time-consuming procedure, and I now see the inestimable virtues of cut sheet feeders!

The print quality is excellent, despite the high speed. The machine uses standard Diablo print wheels, probably at speeds for which they were never intended, yet they seem to work fine. The only area where the print quality was none too hot was in overprinting twice or three times, where the registration was inconsistent and often way out. However, the model I had was one of the early ones, and later machines are reputed to be much better in that regard.

Noise is always a problem with high speed impact printers, and this one is no exception. I can only say it was less than I expected, and it is tolerable in the same office, but better to avoid where possible! Incidentally, this may explain the apparent flimsiness of the outer case: it probably has good sound absorbent qualities.

The SP830 is a large printer, not to mention heavy, but it still will sit quite well beside the average microcomputer. Its biggest advantage is obviously its speed; it is so fast, it really removes the need to have a second dot matrix printer for general work.

Overall, it seemed to be a good performer, and would be a good choice for multi user word processing systems. ■

#### Specifications and Report Card

<b>Unit:</b>	Fujitsu SP830 Daisy Wheel Printer			
<b>Made By:</b>	Fujitsu, Japan			
<b>Print Speed:</b>	80 characters per second			
<b>Best Points:</b>	High speed, emulates Diablo 1620			
<b>Worst Points:</b>	Lightweight cabinet			
<b>Ratings:</b>	excellent	v good	good	poor
<b>Documentation:</b>				✓
<b>Ease of Use:</b>			✓	
<b>Functionality</b>	✓			
<b>Support:</b>		✓		
<b>Value-for-money:</b>		✓		
<b>Extras Included:</b>	Forms tractor			
<b>Options:</b>	Cut sheet feeder			
<b>Price:</b>	\$4060 parallel, \$4275 serial			
<b>Review Unit from:</b>	Ampec Electronics, 1 Wellington Street, Rozelle NSW			

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APPLIED TECHNOLOGY

9 FEATURES  
OTHERS CALL OPTIONS.  
ON MICROBEE  
THEY'RE STANDARD!

# Apple Word Processing Made Easy

By Peter Sandys

IN RECENT years we have seen the introduction of personal computers, small and relatively inexpensive with remarkable power. It has revolutionised the computer industry.

IBM, which for so long remained aloof and unimpressed, has now developed its own personal computer, which no doubt helped it to return a small profit last year.

Meanwhile smaller companies like Apple have been refining their product with add-on equipment so that the power of the microcomputer is such that many small businesses (and many not so small companies) can now perform full accounting functions, financial modelling, data and record storage, statistics and, of course, word processing.

The first attempts at word processing on the microcomputer were simply text editors. They performed basic functions that were not user friendly and assumed a knowledge of computer operating functions. A standard was set by Micropro with Wordstar. As the Xerox photocopy ads say 'is it as good as a Xerox' the same could be heard in the computer shops around the world in reference to Wordstar.

While Apple was taking the world by storm there were some glaring deficiencies in its ability as a word processor. The display was limited to 40 characters across the screen. It did not have lower case letters.

Apple was preoccupied with developing other areas of its computer rather than changing the screen display capabilities. Hence the development by other companies of improved text display cards. Good old American knowhow and free enterprise soon had three or more 80-column cards (with lowercase) available for Apple owners who wanted to improve their word processing. As well the Yanks had developed in excess of thirty word processing programs.

Undaunted by the US competition, two Australian companies decided that the quality of the 80-column boards and the word processing programs was not good enough so they developed their own packages.

Zofarry Enterprises developed an 80-column board and Computer Solutions

the word processor. Each is a separate company, marketing its products independently, but it was logical for the two to be combined.

## The Product Pair

I have not spent that much time with Zardax so it was a new experience for me. I have always used another Australian word processor; I was happy with it and was used to its commands, so I did not feel inclined to learn another.

My introduction to Zardax was not a happy one, the first set of disks refused to go past the set-up stage, which fouled up my plans to give it an in-depth test run over a weekend. I have had my computer for a long time and have seen the same happen often enough before to myself and others to not to blame the program. Its just one of those unfortunate things that can happen.

Zardax is a very powerful word processor which has a very professional feel about it.

The program is also being marketed in the USA. To quote the latest Softtalk product summary '...highly recommended. Single program includes all standard word processing features with considerable extras...'

An earlier issue carried a review of Zardax being used in charitable organisation. This group had been using one of the American word processors with limited results. The head of the organisation said in the middle of the interview that he thought he was sounding like a salesman for Zardax.

In the next issue Steve Wozniak (the one who designed the Apple) said most of the word processors he had used on the Apple with the exception of Wordstar were useless. He did not mention Zardax and I feel if he had known of it he would not have included it in his criticisms.

Zardax has very powerful print commands which are too numerous to mention. It is possible to tell the program that you have single sheet paper and for it to stop at the end of the sheet so that you can insert another sheet. You can control the margins, number pages, put footnotes and headings, indent, justify left; right; and centre, set line spaces, adjust printer fonts, and more. You can adapt the program for many different printers.

These commands are imbedded in the text in the form of dot commands (like

WordStar) — a method I dislike as I would prefer to be able to reset these values outside my text so that I can readily change them at the printout stage.

With text editing it is possible to create glossaries, search and replace words or phrases — individually or globally — move and insert text within the editor, and set tabs.

The second partner in the combo is the Vision-80 card, rated the best 80 column card for the Apple by Byte magazine.

The quality of the Vision-80 cannot be surpassed; it has been available in Australia for two years and has been constantly updated and improved.

## Overseas Success

The Vision-80 is now being marketed in the US by Vista (a company I have not found to be very responsive to customers, a factor which has possibly held back sales in the US). The card is also being marketed in the UK with a lot of success.

The Vision-80 has full communications software built in so that this avoids the need for a communications package. The quality of manufacture is second to none.

For programmers use of the card could not be easier. The ordinary programming languages of the Apple and their commands are fully supported by the card. Pascal automatically accesses the card without any instructions by the user.

In summary: I have always been impressed by the Vision-80 card. Zardax does things differently to what I'm used to (I will admit to bias for my namesake program — but I am *not* related to Sandy), but that bias is based on the old-dog-new-tricks principle.

For a newcomer the program is excellent and has very good documentation. With the savings on both items together even my bias would be tempted.

To be able to purchase two products that have been recognised outside Australia, in the competitive environment of the USA, as the two best products in their field is something not to be dismissed — unless, of course, you have them already. ■

**zardax**





# VECTOR 4

## VECTOR 4 SPECIFICATIONS

### Central Processing Unit:

Processors: 8-bit Z-80B<sup>®</sup> and 16-bit 8088  
(single or multiprocessor operation)  
Clock Speed: 5.1 MHz  
Memory: 128K Dynamic RAM Standard  
Expandable to 256K

### Video Display:

Screen: 12 inch high contrast green phosphor  
20 KHz Horizontal, 60 Hz Vertical  
Alphanumeric: 24 Lines x 80 characters  
High resolution 16 x 13 dot matrix  
High Resolution Graphics: 640h x 312v pixels (B/W)  
Gray Scale Graphics: 160h x 312v pixels, 16 levels of gray  
320h x 312v pixels, 4 levels of gray  
Color Graphics: External RGB Monitor  
160h x 312v pixels, 8 colors  
320h x 312v pixels, 4 of 8 colors

### Keyboard:

Detached, with 8035 auxiliary processor. Capacitance keyswitch with 91 keys, including 15 programmable special function keys, cursor control keys, and 10-key numeric pad for rapid data entry.  
Coiled cable with Interface

### Input/Output:

Serial Keyboard  
Centronics Parallel Interface  
Qume/NEC Parallel Interface  
RS-232 Serial Printer Interface  
RS-232 Communications Interface  
RGB color signals  
Programmable Tone Generators and Speaker  
S-100 expansion slots

### Disk Drives:

Type of Disk:	5¼" Floppy	5¼" Winchester
Total Capacity:	630 Kilobytes	5 Megabytes
Transfer Rate:	250 Kilobytes/sec	5 Megabytes/sec
Rotation Speed:	300 RPM	3600 RPM

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tutorial

# Basic For Birdwatchers

## 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 has in mind, so that 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 that 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 zeroes, as these are terminal nodes of the tree.

```
170 OPEN "R",1,"B:ANIMAL.DAT"
180 FIELD #1,124 AS DQ$,2 AS DYS,2 AS DNS
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";AS
210 IF AS="LIST" THEN 700
215 IF AS="END" THEN CLOSE: END
220 IF LEFT$(AS,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$(DQ$,C) ;
560 INPUT CS
570 CS=LEFT$(CS,1)
580 IF CS<>"Y" AND CS<>"N" THEN 550
590 IF CS = "Y" THEN K = CVI(DYS) :
REM MOVE TO NEXT RECORD
600 IF CS = "N" THEN K = CVI(DNS)
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 redundant





GUESS THE ANIMAL...

Ma' WHEL PUBLISHING  
IS THIS A NEW ~~BOOK~~  
PLOT BY LES..ER...  
MASSA BELL TO  
GRAB THE REINS  
OF Y.C.P ITS  
PRETTY WELL SELF  
EXPLANATORY...00K 001



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

```
260 IF CVI(DY$) <> 0 THEN 240 : 'ASK
  ANOTHER QUESTION
270 GOSUB 640 : REM STRIP OFF SPACES
  FROM FIELDDED STRING
280 PRINT "IS IT A ";LEFT$(DQ$,C);
290 INPUT AS
300 AS=LEFT$(AS,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 AS="Y" THEN PRINT "ANOTHER
  ANIMAL?": GOTO 200
320 INPUT "THE ANIMAL YOU WERE THINKING
  OF WAS A ";ANS
330 PRINT "PLEASE TYPE IN A QUESTION
  THAT WOULD DISTINGUISH A"
340 PRINT AN$;" FROM A ";
350 GOSUB 640
360 PRINT LEFT$(DQ$,C);
370 INPUT QUS
380 PRINT "FOR A ";ANS;" THE ANSWER WOULD BE ";
390 INPUT AS
400 AS=LEFT$(AS,1):IF AS<>"Y" AND
  AS<>"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$ = QUS : 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 (i.e. not just 'yes') then we swap over the two pointers.

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

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

```
450 LSET DQ$ = MKI$(X1):LSET DQ$ = 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$:LSET DQ$ = MKI$(0):
  LSET DQ$ = 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
```

Finally, 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:"
```

```
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";AS
210 IF AS="LIST" THEN 700
215 IF AS="END" THEN CLOSE: END
220 IF LEFT$(AS,1)<>"Y" THEN 200
230 K=1
240 GET #1,K
250 GOSUB 530 : REM ASK QUESTION
260 IF CVI(DY$) <> 0 THEN 240 : "ASK ANOTHER QUESTION
270 GOSUB 640 : REM STRIP OFF SPACES FROM FIELDDED STRING
280 PRINT "IS IT A ";LEFT$(DQ$,C);
290 INPUT AS
300 AS=LEFT$(AS,1)
310 IF AS="Y" THEN PRINT "ANOTHER ANIMAL?": GOTO 200
320 INPUT "THE ANIMAL YOU WERE THINKING OF WAS A ";ANS
330 PRINT "PLEASE TYPE IN A QUESTION THAT WOULD DISTINGUISH A"
340 PRINT AN$;" FROM A ";
350 GOSUB 640
360 PRINT LEFT$(DQ$,C);
370 INPUT QUS
380 PRINT "FOR A ";ANS;" THE ANSWER WOULD BE ";
390 INPUT AS
400 AS=LEFT$(AS,1):IF AS<>"Y" AND AS<>"N" THEN 380
410 GOSUB 640
420 D$ = LEFT$(DQ$,C) : REM SAVE ANIMAL NAME
430 LSET DQ$ = QUS : REM MOVE QUESTION INTO RECORD
440 X1 = N + 2: X2 = N + 1: IF AS = "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
```



```
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:



```

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 human 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. ■

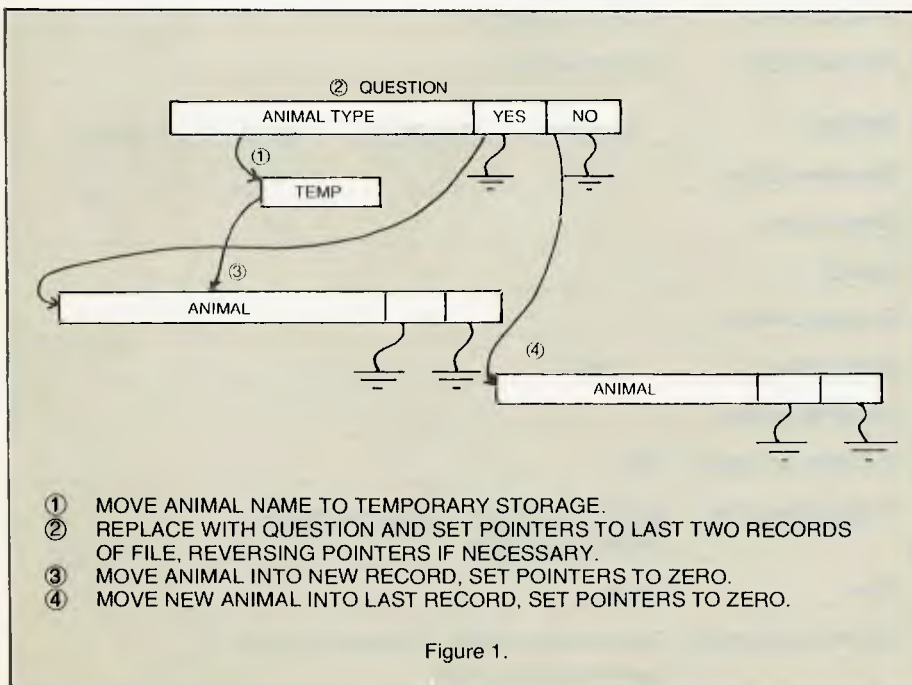


Figure 1.



## APPLE COMPUTER COURSES

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\*I own an Apple II/Apple III  
\*Delete where applicable.



# Penetrating TRS-80 Action

By Rod Stevenson

"YOU ARE the sole survivor of a fighter squadron, whose mission is to invade the enemy defence forces and destroy their illegal neutron bomb cache."

This first sentence from the Penetrator manual reveals the nature of this (relatively) recent release. It is of the action and co-ordination type, as opposed to the intellectual or thinking type.

When the early space-invader type games were marketed for the TRS we were all overjoyed that we no longer had to spend untold fortunes at the local amusement parlours on the video machines.

Then came the next generation such as 'Galaxy' and 'Attack' from Big Five Software, and we were yet more amazed. Now we have games such as Penetrator which, as is to be expected, have advanced further in concept. However the market abounds with such numbers of these games, all of a similar nature, that I feel it's really an individual choice as to which particular one appeals. For they all do much the same thing, but with a varying degree of emphasis on different areas.

Basically there are the two types of game — the action type which demands good manual dexterity, coordination, and fast reflexes; and the thinker's type which is not at all fast, but does require mental exertion to achieve any success at all. I'm not here referring to the 'conventional' games such as Chess, but those such as Othello and Qubic, which are particularly suited to a computer.

So Penetrator is of the action type. It has four 'landscapes' through which you must fly your craft to reach the bomb store, then return through the same path to safety. The four landscapes are in increasing difficulty level, being made so by the varying topography and ceiling structures.

The first is simply mountains of varying heights over which you must negotiate ground missiles. The second is flying through underground caverns with varying ceiling shapes. Stage three is a type of concrete tunnel network, with steep vertical corridors, still with the missiles. Stage four is back to the caverns, but with paratroopers to leap on you. None of the stages have any type of flying defences to attack you.

To fight the enemy defences you have bombs and a forward missile launcher, as well as the usual arrows to control horizontal and vertical movement.

However, there would appear to be an

anomaly with the forward arrow, which controls both the firing (by quick jabs) and the forward movement (by prolonged holding). I as well as many others find this extremely upsetting in that we do not have sufficient control over our fingers to always distinguish between the two. With the action the arrow keys get from all games such as this, the additional 'stabbing' probably is insignificant. The opposing view expressed is that this merely adds to the skill required!

Actually, the back arrow does not allow you to fly backwards, just slows your forward rate. Bombs are slowed by the friction of the atmosphere as they drop, so as you'd expect, greater accuracy is available by dropping from a low height.

If you shoot an enemy missile from too close a range, you will explode too by the shock wave. Small touches such as this go to make the game somewhat more realistic than some others.

As well as the above four levels, there is a training level to allow you to develop accurate control of the craft, which is vital if you're to achieve any success at all.

There is a second tape provided with

the package to allow customised landscaping by the more enthusiastic. While of course a good idea, I wonder how many will take Penetrator so seriously that they want to. And of course it must add to the price for all of us.

As with most mass-duplicated tapes, the recording is a little below the quality from a personally recorded tape. But there is no undue problem with loading, although my standard practice with such is quickly to make a backup copy on my own tape by my own machine.

My copy came up with the heading on the screen of 'Instructions', but the only thing it said was to tell me how to select the level or training mode. An oversight, or just peculiar terminology?

Conclusions: My personal preference is for games such as 'Attack' which provide a degree of thinking and planning with action which is not too demanding for my level of 'uncoordination'.

Perhaps this is why I found I was entirely unable to cope with the forward arrow controlling two functions, and why I prefer 'Eliminator'. But as mentioned above, those who claim this (what I consider a defect) adds to the skill required actually prefer 'Penetrator' to 'Eliminator' for this very reason.

As I said at the start, it seems these types of games are now so numerous that the only real answer is to try as many as you can before deciding which particular variation fits your requirement. ■

## Games Software Report Card

<b>Program:</b>	Penetrator			
<b>Made By:</b>	Beam Software			
<b>Available for:</b>	TRS-80, System 80			
<b>Reviewed By:</b>	Rod Stevenson			
<b>Ratings:</b>	<b>excellent</b>	<b>very good</b>	<b>good</b>	<b>poor</b>
<b>Documentation:</b>			✓	
<b>Ease of Use:</b>			✓	
<b>Speed:</b>		✓		
<b>Entertmt. value:</b>		✓		
<b>Educ. value:</b>	N/A			
<b>Value-for-money:</b>		✓		
<b>Suitable for (ages):</b>	Most			
<b>Holds interest for:</b>	Months if you're keen enough to use the customizing feature			
<b>Price:</b>	\$34.50			
<b>Review copy from:</b>	Compshop Australia, 75 Palmerston Cres, South Melbourne 3205			





## Where Did All The Money Go?

*Stanley Felinski, a Sydney businessman, reports on how his TRS-80 Model 1 was transformed from a space-age ornament into a hardworking and reliable business tool with an Ilehead Professional Upgrade, a line filter and the first commercial copy of a unique Australian-written business program.*

FOR SOME years now I've been dropping in on my good friend Eric, a professional programmer, during his business hours for a mug of coffee and a chat, hoping to pick up a few hints and tips on how to get the best out of my TRS-80 Model 1 system.

Sometimes he would be hunched over his TRS-80 Model 1, complete with green screen, lower-case mod, 100 percent speedup kit, high-res graphics and just about everything but the kitchen sink inside it. He would sigh, say 'just a minute', hit a few keys, the disk drives would purr contentedly for a few seconds and then relatively normal human communication would ensue.

When I invariably asked him what he was doing on his system, he would give me a look usually reserved for people like YC's Office Idiot and tell me he was doing accounts.

My own painful and expensive experience of 'doing accounts' on a Tandy involved dozens of disk changes, referring to a chart of accounts, looking up a client list, checking whether they were debtors or creditors, finally selecting the appropriate disk, hitting return, only to find that the system had suddenly gone on that grim silent journey into the unknown.

When I finally got him to explain to a neophyte like me how come he could do his accounts like magic on his TRS-80 after I had to give the whole thing up as an exercise in futility, he said it was because:

- He had written the program himself.
- He didn't demand too much of a hobbyist grade microcomputer.
- He only got it to do precisely and exactly what he wanted it to do.

Most important, he had made sure that the equipment was as reliable and trouble-free as human ingenuity could make it (Eric has some of the best micro-technicians in Australia in his service, so

that last statement I know to be true.)

He looked sideways at me as if he hoped that was the end of this particular conversation, but he had told me just enough to whet my appetite. Maybe he felt more communicative than usual because I finally got him to explain in some detail what he was driving at.

"Most people these days think that computers were invented by Lord Tandy, the first Earl of Radio Shack", he opened, "but in fact the eight-bit microcomputer is still very much in its infancy in terms of creating a new class of programmer.

"Therefore there are generally two kinds of 'professional' programmers — those with large mini or mainframe backgrounds who have grown up with memory-gobbling languages such as COBOL, or the overnight whizz-kids who owe their enlightenment to Lord Tandy.

"This produces two basic types of business and application software. Firstly you get COBOL re-writes into BASIC. These are usually a series of separate loading program modules translated (usually badly) into Microsoft BASIC from their venerable ancestors in the COBOL lineage.

"These are the kinds of programs you've been running — extremely limited number of entries, no effective data-packing techniques, bad utilisation of disk space and chundering out enough reports to keep an army of accountants happy until next financial year.

"And possibly worst of all — as most of these so-called accounts packs were originally written by main-framers with acres of core (or RAM to neophytes like you); gigabytes of storage or high-speed hard disks, and as they all rely heavily on disk input-output for filing and cross-indexing and so on, they become excruciatingly slow on a floppy disk system".

"But aren't floppy disks supposed to be fast?" I gently enquired.

"Compared to what," came the irritated reply.

"Cassette? Strictly for the beginner. Flingy-sloppy? Again only for the very young who have much more time on their hands than is really good for them."

"Even if you fit a double-density board, a typical Tandy system is quite inadequate to do a full accounting job on the type of application programs usually written by this type of programmer! The only place for this type of software is on a system with hard-disk, where it originally came from.

"What about the overnight whizz-kids", i interjected. "Surely they understand 8-bit micros and what they can do?"

"Yes and no", came a thoughtful reply. "In many cases their mastery of the subtleties of BASIC never ceases to amaze me, but precisely because they have never experienced the mental discipline of programming in a structured language like COBOL or Pascal their programs usually end up being a huge gothic construction of fancy GOTOs and GOSUBs which are virtually impossible to modify or edit in any meaningful way."

"Often they are user friendly (in my day they used to call it idiot-proofing, but we discovered that there are a lot of cunning idiots) and they take great care to make the whole process as pretty and painless as possible.

"Only one problem. Their programs usually tell the harassed businessman just about everything EXCEPT what he really needs to know immediately!

"Again, as they are usually written in America, their date formats and the general treatment of the accounting process is invariably unsatisfactory under Australian conditions". He leaned towards the glowing green screen as if that was the end of the story.

"A typical 8-bit microcomputer in excellent working condition with the right software can be an incalculable boon to the small businessman. But, firstly, most hobbyist grade microcomputers are *not* in excellent working condition.

"They are manufactured down to a price — not up to a working specification. The components used in their assembly are invariably of a minimum design standard and line-filtering is virtually non-existent, so when the fridge motor switches on or the hot water thermostat switches off — bang goes your program in memory. Or, worse still if your system was doing any disk I/O chances are you have a glitched disk, plus of course your system has re-booted."

This man has been spying through my study window, I thought. "If any 8-bit microcomputer is doing these things, what could be done to stop it?", I ventured to ask at last.

He forced a grin over his fourth mug of coffee, "It's a question of budget", he replied.

"If you have 40 or 50 thousand dollars to spare — install your own power plant. On the other hand, install a heavy duty line



filter, preferably one with a varistor fitted in the circuit".

"How do I know if it has a varistor fitted?", I asked.

"You don't", he retorted. "Just make sure you buy one from a dealer that guarantees that the line filter has one fitted", he said over his shoulder as he disappeared into his backroom.

He re-appeared carrying a small black metal box weighing about two kilos. "This is a line filter — heavy duty back-to-back chokes and a front-end varistor".

"It is \$70 list price, \$69.99 to you as you're a good friend", he grinned.

"Believe it or not, it will cure 90 percent of all system crashes. If you want better reliability than that, then your next stop is my Professional Upgrade. And that will set you back a minimum of \$250, more if there are any major existing faults with your system, such as flakey memory, unreliable disk controller, wobbly Z-80 and so on."

He looked at me quizzically, while I mulled that one over. Two hundred and fifty bucks just to make the system work the way it should have done in the first place!

"Any discount for good friends?", I nervously muttered.

"You aren't that good a friend", came the predictable reply. "You haven't bought anything substantial from me for over a month."

I thought — why should I when my machine is about as useful as a space-age bookend at the moment.

"Okay, fix it", I finally exclaimed. "But what about your cash-flow program, how about a copy of that?" I kept my cheque book waving in the acrid cheroot smoke.

"You couldn't afford it, and even if you could, you wouldn't know how to use it. And besides, it's specific to my client's businesses. It does exactly what I want it to do. No more — no less. What I want to know about my and my client's business isn't necessarily what you want to know about yours", he said finally, looking defensive.

"Again, it's not properly idiot-proofed", he smirked, as if that unkind cut was enough to put me down for keeps.

I tentatively unscrewed my 18 carat gold pen with my teeth, keeping my cheque book ostensibly in sight.

"Surely, every business has a need for broadly similar financial information, like accounts payable, receivables and so on", I ventured.

"Nonsense", he snorted, sneaking a slightly averted glance at my cheque book. "Most professional people and small businessmen want to know how much money they currently have in the bank. Secondly, they want to know where



it's all gone. They want to know immediately for example, how many cheques they've made out to Bloggs and Co. from the beginning of the current financial year.

"They want to know how much they've spent on legal fees or advertising and wages for instance.

"Can your expensive accounts program do that?" he exclaimed.

Got you, I thought. "No they can't, nor can any program I've seen but yours do it. But what your program does is exactly what I want to know about my cash flow. There isn't a small businessman who wouldn't want that kind of information at his fingertips.

"It's of universal application to any business involved with buying and selling. In fact even a straight service industry could use that kind of information", I answered.

"There's no documentation written, I use it for my bookkeeping clients and myself and only I know how to operate it and I haven't time to pretty it up with graphics", he retorted, still looking a bit defensive.

"You could knock out a few pages of explanations and instructions in an evening. I've seen you write a serious journal article in a couple of days. Why don't you do it?" I asked.

"Okay", he said, much to my surprise. "But I'm not giving it away. You can have the honour of being the first software customer."

We finally agreed on a price of \$99. Cheap enough to be a valuable investment for anyone responsible for running a business or professional office and expensive enough to make sure that it only got into the hands of someone who would

appreciate its advantages and, hopefully, away from the pirates.

After picking up the line filter and having the Professional Upgrade done on my system, I gleefully carried the priceless first copy home, switched on my system as instructed, put the disk in my first disk drive and hit the reset button.

The DOS READY flashes by, then a directory of the disk, then a printer driver program loads and runs. (We both use high speed serial printers), then the main program — called CASHFLOW/BUS — runs. You can then see the record numbers reading right on the screen in front of you.

As I'd been warned, no graphics, no visual gimmicks, but plenty of choices to give me all possible information on my banking and cash-flow activities.

Like most businesses, practically all my company transactions are conducted through the bank, either by a deposit or by writing out a cheque.

Following the brief but adequate notes I'd been given (the final documentation is much more extensive), I started to enter in my deposit book.

After typing in 1 (selecting item 1 on the menu), and hitting ENTER, the screen cleared and the lines  
THIS ROUTINE ADDS DATA  
THIS IS ENTRY NO 1  
DATE (DD/MM/YY)?  
suddenly appeared.

I entered the date of the first entry in the deposit book of the current financial year and then hit the ENTER key.

The video then showed ENTER DESCRIPTION (D=DEPOSIT)? I did what it said and entered a 'D'. Then it curtly asked AMOUNT? I duly entered the amount. No dollar sign and only use a decimal point if



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any cents were deposited, as my notes told me.

Then I was asked CHEQUE NUMBER (4 CHARS)?

But this wasn't a cheque, it was a deposit! Then I remembered, all deposits begin with an A and run from A001 to A999.

The letter B is reserved for Bankcard charges and all letters from C to W are reserved for chequebook prefixes, the other three characters in the cheque number entry are reserved for the last digits of the actual cheque number. Thus, if the first cheque entered from the first chequebook was numbered 8763751, then the cheque would be entered as C751. Only four characters instead of seven.

I was beginning to learn what data compression means — very smart techniques. After entering the first deposit-book, I then entered the details from a used cheque-book stub.

Incredibly this program holds 1500 entries in memory in a 48K Model 1 system, more than enough for any small to medium business.

Who writes more than 20 cheques a week or who makes more than 250 bank deposits a year? That's one deposit per trading day throughout the year.

I then started to play around with the other options on the menu. I listed out payments to Telecom (abbreviated to 'TELE' as I was advised to do to save array space).

I then listed out all payments under the 'Advertising' code. Wonderful! Nicely tabulated, a list appeared showing date, cheque no., type, description and amount and most important to me, a running total of what I'd spent. A simple task with pen and paper to work out how spending was comparing with budget for any period.

After a couple of hours of date entry and checking, it occurred to me that the system never seemed to take off into a 'garbage collection'. I never lost control of the keyboard during any of the functions. Marvellous! I wonder how he got over that problem?

I tried the SORT routine, it took about six seconds to sort nearly 1000 entries. A bit better than Tandy's notorious Mailing List.

I next scanned a portion of the entries by using option 2, everything sorted and in perfect order. The running balance on the right of the screen (or the printer if you have one attached), showed me exactly what the bank balance was on any particular day. (Useful for those occasional dogfights with the bank manager if you're running on overdraft).

Next, I saved all the data I had entered to disk (option 7 on the menu).

The screen told me how many entries I had in memory and also counted the entries as they were being filed.

Eric had pointed out to me, it is not a conventional book-keeping system, but it is possible in literally two minutes from pressing the RESET button to print out a complete cash-flow analysis.

The only three items you have to add manually are entry of Stock on Hand, creditors balance and debtors balance, and you have literally the bare bones of a balance sheet and a profit and loss account which should save any businessman hundreds of dollars off his annual accountancy fees.

A number of professional accountants are now using this program to reconstruct their clients' accounts, and they have all verified that proper use of this program is an acceptable double-entry book-keeping standard.

The full listing of the entries on the printer is acceptable as a full cash journal and the various entry codes complete the 'double-entry' function by providing separate ledger listings under various classifications.

My personal conclusions, — this program is brilliant, it's the kind of program that everyone thinks they could write, if they had twenty years experience and could take 12 months to write it. To my certain knowledge, Eric has been polishing and re-writing this program for nearly four years, (not full time of course), and he has twenty years experience as an academic, professional programmer and systems theorist.

For \$250 for the Ilehead Professional Upgrade, \$70 for the heavy-duty line filter and \$99 for the Cash Flow Analysis program, my virtually useless TRS-80 48K and disk drives has been transformed into a fully functional business system.

It is the envy of some of my acquaintances who have paid over \$10,000 for their office microcomputer and still cannot use it as effectively as I now use mine. In fact the program is running continuously when I am in my offices.

If you already have a TRS-80 Model 1 with a heavy-duty line filter and you have already had a Professional Upgrade done on it, then that makes you a lot smarter than me.

If you are using the TRS-80 in a business situation and you don't get this program, that makes me a lot more than \$99 smarter than you...

*(The Cash Flow program is available from Ilehead Pty Ltd, PO Box 215, Forestville, 2087. Phone (02) 452 4435. Customised versions are available on application. A pickup and delivery service is available throughout Sydney metropolitan area for the \$250 Professional Upgrade (keyboard and interface, slightly extra if you want your disk-drives checked out and repaired if necessary). Charge is \$10 each way.)*





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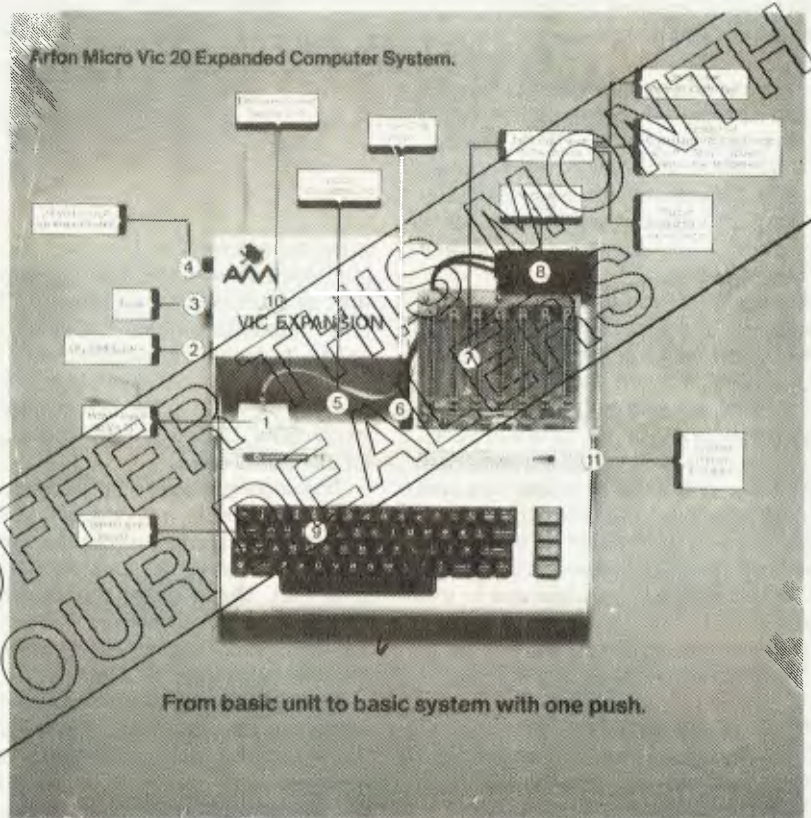
The cassette port and disc port are still totally usable as are the games paddles etc. Your modulator will now be held at the rear of the expansion board.

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We wish you continued success with your new Vic 20 system and look forward to any correspondence you may like to send to our users group.



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THE really BIG news this month is the CP/M convention to be held in San Francisco early next Year. CP/M '83 will be held at San Francisco in the Moscone Centre from Friday January 21st to Sunday January 23, 1983.

It is an international exposition and conference for manufactures, independent software developers, OEMs, software publishers and distributors, dealers and users.

The exposition part of CP/M '83 is being billed as the largest presentation of CP/M based hardware and software ever assembled (which I believe is certainly true).

A seminar and conference program will include presentations from industry 'heavies' and will go into CP/M applications, technical information, development aids and software distribution. Separate end-user conferences will strive to show users how to get the most out of their CP/M computers.

All in all, I think that this is going to be a fantastic, unique opportunity to get a great deal of information on nearly everything about CP/M hardware and software.

In conjunction with *Your Computer* I'm organising a tour group to go to CP/M '83. If you are interested in getting a good deal on air fares and accommodation as well as being having the benefits of being able to get a cross fertilisation of ideas with other Australian CP/M users in the group, look for the full details elsewhere in this issue.

Time is short, so if you want to go to CP/M '83, you have to act NOW!

## New CP/M Documentation

Digital Research has just announced the release of all-new documentation for CP/M 2.2.

As the announcement came just before we went to press, I obviously haven't had a chance to examine it yet...but stay tuned for more detail as soon as it arrives.

## CP/M Assemblers

Let's have a quick look at various 'assemblers' for CP/M environments.

Any assembler operates on two sets of instructions. The one is a mnemonic set (or sets) of operation codes for the target processor and the other is the pseudo-op set for the assembler itself.

The pseudo-ops are what govern the way an assembler handles the mnemonics translation into object code for the target machine. In general, the greater the number of pseudo-ops, the more flexible

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is the assembler.

There are two basic types of output that may be produced by assemblers. The first is an output assembled to execute an absolute (or predefined) address, this is generally in the form of an Intel format HEX file. The HEX file is 'loaded' to produce an executable COM file with the standard CP/M LOAD utility.

The second type of output is assembled to be relocatable, with the actual execution address being established by a 'link editor' or 'linker', this generally in the form of a REL file in either the Microsoft or TDL/Xitan/PSA formats. The linker performs the 'loading' of the assembler REL file to produce a COM file.

Relocatable output assemblers are obviously much more flexible, particularly if large projects are undertaken, but the price paid for the flexibility is a longer assemble/load cycle than absolute output assemblers.

Relocatable assemblers allow large programs to be developed in small 'modules' which are joined together by the linker. This means that to make a change in one part of a program generally means only changing one module. It can be linked with the existing unchanged modules to produce a new COM file.

Modules produced by relocatable assemblers can generally be linked with the output of high level languages which produce REL files in the same format.

Relocatable assemblers generally have a linker and library manager programs supplied with them. The library manager program allows the building of libraries of REL files. These libraries are

such that the linker can be told to search the library file to satisfy any unresolved symbols from a link. Only those modules in a library which satisfy unresolved link requests are loaded by the linker.

## Old Faithful...ASM

All CP/M systems are supplied with an assembler called ASM. This assembler is fairly basic assembler for the Intel 8080 mnemonic set, it has no macro capabilities and does not produce a symbol table but does support a single level of IF conditional assembly pseudo-ops. The input file is an Intel mnemonic source file and the output is an Intel format HEX file and a PRN file.

Because it is the assembler that comes with every CP/M system it is the 'lowest common denominator' as far as evaluating other CP/M assemblers.

Besides ASM there are four other assembler packages in common use on CP/M systems. They are MAC/RMAC, MACRO-80, the TDL/Xitan/PSA assemblers and ACT. These are all macro assemblers but provide quite different facilities.

## Digital Research's MAC/RMAC

MAC/RMAC is a macro assembler, in two forms, by Digital Research. MAC is the earlier product and produces non-relocatable code. RMAC is a more recent version and produces relocatable code in the Microsoft format. RMAC is supplied with a companion linker and library manager. In most respects MAC and RMAC are otherwise identical and will be considered together.

MAC/RMAC uses the Intel mnemonics set and supports the full Intel macro specification. To explain 'macros' is outside the scope of what can be handled in a column, the only thing I can suggest is to look at a reference book on assemblers or get a 'hacker' to explain it to you. The best explanation of macros that I have ever found is in the MAC manual.

The manual contains numerous, excellent, complete examples of how to use the macro capabilities of the assembler. MAC/RMAC supports true 'macro libraries', these are files of predefined macros which is searched by the assembler during an assembly to satisfy macro requests. Only those macros in the library which are actually used are parsed and assembled.

MAC/RMAC is supplied with many example macro files including a library which allows the assembling of code for the Z80,



unfortunately the Z80 macro mnemonics are yet another unique 'logical' extension to the Intel 8080 set rather than the Zilog Z80 set.

RMAC is included with the PL/1-80 package.

### Microsoft's MACRO-80

Macro-80 (or M80) is a relocatable assembler from Microsoft which of course produces code in the Microsoft REL format. It is supplied with a companion linker and library manager.

M80 has the unique ability to handle both the Intel and Zilog mnemonic sets. M80 defaults to the Intel set but there is a pseudo-op which will switch it into the Zilog set.

M80 supports macros but has a rather strange macro library capability. Macro libraries can be specified but the whole library is loaded whether it is needed or not. Only those macros used are actually assembled, but all the macros are parsed which slows down the assembly unnecessarily.

M80 is a fine product but is not well documented. The documentation has improved over the years but is still inadequate. There are several aspects of the assemble/link operation which are very poorly explained and there are no example files supplied.

M80 is supplied with all the Microsoft high level language compilers (that is, FORTRAN, COBOL, BASCOM).

### TDL/Xitan/PSA

The current incarnation of this assembler is from PSA, it is a direct descendent of the TDL/Xitan assembler. I don't know what the current delivery of this assembler includes, I think the linker must be purchased separately.

This assembler is very popular in the US but is relatively rarely used in Australia. The relocatable output it produces is in the TDL REL format which is not compatible with the Microsoft REL format.

The assembler has a very rich set of pseudo ops which allows very fine control of the assembly process. The Z80 opcodes are handled as another 'logical' extension of the INTEL 8080 opcode set.

As I don't use this assembler myself I won't comment further on it.

### Sorcim's ACT80

The ACT family of assemblers from SORCIM are interesting in that they have diverged somewhat from the mainstream of assembler development.

The four ACT assemblers will assemble code for 5 different processors (8080, Z80, 6800, 1802, 8086) but maintain pseudo-op compatibility between themselves.

They produce HEX output files, have good macro capabilities (but no macro libraries), procedures with local symbols, the ability to specify arbitrarily complex data fields without regard to byte boundaries and have some interesting features.

The one I find most fascinating is the ability to display messages during the course of assembly which can indicate the values assigned to labels by the assembly process.

The ACT assemblers have the ability to assemble a source file which is made up from many short files. This allows a big source files such as a BIOS to be created and maintained as many short files, (i.e. one for peripheral I/O, one for disk I/O, one for Warm Boot and so on) which are only tied together at source level (rather than at link level) by the assembler when the assembly is done.

The opcodes used for the 8080/Z80 are the standard INTEL 8080 ones plus a 'Zilog-like' set. These can be intermixed quite freely.

One symbol value can be passed from the command line to an internal symbol in the assembler. This can be used to set up an internal 'equate' to control conditional assemblies and so on.

Complete flexibility in the naming of input and output files is also possible from the command line. These assemblers are also very fast, typically twice as fast as MAC on a similar length file.

The documentation accompanying ACT is very good and fully explains all the pseudo ops and assembler operation.

### Which Do I Use?

MAC for general 8080/86 work where relocatable code isn't needed, RMAC where relocatable code is needed (the macro library capabilities of MAC/RMAC are very useful to me), MACRO80 for general Z80 work (there really isn't any other choice) and ACT80 for all BIOS work (the parameter passing, variable field definition, source linking, symbol value messages and speed are tremendous advantages and macro libraries are of little use in BIOS work).

For 8086 I'm mostly using ACT86 or ASM86.

The various assemblers have individual strengths and weaknesses. You should regard them as individual tools in your

software toolbox; choosing the tool best suited for the particular job in hand will give you the quickest and most satisfactory result with the least fuss.

Don't be afraid to experiment with new tools, if you use a tool often, even a small increase in performance gained by switching to a new program (tool) can have a very significant effect on your productivity.

On the other hand if you use a tool only occasionally, the amount of time taken in learning how to use it can more than offset any time save from increased performance.

I tend to use text editors, assemblers and language compilers constantly, so I am always on the lookout for any way to get even small throughput improvements in any of those tools.

### Microsoft 'Clac-Clone'

Microsoft has finally released the CP/M version of its spreadsheet calculator, Multiplan.

From the glossy brochure Multiplan looks rather nice; it allows you to reference positions on the spread sheet by meaningful labels (that is, SALES - OVERHEADS rather than L44 - A16) and has an on-line help system.

Now if Wiser-Microsoft will just let us have a copy of the CP/M version for review, we can tell you all about it in detail!

Microsoft has upgraded all its product packaging and the software now comes in a hard plastic case which unfolds to act as a stand for the documentation binder.

Wiser-Microsoft can now handle updates for Microsoft products locally (though you should approach your dealer for the update. This is a big improvement over the previous situation — Microsoft has always you return the documentation when purchasing an update, and airmailing an MBASIC manual back to the US used to cost almost as much as the update!

### RCPM News

The number of calls is now over 1800. As I write this at the end of September the expected new SIG/M volumes hadn't arrived....but any day now.

If you haven't found out what micro-communications is all about yet send a large (A4) SSAE, for the 'RCPM Connection Notes', to:

Remote CP/M System,  
P.O. Box 80,  
Newport Beach,  
NSW, 2106



By Rod Stevenson

BEFORE getting down to the 'meat' intended for this month, I'd like to pass on some assorted hints sent to me by various readers.

I make no more comment on each than is given me, as I consider them 'one-liners', not needing proper and full explanation. And I had anyway intended to cover some of them more fully in a future column; but as always, if there's an immediate need...

- When writing Assembly take care with the C flag in particular, as it's easy to get a JR wrong way round by just looking at the code while writing it.
- Allied to the above, use a debugger which shows the actual flags, not just the hex value in the flag register.
- Seems the same as above, but not quite; use a debugger that shows the flags continuously, not just when asked.
- Beware of not saving the source-code before attempting to run the assembled program.
- Take time and trouble to really understand hexadecimal base numbers — 39H + 01H does not equal 40H!
- A common source of woe is to neglect to balance the stack (unequal PUSHes and POPs) when jumping about and using subroutines.
- EDTASM+ uses the ROM print driver routine. 4026H has address 58D and expects the character to be printed to be in C register (not in A as one might think).
- Don't assume the author of the program uses terminology as you do. For example, setting a flag might mean putting zero into a memory location then checking for z.
- A new keyboard driver can be patched by putting its address into 4016H-4017H.

The fact that all of these deal with Assembly programming probably shows my own preference and preoccupation with it — I will pass on some others dealing with BASIC in a future column. Those who have contributed these and the others I have in hand please accept my 'mass thankyou' here.

The subject of the last item, the keyboard driver, I'll be covering in great deal in a near-future column, so don't be concerned if it seems a little vague as presented.

The need for a debugger as alluded to in three of the items above is filled completely by DBUG, which is part of the 'Assembly Language Toolkit' from Micro-80 reviewed in an earlier issue. Funny thing that! Coincidence? Or a case of 'g, eat

minds think alike'?

## Program Addresses

It seems there is wide interest in the great number of maps published to show the starting-ending-entry addresses of various programs, and that the very program wanted is often not mentioned.

Mon-3/4 shows these, and is itself relocatable, so if in this predicament, consider adding it to your utilities. Of course it also performs other wonders as I've enthused about earlier.

## Hobby Or Business?

I did cover this question in what I thought was enough detail in an earlier column, and I suppose it might not really apply as I imagine my readers are more likely to be hobbyists (like myself) than those who purchased their system for legitimate business reasons. But here goes anyway.

It has dawned on me that part of the bad image of computers is the unrealistic expectations of some purchasers with (relatively) small budgets to spend on equipment to perform (relatively) big tasks. Obviously not at the sophisticated level of Banks and the like, which have whole departments adequately qualified to assess the needs, but at the level of (for instance) a printing company that wants to lighten the clerical work-load and believes the first salesman through the door.

While Tandy would like us to believe its advertising that the Models 1 and 3 are suitable for business (and it's true: they can be used for some things), it is realistic enough to also market the Model 2 as the true business machine.

Certainly hobbyists don't only use Models 1 and 3, and business-persons don't only use Model 2, but I fear that unless one is prepared to properly and fully investigate the situation, it's a question of 'horses for courses'!

The other great contributor to the regretfully poor public relations enjoyed by computers, and the belief that they will ultimately 'take over the world' is our willingness to let them!

And it's not only the organisation that changes its whole human-oriented and human-understandable procedure and system rather than re-program the computer to cope with human needs, it's us, the humble hobbyists, who write programs for others (non-computerists) which require a knowledge of computing.

It's clearly silly to expect the person who wants to add two and two to have an un-

derstanding of accumulators, registers, mnemonics, carry-flags, T-states, M-cycles, and so on; yet the same sort of expectation (albeit more advanced) does exist at the level of, for instance a mailing list program.

So let us, as hobbyists, not add to the development of non-appreciation and of dislike of computers.

## Adelaide Users' Group

My thanks for allowing this unpaid commercial — really I consider it a two-way benefit. For those readers who have written to me for whatever reason I've included with my reply a copy of the current (at the time) issue of The Adelaide Micro-User News.

And we (the committee) are indeed pleased in the extreme to total over 38 percent of our 150-plus membership as non-locals who have no expectation of attending meetings, but consider the Newsletter alone worth the subscription.

We even have a Sorcerer owner, so how about it Peter Pot? We are anxious to swap Newsletters with other Users' Groups. All you stand to lose is a stamp, so why not save up and risk it?

## Tape Problems?

Being a non-diskie myself I've developed something of a 'system' and a standard procedure to answer those who assume wrongly that until they can afford disk they will necessarily be plagued with the unreliabilities so widely said to be inherent in the tape system.

All I want to do is pass on my technique to enable you to decide for yourself if you must continue to submit to such problems.

I don't include here such variations as software solutions and speed-ups, or hardware devices such as the TC-8 fast cassette interface, or 'in-betweens' such as the Stringy Floppy. So all you'll need is the patience to try these steps to improve your cassette's reliability.

I have a CTR-80 recorder: I have noted that a greater proportion of those troubled have CTR-41's. Not that I suggest changing, just to beware of the Tandy stores' policy of trying to clear stock by selling any recorder as a second unit for backup, or just audio recording.

And don't think an expensive recorder will necessarily do better — a Nakamichi had no success at all!

Assuming a CTR-80, some modifications will help. On most earlier units a capacitor had been left out — it was even marked on the circuit-board.



So if you look near the top and find two empty holes just insert a 22 micro-farad electrolytic. The effect was that when the remote control stopped the tape with a program under the head, a spike was put on the tape which made it useless; no reason why the tape should be stopped, but even one time in 100 can be embarrassing!

Another modification is to by-pass the remote cut-out with a switch to allow you to control the motor to position the tape correctly before trying to load it into the computer. All that's necessary is to bridge the contacts at the rear of the remote socket with a wire to a button which conveniently can be put through the decoration hole pattern next to the speaker in the top.

The thing to do next to make the button really effective is to by-pass the speaker cut-out with a 100 ohm (value not critical) resistor to allow you to hear what's on tape as you manually advance it, and to hear any irregularities in the tone as it's loading in.

The relevant contacts are near the top of the herring-bone pattern on the circuit-board, and one of them is actually labelled 'SP' with the other one being on the other side of the 'backbone'.

For both of these modifications it's safe to test with a pair of tweezers as the voltage is low enough (6v) to hurt only if you do it with your tongue! The reason for using a resistor and not just a plain wire is not only to lower the sound volume, but to avoid loading the signal to the computer.

The last of the 'ordinary' modifications is to attach a VU meter. I have a panel-mounting one which is not mounted in a panel; I mention this because it seems not all are of suitable sensitivity.

Mine claims to be 0.8 volts at 0 VU reading. It's put across (not in series with) the earpiece line; a separate cord with 3.5mm socket and plug on the ends makes for better versatility than cutting into the cable from the computer.

The optimum reading is indicated by feedback when recording onto tape — that is, the meter will register when recording, and this is the level the computer expects when trying to read from tape; usually around -7 (minus seven) dB. Of course the ultimate is to measure the 2 volts peak-to-peak and check the waveform with an oscilloscope, but how practical is that every time you want to load a tape?

Now you may well say why alter the setting of the volume? Because not all

tapes will be recorded at your optimum level.

In particular, mass-duplicated tapes are seldom (I've never found one) good, but the recorder itself may be out of adjustment.

The thing to do with the mass-duplicated horror is to somehow get it in (you may need a much higher or lower volume level to compensate for such things a 'fuzziness' and bad frequency recording), then re-record it yourself so there's not the problem every time — a tape you record on your own recorder is always the best to read.

With regard to adjustments, the only one (apart from cleaning and demagnetising the head) you can make yourself is to adjust the head until the volume is at its loudest — by a small screwdriver through the hole provided in the section next to the microphone, above the 'I' in Realistic.

There is also a modification to allow hearing the signal being recorded; it seems of little practical necessity, and produces a high level glitch at the start of recording which needs to be bypassed before loading the program if the computer is at all sensitive.

Speaking of sensitivity, it seems there is a wide variation between units with regard to sensitivity and acceptance of less than perfect recorded quality. Let me say that mine is one of the sensitive ones, yet has been entirely acceptable since making all of the above modifications.

While I have personal knowledge of the CTR-80 only, I do understand such measures are equally effective on the CTR-41. In addition to the above, the tone switch on the front needs to be permanently set high, and it seems convenient to use the then unused switch as the motor bypass — there is far more advantage in doing this with the CTR-41, since the remote also controls fast forward and rewind.

There also seems to be a problem with the earth loop formed by the track connecting all the input sockets at the side of the circuit board. What's necessary is to cut this.

As mentioned at the start of this subject, there are ways around this whole area by hardware modifications. The commercially available 'Data Dubber' supposedly re-shapes the wave into a true square wave as put out by the computer and corrupted by the recorder. However I have yet to hear from anyone having more success with this device than can be achieved by merely attention to the points mentioned above.

There are other assorted devices to similarly make good tapes from poor, and the trap is that they seem to install a false sense of security so that one doesn't even try such a simple thing as a different volume setting (up or down) before declaring a tape unloadable.

The software solution such as 'Level 3' provides is good for BASIC tapes, but at the expense of memory.

Of course the major area of the actual tape used is not to be left untouched. After a great deal of time conducting my own tests, the only tape I can recommend is TDK-D. Not because it's a superb recording medium (D is the lowest of the TDK range), but because quality control seems to be adequate.

Even the supposedly 'certified data tapes' from various other manufacturers seem to be plagued with dropouts which produce widely varying volume levels (clearly visible on the VU meter), and of course it only takes one such to render a whole program unloadable. Another problem (not limited to cheap tapes) is that the recordings which were perfectly loadable disappear after a few months — incredible, but true!

So next time you need a tape, please try TDK. Availability does vary widely it seems, but it's certainly well worth tracking down a source of supply. Currently available in Adelaide at \$18 for 10 C-60, or \$22 for 10 C-90.

While on the subject of tapes, care of them is important. In particular, always wind to one end after use. If you just leave them where finished after the program has loaded, the guide-posts will put a kink in the surface across the recording — this will flatten out with time when rewound, but until it does there's no way to load it.

Some advise to fast wind the tape to loosen it before use, but I find all that's necessary is a sharp bang on the palm of the hand if it is tight & hard to wind at proper speed. And any irregularities in signal will be evident if you've fitted the resistor mentioned above and thus are listening to the loading.

Of course the usual precautions apply with regard to keeping away from electric fields such as the power supply. Also of vital importance is the making of regular backups of all important programs — and on another cassette so that if mechanical damage strikes all is not lost.

All this is not meant to imply that I prefer tape to disk; just to point out that you need not spend \$1000-plus to avoid frustrations from tape. ■



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Send it to **Your Computer Readers' Classifieds**, PO Box 21, Waterloo, NSW 2017.

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**Sell ZX80:** including 8K ROM, 16K RAM, manuals, \$200. Also ZX81 keyboard assembled with instructions for fitting \$40. Phone (03) 877 3952.

**Keyboard:** Clare C70 in case, \$140. East Ryde (02) 888 7624.

**Super 80:** 48K, S100, case, graphics, EPROM BASIC, manuals software, cassette recorder. \$475. Phone (08) 49 37050.

**Commodore:** 8032 computer with cassette unit and manuals. Excellent condition. Must sell. \$1800.00 ono. Phone (03) 584 6926.

**ZX81 Club:** In need of contacts to sell, swap software? Send all credentials to: P. Carswell, 22 Brand Street, Bundaberg, 4670.

**System 80:** 16K, early model, as new condition. Comes with games and books. \$400. A. Whiteman — Phone (02) 626 4233.

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**Modem:** Prentice Star V21 acoustic, RS232, as new in carton. With modem programs on disk. \$160 ono. East Ryde (02) 888 7624.

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**Must Sell:** TRS80, 4 x Model 1, 1 x Model 3, network controller, line printer, 2 x colour computers, software, etc. Best prices. (047) 21 4244.

**Video Display Terminal:** with detached keyboard, serial interface, 24x80 display and full cursor addressing. Upper case only. \$250. (07) 376-3323.

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**ZX81:** Fifteen listed programs. Programs, \$10.00; catalog, \$2.00. Cheque/Postal Order: Poseidon Software, 72 May Street, Preston, 3072.

**Super-80:** Includes power supply, fully socketed, BASIC in EPROMs, 16K RAM, S100 interface with S100 wire wrap card, technical and BASIC manuals. \$295. Freight free NSW and Vic. Write G. Night 25 Sheaffe Street, Holder, ACT 2611. Phone (062) 88 4141.

**Sharp PC 1211:** Pocket Computer, complete with printer/cassette interface. \$250. ono. Write T. Baylis, PO Box 38680, Winnellie, N.T., 5789.

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**Apple II Games:** All types from \$4.00. Catalogue + details. Ban-pit. 79 Lakeside Ave., Mount Beauty, Victoria, 3699. Phone (057) 57 2097 (after 4).

**Sell:** Super-80 BASIC program on cassette (\$8.00) and monitor EPROM V1.2 (\$17.00). Value — normally \$37.00 but now only \$25.00. Write or phone Victor Zalagos, 34 Knights Road, Galston, NSW. (02) 653 1738.

**For Sale:** Dream 6802 computer, with power supply, cassette, some programs and full documentation. \$120 ono. Phone (069) 22 5335 after 5pm.

**Printer:** C. Itoh 8300P dot matrix, 2 yrs old. Sell for \$425 purchaser pays freight. Phone (046) 66 9378 after hours.

**Trade:** Software for Apple, Z80 CP/M, Sorcerer. V. Mancuso, 25/4 Brown Street, Newtown, N.S.W. 2042.

**Sell:** Sharp PC 1211 Pocket Computer and cassette interface. All manuals cost \$260 except \$190. John P.O. Box 1081, Geelong, 3220. Phone (052) 50 1997.

**The Brisbane Super 80 Users Group** who have approximately 80 financial members and produce a regular monthly newsletter will be holding an open day and annual general meeting at the Western Districts Aust. Rules Club, located at Oxley Road, (corner of Queenscroft Street) Chelmer, starting at 10 am and finishing at 4 pm. Software, hardware, programs, mags etc. will be on sale. This is the time to swap programs and ideas. The snack and drinking bars will be open for normal business. Garry Gatfield is the convenor and also the person to contact regarding this special day. His home phone no. is (08) 355 3173 — all welcome.

**For Sale:** SGS Nanocomputer Training System, complete with all manuals. \$250 or trade-in on Micro. Ring Mr Sydney on (02) 95 3838.

**Disk Drive System:** Micropolis 1043/23 with S100 controller, 315 Kbytes per drive. Mdos, CP/M 2.2, Wordstar and other quality software and games plus all service manuals and 40 diskettes included. Set up for DG680/640/654— as is or will modify to suit. \$1500 or best offer. East Ryde, (02) 888 7624.

**Sell Microace:** 1K RAM, runs on ZX80 software, includes 17 programs on 3 tapes + Invaders tape, all leads + manuals incl. Sell for \$150 ono. Phone (091) 83 1250.

**Pet Programs:** on tape (included), 5 for \$6. Enquires to S. Jones, 34 De Graaff Street, Holder, ACT 2611.

**Televideo 950:** Completely as new. \$1400 ono. Owners, workshop and customising manuals included. Also dust-cover. (08) 353 2273.

**Word Processor:** Executive Secretary for Apple II — includes data-base, embedded printer commands, user-definable phrase abbreviations, \$220. Phone (069) 22 5451.

**64K MemoPak for ZX81:** New, unpacked — \$275. Phone (056) 72 2081 after 6pm.

**Automation Statham** expects to have a position available in late January for a trainee technician to work on micro-computers and peripherals. We would like to hear from people who will be leaving school at the end of this year with some knowledge of micros at the hardware and machine code level.

Please detail your experience and schooling to:

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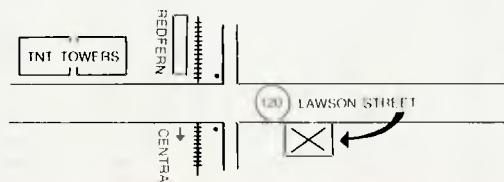
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# your PEACH computer

By Dom Swinkels

IN THE previous article, we looked at the various hardware components and software commands which control the modes in which the Peach can operate. Assuming you are happily writing programs in Microsoft BASIC, as supplied with the machine, this may be a good time to take a look at the BASIC language on the Peach.

The BASIC language for the Peach comes in two versions at this stage. One is held in ROM and is for use without disk drives and the other is held partly in ROM and partly in RAM for use with one or more disk drives.

In the case of disk BASIC the part which refers only to disk related operations is automatically loaded from disk every time you power up. Otherwise you cannot access the disk subsequently as the necessary commands are not available. The only cure is to put a suitable disk in and to do a soft power up using the NEW ON command.

Microsoft BASIC is of course well known and is used on many microcomputers. However each implementation has some machine specific features and the BASIC language changes as programming customs and demands change. The range of commands available also depends on the size and cost of the machine, its standard accessories (such as light pens, RS-232 and parallel printer ports) and its graphics and colour capabilities. So, no matter how familiar one is with BASIC in general, it is still necessary to go to the manual to discover the machine specific features.

The Peach manuals leave a great deal to be desired in terms of ease of use, clarity and completeness. And without an index I found myself spending much time searching through them.

Therefore, the first thing I did, was to make myself a list of all the commands I could find in the manuals, sorted them into alphabetical order and printed them out. Like many computer users I have a range of useful tables and summaries stuck on the wall behind my machine and the alphabetical list of commands and their formats is one of the most useful. I am happy to send a copy to anyone who sends me a stamped, self-addressed envelope. I will give my address at the end of this article.

Now let us return to the overview of BASIC on the Peach. When we enter a line via the keyboard and press RETURN, the BASIC interpreter looks at the line. If the line does not start with a number then it is interpreted and executed immediately

and if any syntax errors occur, the execution is stopped at that point and an error message is given.

If the line starts with a number from 0 to 63999, then the line is stored as a program line to be executed later. It is not checked for syntax errors but is tokenised and stored as best as possible.

## BASIC Tokens

The process of tokenising may require some explanation. To keep the amount of memory used for program storage down and to speed up the execution of BASIC

programs, each valid BASIC word in the input line is replaced by one or two hexadecimal numbers before storing the line in the program in memory. Thus the word RANDOMISE would take up nine bytes.

When listing the program, the reverse occurs and tokens are converted back to words.

If we therefore want to look at our program as it is stored in memory or on disk, we need to know the token values of all reserved BASIC words. The manual is no help in this respect but a little detective work soon yielded the necessary informa-

TABLE 1. Summary of BASIC tokens in PEACH Microsoft BASIC.

TOKEN	BASIC WORD	TOKEN	BASIC WORD	TOKEN	BASIC WORD
B0	END	FF B0	SGN	B3	FAINT
B1	FOR	FF B1	INT	B4	BEEP
B2	NEXT	FF B2	ABS	B5	COLOR
B3	DATA	FF B3	FRE	B6	LINE
B4	DIM	FF B4	FOS	B7	DEF
B5	READ	FF B5	SQR	B8	POKE
B6	LET	FF B6	LOG	B9	PRINT
B7	GO	FF B7	EXP	BA	CONT
B8	RUN	FF B8	COS	BB	LIST
B9	IF	FF B9	SIN	BC	CLEAR
BA	RESTORE	FF BA	TAN	BD	RANDOMIZE
BB	RETURN	FF BB	ATN	BE	WHILE
BC	REM	FF BC	FEEK	BF	WEND
BD	'	FF BD	LEN	C0	NEW
BE	STOP	FF BE	STR\$	C1	TAB (
BF	ELSE	FF BF	VAL	C2	TO
C0	TRON	FF C0	ASC	C3	SUB
C1	TROFF	FF C1	CHR\$	C4	FN
C2	SWAP	FF C2	CINT	C5	SFC (
C3	DEFSTR	FF C3	CSNG	C6	USING
C4	DEFINT	FF C4	CDBL	C7	USR
C5	DEFSNG	FF C5	FIX	C8	ERL
C6	DEFDBL	FF C6	SPACE\$	C9	ERR
C7	ON	FF C7	HEX\$	CA	OFF
C8	WAIT	FF C8	OCT\$	CB	THEN
C9	RENUM	FF C9	LOF	CC	NOT
CA	EDIT	FF CA	EOF	CD	STEP
CB	ERROR	FF CB	PEN	CE	+
CC	RESUME	FF CC	LEFT\$	CF	-
CD	AUTO	FF CD	RIGHT\$	D0	*
CE	DELETE	FF CE	MID\$	D1	/
CF	TERM	FF CF	INSTR	D2	^
D0	WIDTH	FF D0	SCREEN	D3	AND
D1	UNLIST	FF D1	VARPTR	D4	OR
D2	MON	FF D2	STRING\$	D5	XOR
D3	LOCATE	FF D3	RND	D6	EQV
D4	CLS	FF D4	INKEY\$	D7	IMP
D5	CONSOLE	FF D5	INPUT	D8	MOD
D6	PSET	FF D6	CSRLIN	D9	DIV
D7	PRESET	FF D7	POINT	DA	>
D8	MOTOR	FF D8	TIME	DB	=
D9	SKIPF	FF D9	DATE	DC	<
DA	SAVE	FF DA	DSKIF	DD	DSKINI
DB	LOAD	FF DB	CVI	DE	DSKIF\$
DC	MERGE	FF DC	CVS	DF	KILL
DD	EXEC	FF DD	CVD	E0	NAME
DE	OPEN	FF DE	MKI\$	E1	FIELD
DF	CLOSE	FF DF	MKS\$	E2	LSET
E0	FILES	FF E0	MKD\$	E3	RSET
E1	COM	FF E1	LOC	E4	PUT
E2	KEY	FF E2	DSKI\$	E5	GET



tion for both ROM and disk BASIC.

Table 1 shows all the tokens and their ASCII equivalents. The values within the box refer to disk BASIC only (Version 1.1) and are not available or required for ROM BASIC. Several items in Table 1 deserve special mention.

- **Div/Mod:** The BASIC word DIV listed for token D9 requires some explanation. Peach Microsoft actually does not recognise the word 'DIV' but does include this function.

DIV stands for integer division, that is, 17DIV5 will give the result 3 (the whole number of times 5 can be divided into 17) while 17MOD5 gives the result 2 (the remainder after 5 has been divided into 17 the maximum whole number of times).

However, for some reason Peach BASIC uses the YEN symbol in place of the word DIV. The ASCII code for the YEN symbol on the Peach is 92. My printer (Epson MX-80) prints '/' for this code.

To make sure the meaning is clear, I decided to list it as DIV in Table 1. If you now proceed to look for the YEN symbol on your keyboard you may not find it. When the Japanese symbols were removed from the keyboard for the Australian market, the YEN symbol also went, so that we are left with a blank key in the top right hand corner of the keyboard. This key is the YEN symbol key used both for integer division (DIV) and in PRINT USING formats.

- **While/Wend:** Two reserved words in Peach BASIC with tokens BE and BF are WHILE and WEND. These two words are usually used to construct a conditional program segment of the form:

```
100 WHILE (logic expression)
110 ..
120 ..
130 WEND
```

In this segment the program lines between WHILE and WEND are executed as long as the condition of the logic expression is true.

It was obviously planned to have this ability in Peach BASIC, but there appears to be a bug in this routine. Error codes for illegal use of WHILE without WEND (error number 24) and for WEND without WHILE (error number 25) are listed in the manuals but no mention is made of WHILE and WEND elsewhere.

While it may be a little embarrassing to have to admit to having a bug in ROM, I

TABLE 2. Starting points of BASIC programs in hex (decimal).

Width	Resolution	ROM BASIC	Disk BASIC 1.1
40 char/line	normal	0B68(2920)	0F72(3954)
80 char/line	normal	0F68(3944)	1372(4978)
40 char/line	high	2768(10088)	2B72(11122)
80 char/line	high	4768(18280)	4B72(19314)

feel the manual should mention that WHILE and WEND are reserved words. Imagine the confusion of the poor programmer, who wants to use first names for some of his variables. PETER=12 would be completely acceptable but WENDY=13 would result in an error since it contains the embedded reserved word WEND.

- **Unlist:** The most interesting unlisted reserved word in Peach BASIC is probably the command UNLIST with token A1.

This command causes a program or part of it to become unlistable to the screen, the printer or a file. The program, invisible as it is, can still be run normally. The entire program can be UNLISTed or it can be made unlistable from a given line onwards.

Thus, UNLIST 100 will allow all lines numbered less than 100 to be listed normally, while lines numbered 100 and higher will not be listed, although they can be executed, changed, saved and so on normally. The RENUM command can no longer be used and results in a 'Protected Program' message.

So if you want to keep a clever subroutine to yourself but are willing to share your program with a friend, put the subroutine at the end and then use UNLIST from the start of the subroutine. A program which is UNLISTed and then saved to tape or disk remains UNLISTed.

Of course any form of program protection can be defeated. In fact, there is a certain challenge in getting around forms of protection.

I will therefore not spoil your fun by telling you how to make an UNLISTed program listable again, except to say that most of the information you need for one method of voiding this or other forms of protection is given in this article.

### BASIC In Memory

Now that we have found tokens used to store BASIC reserved words in memory we need to know where in memory to look for our program and how each line is stored.

The starting point of BASIC programs in memory depends on whether we are using ROM or disk BASIC and on the amount of memory set aside for screen displays. Table 2 gives a summary of the various possibilities. For example, the starting point of BASIC using disk BASIC Version 1.1 after power up with normal resolution and 80 characters per line is 1372 in hexadecimal or 4978 in decimal.

If we now put a small BASIC program in memory and examine the memory locations from that point on we will see something like the example given in Table 3. The first two bytes contain the memory location of the next line number we assigned in our program line.

In this all the alphanumeric characters, other than the reserved words, are stored in the form of their ASCII codes. The end of the line is indicated by a null byte and the end of the program by three null bytes. This pattern is repeated for every line of our program.

Table 3 gives the program which will list the contents of memory.

TABLE 3. Sample program in memory.

```
10 FOR J=1 TO 10
20 PRINT J
30 NEXT J
40 END

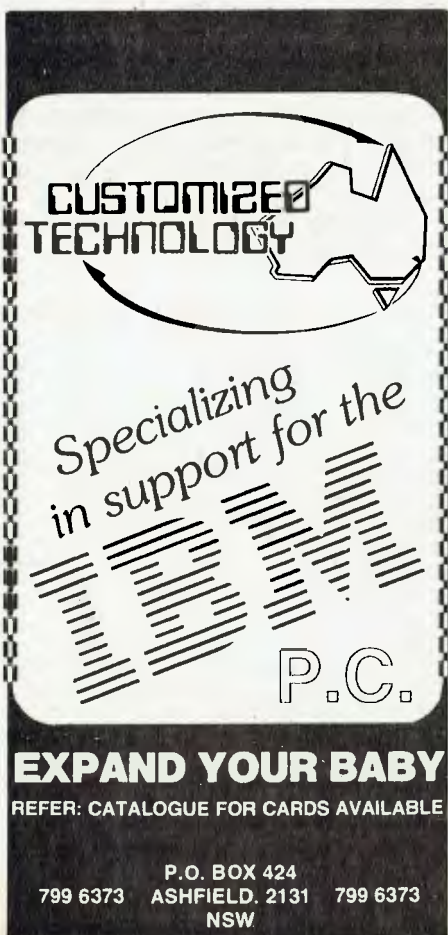
1372-13..memory location
1373-81 of next line
1374-00..program line
1375-0A 10
1376-81..FOR
1377-20..space
1378-4A..J
1379-DB..=
137A-31..1
137B-20..space
137C-C2..TO
137D-20..space
137E-31..1
137F-30..0
1380-00..end of line
1381-13..memory location
1382-89 of next line
1383-00..program line
1384-14 20
1385-B9..PRINT
1386-20..space
1387-4A..J
```



```
138B-00..end of line
1389-13..memory location
138A-91 of next line
138B-00..program line
138C-1E 30
138D-82..NEXT
138E-20..space
138F-4A..J
1390-00..end of line
1391-13..memory location
1392-97 of next line
1393-00..program line
1394-2B 40
1395-80..END
1396-00..end of line
1397-00..end of program
139B-00
1399-00
```

I suggest you experiment a little with short programs and study their tokenised form in memory. See what happens when you insert a new line into the program and when you delete a line.

Finally, if you find a simple way of listing an UNLISTed program or discover other interesting information about the Peach system, please drop me a line. My address is 23 Dalvern Close, Adamstown Heights, NSW, 2289. □



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BRIEFLY, I want to give a rundown on the large range of new games released for the Apple in the past two months.

Wizardry scenario number two is now available and continues the saga of adventure. It's programs like this which make you really appreciate your Apple. The second scenario is as good as the first and in some ways a little sneakier. The actual title is The Knight of Diamonds.

There is a fresh batch of programs out by Strategic Simulations.

Strategic has continued with its wargame programs and has also branched out with a series it calls Rapid Fire. Of the wargame programs Pursuit of The Graf Spee is now available whilst for the masochists amongst you war gamers there is the Guadalcanal campaign which can take up to 80 hours to complete if you elect to play the whole scenario.

Gregor, who reviewed Graf Spee, has more patience than me and he will be working on a detailed review. Roger Keating is still working on a new game which is of the standard we Aussies can be proud of (even if he has a Kiwi accent).

The Rapid Fire series is for those who want strategy games without having the patience to read and digest the rules. There are two programs in this series. Galactic Gladiators, with a rather shapely maiden on the cover facing the dreaded alien warriors, and Cytron Masters.

Of the two programs I was very taken by Cytron Masters. It was written by Dan Bunten who produced Cartels and Cutthroats (one of my favourite games). It is a one or two player game.

The scene is in the future where small armies of Cytrons have replaced large-scale warfare by being the instruments for settling interplanetary disputes. You start by becoming an apprentice Cytron Master. To plunge in and expect to do battle at any other level is rather foolish.

Before you begin to do battle the program disk takes you through a familiarisation routine where you quickly learn how a piece moves and what its limitations are. You learn how to direct them and place them. You also learn how to fire and direct missiles at a target.

After you feel confident you have the basics you are ready to begin your first battle. You appear on one side of the screen commanding your Cytrons against the computer. You can capture the enemy's power bases and finally his command center. At the same time you have to defend against his attacks on your

bases. The game is complicated by the use of missiles.

I have not yet beaten the computer as time has not been on my side lately. I am impressed with the game because it takes you step by step through a training session, which is essential for learning the rudimentary elements of the game. Also the game itself is fun.

Galactic Gladiators is another combat game. It follows a different theme in that you have individual control over the fighters under your command. Cytron Masters allows your pieces to follow out instructions within a set framework until you redirect them to do otherwise.

Hopefully I will have an in-depth review for you soon.

### Moving Adventures

Escape From Rungistan is an adventure game with a difference. It is fun and similar to other high-res adventure games, but there is a difference: there is an active display.

Whereas ordinary adventures show a picture then some text Escape has pictures which sometimes move. Examples are a mouse which appears at the beginning and runs across the room — you have to be quick to catch it.

At another part of the game a snake appears which will strike if annoyed, again this appears on the screen and moves. Another scene has snow which can be deadly, and another section requires you to ski using the paddles to avoid trees.

I cannot go into all the details as this will give you hints of traps to avoid. I know how to finish the game so anyone who is really stuck can write for answers. It's by Sirius Software.

### Other Fun Disks...

**Cross Country Rallye:** You have a car which you manoeuvre around the screen to the different checkpoints.

You have to avoid the crash cars which are there to try and stop you. You also have to watch your fuel and smoke screen generator (to stop the crash cars following you).

**Alien:** Good, but maybe a little late. If you don't have Galaxians and the others then it's worth getting.

**Duelling Digits:** A good educational and fun game — finally arrived!

**Labyrinth:** I did a short review in June; it has now finally arrived in Australia. It is of the quality expected now of Broderbund. Worth checking out. ■



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- Basic system includes 64K RAM Processor, with separate screen, 5.25" or 8" floppy drives and printer.
- Modular and ergonomic design for ease of operation. Choice of integrated commercial packages for Australian business.
- Suitable for personal, professional and business applications.



## SHARP MZ-80B

- Basic unit includes 64K RAM, screen, plus graphic RAM, cassette and keyboard as illustrated.
- 3-dimensional, high resolution graphics.
- Standard CP/M operating systems available.
- Capacity can be expanded with 5.25" dual floppy drives and printers.
- Ideal for professional and engineering applications as well as personal business management.



## SHARP PC-1500

- Powerful 8 bit processor.
- Optional 4-colour graphic/cassette interface.
- Battery and mains operation.
- Suitable for field or office use, particularly educational, hobby and business.

To: Sharp Corporation of Australia, VC 1  
 64 Seville Street, Fairfield, NSW 2165.  
 Please send me information on  
 PC 3201     MZ 80B     PC 1500  
 Name .....  
 Company .....  
 Address.....  
 Phone .....

Sharp, the name you know for innovation in business equipment, present three remarkable computers.

Their features speak for themselves, their proven technology is your reassurance.

# SHARP®

We put you a step ahead