

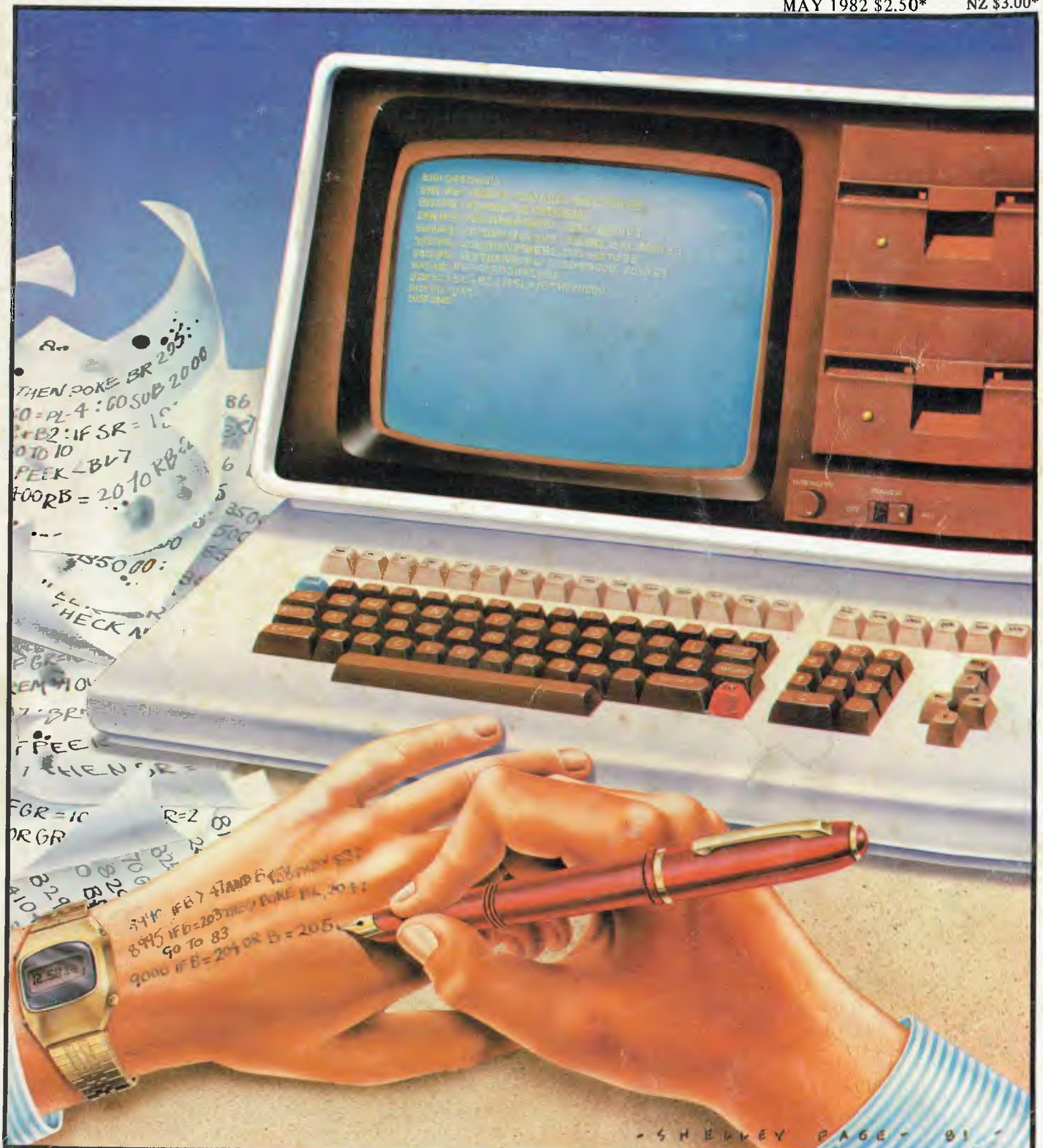
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Australian Personal Computer

Australia's top selling micro magazine

MAY 1982 \$2.50*

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- SHELLEY PAGE - 81 -

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The new HITACHI PEACH out-performs any small business/personal system you may now be considering, but only costs **\$1495** plus sales tax if applicable

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sinclair ZX81 PERSONAL COMPUTER



Sinclair ZX81 Personal Computer

the heart of a system

that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under \$300. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just \$199, the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, and to drive the new ZX Printer



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
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- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.



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Price includes connectors for TV and cassette, FREE manual, sales tax, post and packing (but excludes mains adaptor).



Announcing The Complete Sinclair ZX81 Basic Course

Takes the mystery out of writing programs! This attractive lay-flat reference manual contains 240 pages of information illustrating the use and possibilities of the Sinclair ZX81:

- How to write programs
- A permanent work of reference
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- Every function covered



ter-



**Available now-
the ZX Printer
for only \$190**

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha- numerics and highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further instructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you can plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

**16K-byte RAM
pack for massive
add-on memory.**

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

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	16K-BYTE RAM pack (optional extra)	\$150	
	1.2 AMP Adaptor	\$17.50	
	ZX Printer	\$190	
	ZX paper / 5 rolls	\$24.50	
	The complete ZX81 Basic Course	\$34.50	
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Sinclair software on cassette.



The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 - or see our separate advertisement in this magazine.

The ultimate course in ZX81 BASIC programming.



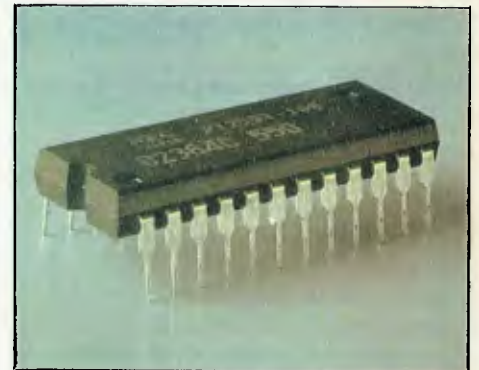
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn on the machine, through the machine. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...



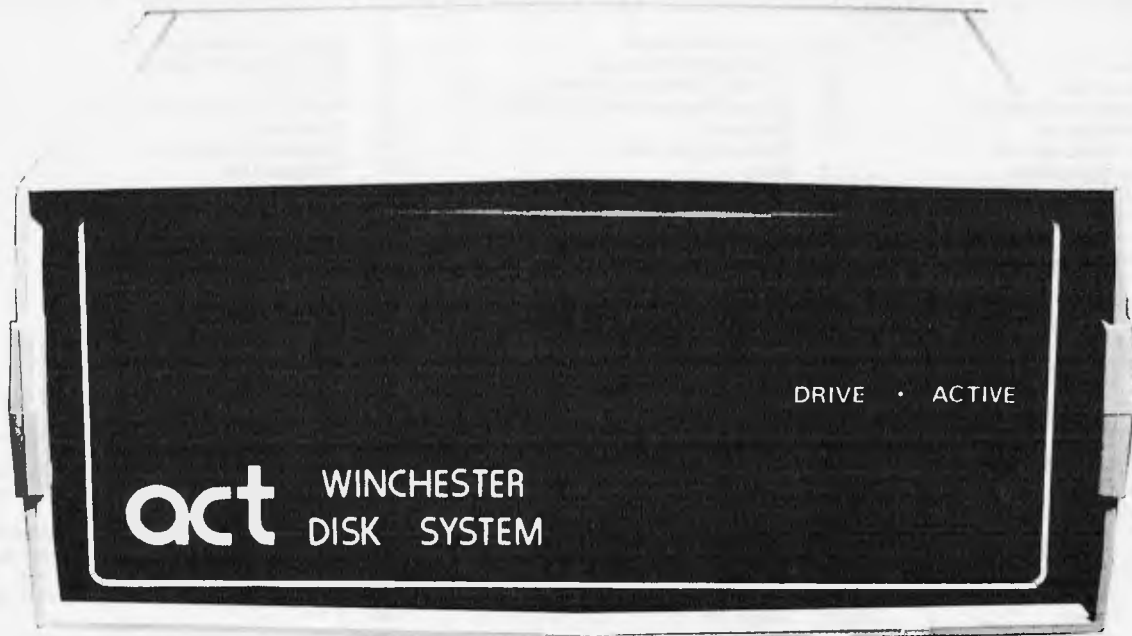
The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 - including the ability to drive the Sinclair ZX Printer.

Sinclair ZX81

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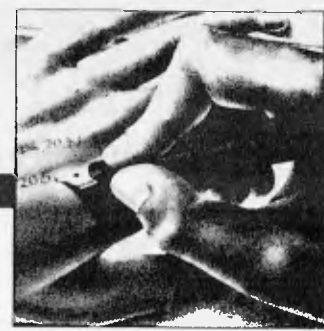
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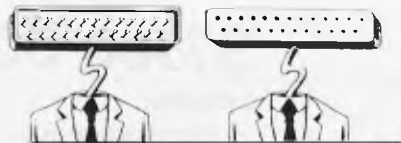
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PRINTER SURVEY



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Miriam Cosic and associates report on the latest news from the world micro scene.

Technical Applications

A new Australian-designed micro was released recently. The Option II, manufactured by Microprocessor Applications, was selected for supply to Victorian technical schools after having been designed to tender specifications.

According to managing director, Terry Gray, it became apparent that many users preferred to build to multi-user status gradually to ease the strain on capital funds, and to allow staff to become familiar with a simpler system. So we set about designing a machine which provided a much lower cost entry point, with a clear upgrade path to our eight-user Micromation system.

The basic configuration of the Option II is a single-board Z80 processor, and one inbuilt double-sided 8 inch disk drive giving one Mb of storage. The benchtop or rack mounted unit also features 128k of RAM, CP/M, standard S232 and parallel interface, copy and file transfer programs, and the ability to run MPA Basic — a batch card reader Basic designed for schools. It can be gradually expanded with the addition of a second 8 inch drive, 10Mb hard disk, and a batch card reader.

The disk system is IBM-compatible in single-density format, and the 128k of RAM is bank selectable in 64k blocks.

Microprocessor Applications lives at 48 Rutland Road, Box Hill, Vic. 3128; Tel: (03) 890 0277.

Bright Young Things

It's almost a cliché in the industry that the new generation of computer literate kids speak a different language to even the professional oldies. So it had to happen . . .

A new software company called Softox has been established, owned and run by teenagers. They are initially concentrating on the Apple, but intend to expand in the future. Two of the proprietors are Apple programmers, and the third designs documentation

covers and computer graphics.

Their first product is Gammon II, an Apple version of Backgammon written by 14 year old Mark Lipman. He is working on a new program which extends, improves and speeds up Applesoft Basic, and there are several other programs, including a real time graphics adventure, on the drawing board.

Another arm of this business is searching for and marketing programs for micros by other enterprising people.

The bright young things can be contacted at Softox, 496 Port Hacking Road, Caringbah, NSW 2229.

Cromemco Info

A new range of 68000-based system configurations, and software packages to support the new 68000/Z80A Dual Processor unit, are available from Cromemco through Informative Systems.

According to sales manager, Norman Rosenbaum, the new Cromemco 16-bitter and software can handle scientific and engineering computations and data bases which would previously have required main-frame or mini power.

"With its 32-bit internal architecture the 68000 has made the Cromemco the most powerful microprocessor on the market," he said.

Among the software package releases are CROMIX, Fortran 77, Cobol 80, Pascal C, Structured Basic, and a Macro Assembler. And new system boards include a memory controller unit, and 256k and 512k RAM boards.

With the dual processor, the Cromemco will run both Z80A and 68000 programs and can address up to 16Mb.

New configurations are a 68000 version of the System One, with dual 5 inch drives and either 256k or 512k RAM; and a 68000 double processor version of the system Three with dual 8 inch floppy drives can be expanded up to 4Mb of error-correcting RAM.

The new products should be in stock by June, at Informative Systems, 337 Moray Street, South Melbourne 3205; Tel: (03) 690 2284.

Western Winchester

Western Digital's WD1000 is a stand-alone, general purpose Winchester controller, designed to interface up to four Winchester drives to a host processor. The drive signals are based on the floppy look-alikes made popular by Shugart's SA1000, and other drives from Quantum and Tandon.

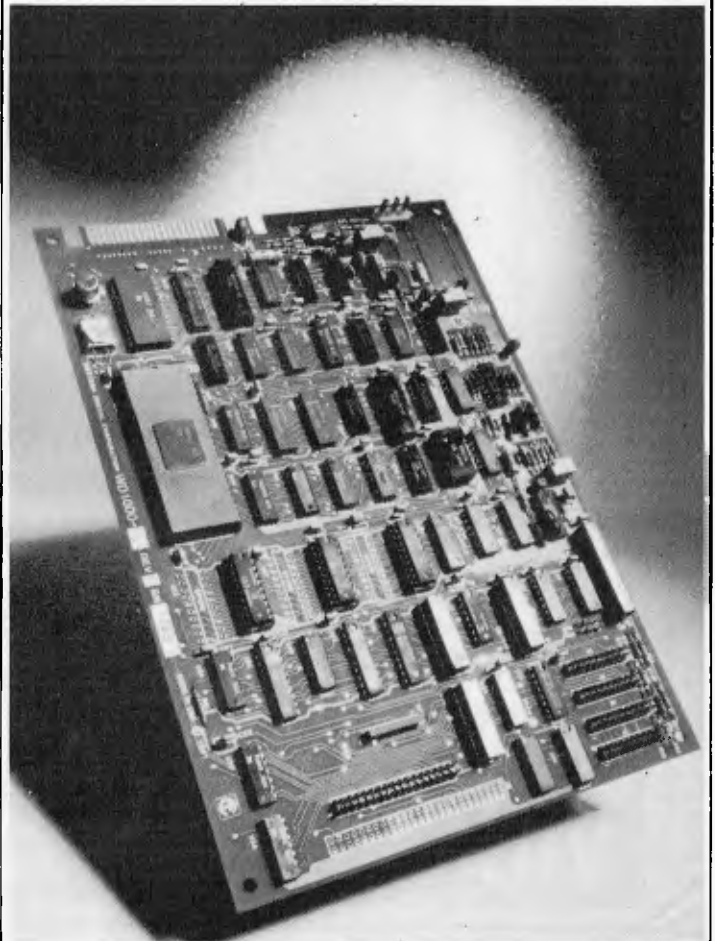
All necessary buffers and receivers/drivers are included on the board to allow direct connection to the drives. Either a 34 pin (5¼ inch drive) or a 50 pin (8 inch drive) connector is provided, as well as four 20 pin data connectors.

Communications to and from the host computer are

made via a separate computer access port. This port consists mainly of an eight bit bidirectional bus and appropriate control signals, and all data to be written to or read from disk, status indication, and macro commands are transferred via this bus. An on-board sector buffer allows data transfers to the host computer independent of the actual transfer rate of the drive.

It seems that Tandy has signed with Western Digital for a supply of these devices, and the Australian distributors expect a "rapid downturn in price" from these sort of volumes. That means they expect them to get cheaper.

The Australian distributors are Daneva Australia, 66 Bay Road, Sandringham, Vic. 3191; Tel: (03) 598 5622.



Western Digital's WD1000 Winchester Controller.

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003	SUB-ATTACK	103	HESPLOT	405	VICTERM
004	MOORSE	104	MAZE OF MIKOR	406	VICAT
005	RAINBOW	105	PINBALL	407	VICHECK
006	CRAZY BALLOON	106	SKIER	408	SPACE DIVISION
007	MOLE ATTACK	107	SIMPLE SIMON	409	LONG DIVISION
008	SUBMARINE	108	TANK WARS	410	SUPER HANGMAN
009	NAVAL BATTLE	109	VICTREK (8K)	411	GLOBBLER
010	FIRE TREK	110	FUEL PIRATES	412	THE ALIEN
011	TREASURE CARRY IN	111	PAK BOMBER	413	3D MAZE
012	HEAD ON	112	LASER BLITZ	414	CAROM
013	I.C.B. MISSION	201	HOUSEHOLD FINANCE 1 & 2	415	RACEWAY
014	BALLOON BOMBER	202	HOUSEHOLD FINANCE 3 & 4	416	LASER WAR
015	TEN PIN BOWLS	203	VIC TRAP	417	DRAGON MAZE
016	HI-RES. DEMO	204	SEAWOLF	501	JUNGLE
017	VIC CUBE	205	BOUNCE OUT	502	DUNE BUGGY
018	MONSTER CHASE	206	MONSTER MAZE	503	SKI-RUN
019	LASER FIGHT	207	HOME INVENTORY	504	THE WORM
020	EUREKA STOCKADE	208	MATHS HURDLER	505	SUPER WORM
021	LUNAR LANDER	209	LOAN ANALYSER	506	COSMIC BATTLES
022	ROCKET COMMAND	210	CODE MAKER	507	SPACE DEFENSE
023	CITY BOMBER	211	CODE BREAKER	508	FROGGER
024	MINFIELD	212	CAR COSTS	509	CAR RACE
025	HANGMAN	301	METEORS	601	A-MAZ-ING (6K)
026	PACKMAN	302	DEPTH CHARGE	602	AMOK
027	SUPERLANDER	303	GUNFIGHT	603	MASTER WIT
028	TARGET	304	ASTEROIDS	604	ALIEN BLITZ
029	MAZE	305	VICVADER	605	KIDDIE CHECKERS
030	PIANO/DRAGON	306	UFO ATTACK	606	SIMON
031	SOUND EFFECTS	307	SLOT MACHINE	607	WALL STREET
032	CHEQUE BALANCER	308	SLALOM	608	VICALC
033	AUNT SALLY	309	INDY 500	701	SPACE INTRUDERS
034	SEMAPHORE (3K)	310	OTHELLO	801	CHECKER KING
035	SEMAPHORE (6K)	401	STAR WARS	802	TIME TREK
036	CHARACTER CREATOR	402	SKY MATHS (6K)	901	MIN-VIC

Tear out this page now and send your order in to the following dealers:

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 Victoria Park Computer Centre,
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 Victoria Park (09) 361 1355

SA, NT, VIC & TAS
 Computer Imports Colour
 Computer Centre,
 220 Morphett Street,
 Adelaide (08) 211 8146

NSW, QLD, ACT & NZ
 Computer Cellar Pty. Ltd.,
 136 Maitland Road,
 Mayfield,
 Newcastle (049) 67 7500

or direct to...

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220 Morphett Street,
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NSW, QLD, ACT & NZ
Computer Cellar Pty. Ltd.,
136 Maitland Road,
Mayfield,
Newcastle (049) 67 7500

By now you must be delighted with your Vic 20 and are starting to realise more fully the enormous potential that this product offers. The value of a computer that uses the same micro chip and operating system as a world wide success gives it a range that will be hard to match in a totally new computer. The addition of a colour display makes it a very up-market product right from the start.

We have taken this microcomputer with its power unit, its modulator, decided upon the expansion you would need and condensed it all into an expandable computer system. To allow you sufficient power we have replaced the small power supply with a specially designed power pack. We are giving you a mother board with 7 cartridge expansion sockets.

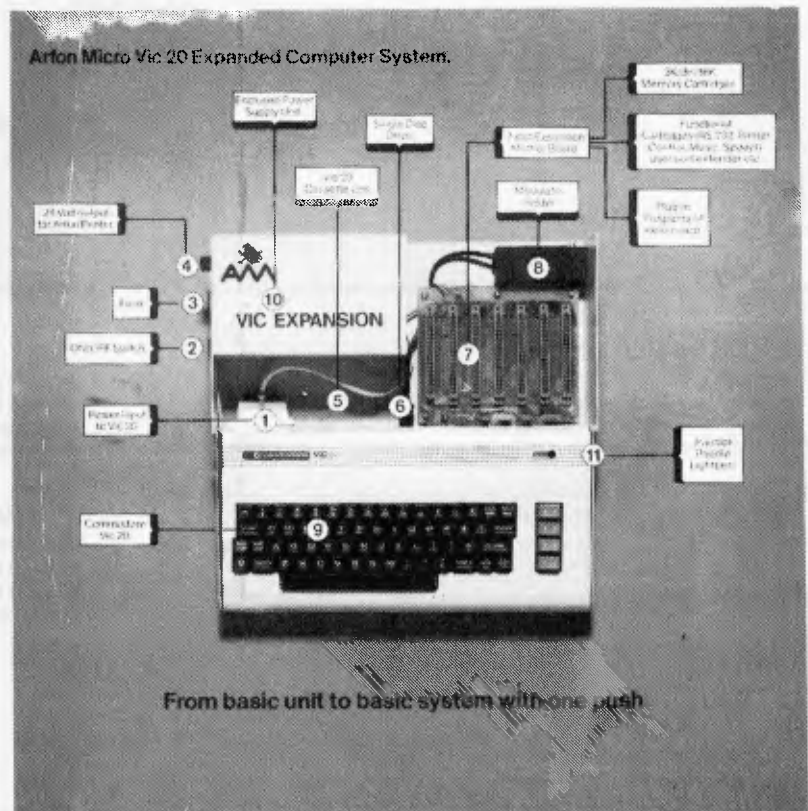
The cassette port and disc port are still totally usable as are the games paddles etc. Your modulator will now be held at the rear of the expansion board.

We have housed your new computer system including the Vic 20 itself in an aluminium shell. The front of the housing follows the contour of your Vic 20 while the rear is raised to give protection to your cartridges.

As an option we offer an aluminium cover to give greater security and protection, at the same time providing a base for your television. Educational users will no doubt secure this cover to the main shell preventing the removal of cartridges.

The power pack has an extra 24 volt rail and socket at the side of the shell that will power the new Arfon Micro Printer which is being especially designed for our Vic 20 range.

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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From basic unit to basic system with one push.

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Program modules
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DELUX COLOUR BUSINESS PACK 3

PEACH CPU — EXTRA MEMORY
HIGH RES COLOUR SCREENS
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INC. HIWRITER PROGRAM
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IS FOR YOU



A Wealth of Winnies

There's more for those interested in Winchester technology. The new ACT hard disk package contains a Winchester-type 5 1/4 inch drive with either 5 or 10 Mb of unformatted mass storage, and a microsequencing controller card. The controller end of the package has been designed to run a second disk if required.

It will interface with TRS-80, North Star, Epic, Xerox, IBM, Apple III, Superbrain or S-100 bus systems, and is available from Australian Computer and Telecommunications, 75 Willoughby Road, Crows Nest, NSW 2065; Tel: (02) 439 6300.

Graphics Upgrade

A graphics modification kit is available for the Dick Smith Super 80 Kit Computer.

There are two versions. The first contains 64 "special"

graphics symbols ranging from card suits and stick figures to large block-style graphics. The second provides the full set of 64 "chunky" graphics similar to those used on the system 80 and TRS-80.

Each new character has been given its own ASCII code number, so can be POKEd into RAM or PRINTEd onto the screen. The kit plugs into the main printed circuit board, and needs a micor modification to get it going.

Either version of the kit costs \$39.50, plus \$2.00 for postage, from El Graphix, P.O. Box 278, Croydon, Vic 3136.

Key to the South

A new computer shop has opened in Adelaide. It's called Key Computer and holds a franchise from the Computer Country in Melbourne.

Consequently, it will be carrying the hundred and one products which its Big Brother handles, including Apple, Hitachi Peach, Osborne, NEC PC8000, Atari, North Star,

Micromation, CEC, Casio FX 9000P, Hewlett Packard, Higher Scientific, software for all of these, plus software and peripherals for assorted other machines like the TRS-80.

It will also be the main Sth Australian dealer for the Australian Beginning, and will be holding periodic seminars for local users of the service.

Key Computer can be found at 1055 South Road, Edwardstown, SA 5039.

Little Big Board

A Little Big Board has come onto the scene. It is a Z80A based machine with 64k of RAM on board, which can be purchased in a variety of configurations. These include, as a complete terminal with two disk drives and CP/M 2.2; or assembled and tested with monitor program, with or without power supply.

The dimensions of the beastie are 4.5 inches by 8.25 inches; and it has two RS232C ports and the real time clock has a battery backup. Operating systems are CP/M or M/PM II.

For further information contact Pulsar Electronics, 323 Bell Street, Pascoe Vale South, Vic. 3044; Tel: (03) 354 2125.

Computer Radio

Another course to be broadcast by the University of New South Wales is titled Selecting a Computing System for a Small Business. Topics will cover what a computer is and what it can do for you, what your options are and where to get help, requesting a proposal from suppliers and how to get a good contract, planning and installation, and staff involvement.

The lectures, starting in June, will be accompanied by two seminars for \$20, plus the cost of an el cheapo ready modified radio from the Uni. or the effort of modifying your own.

Other courses are an introduction to Cobol programming, and an elementary course on SPSS - A Computer Package for Statistical Analysis.

Enquiries to the Division of Postgraduate Extension Studies,



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16th Floor, Mathews Building,
University of NSW; Tel: (02)
662 2691.

North-south Openings

Tandy has opened two new stores, bringing the total to ten in major cities plus 17 computer departments within general retail stores.

In Brisbane the new Computer Centre is at 301 Wickham Street, Fortitude Valley, and is headed by Greg Trigger. A Queensland Educational Marketing Co-ordinator will be attached to the office. Leo Wilson, in this position, will be working with various state and tertiary bodies to facilitate the harnessing of micro technology for schools, following the placement of TRS-80 onto the State Stores Board contract.

A similar position has been created in Adelaide, with the thankfully abridged name of Centre Educator. Jeff Billings will fill the role. The

Adelaide store's address is 240 Morphett Street, and the boss is John Shipp.

Both stores are displaying Tandy's network system, which will allow up to sixteen user stations, in a classroom environment.

But in spite of its headlong love affair with education, Tandy's new stores will still be courting the business community which accounts for about 70% of the company's computer sales.

Micros for Shepparton

Country Victorians will be interested in a shop in Shepparton. It's called Data Parts and has been going for about 18 months, selling memory components, books, hobbyist supplies and other paraphernalia.

Recently it has taken up agencies for Commodore, Atari and Ohio Scientific microcomputers.

The company is currently

developing an interface lead which will allow the VIC to accept a standard audio cassette.

Locals will find the place at 1 - 3 Naomi Street, Shepparton, Vic. Tel: (058) 21 7155.

Sydney Solutions

Archives Computers (Aust) did so well at the Business Efficiency Fair in Sydney, that it has accelerated plans to open an office in that city.

The new retail operation is called Australian Business Solutions. Archives operations manager, Mark Platt, is heading a full team of software consultants, sales and service staff.

Gower Smith, head of Archives, having vindicated his ability to do things the right way after having been orphaned last year, said that the major reason for the company's success would appear to be the excellent suites of business system software offered, and the customised data base management systems.

Australian Business Solutions is on the 59th floor

of the MLC Centre in Martin Place, Sydney; Tel: (02) 235 1151.

Uncle Clive Excels Himself

After having been pipped at the post for the BBC Computer contract, Clive Sinclair has come out with a bigger, brighter and cheaper, colour computer.

It's called the Spectrum in the UK, though it obviously won't be called that here; and Sinclair Equipment head, Julian Barson, tips its appearance for Christmas maybe, January probably. Yes, Julian.

It's got colour, and sound, and high resolution graphics, and an expanded ROM, and more on-board RAM than its predecessor and is not much bigger than the ZX81. It will cost around \$400... more next month.

Apple Digest

New educational software for

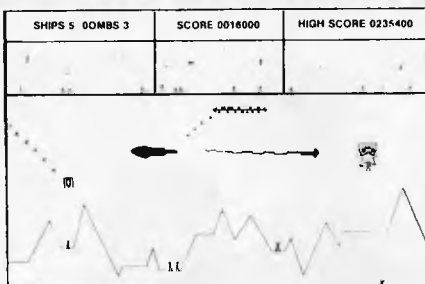
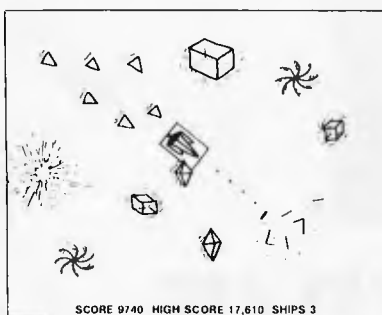
SORCERER SOFTWARE SUPER SPECIALS

Limited time only.

ASTRO INVASION

We have taken 'Super Asteroids' which has been one of the finest arcade games around for the Sorcerer, sped it up, added shields, three dimensional, revolving objects (and more of them), friction, multiple user facilities and improved sound effects.

\$24.95



DEFENDER

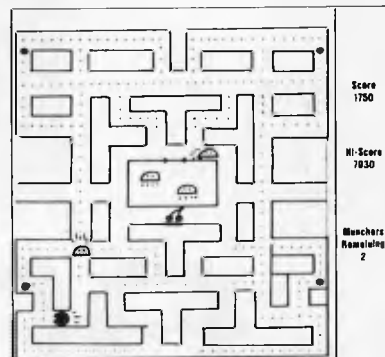
'Red Alert. Red Alert!' screams the hot line. 'Aliens heading for earth.' The people are in danger. It is your job to defend them. Your radar gives you an advantage over the 'Aliens' as you can see them a long way in front as well as behind. Can YOU save your people??

\$22.50

MUNCH

Beware of the GHOST MONSTERS as they chase you around the maze. Eating a flashin POWER PILL causes the insidious monsters to become temporarily sedated and may be eaten for bonus points. Pieces of fruit occasionally appear and may also be eaten.

\$22.50



Take advantage of these give-away prices and write to
SYSTEM SOFTWARE, 1 Kent Street, BICTON, 6157

(Ph. — 339 3842). Cash, Money Orders, Cheques and Bankcard all accepted.

DON'T MISS OUT!!

ALL PROGRAMS HAVE SOUND AND COME ON CASSETTE.

PRINTOUT

the Apple will be developed and marketed in the US by Reader's Digest, supported by Apple Inc.

Apple will be helping with technical information, computer training for RD staff, access to micros, and marketing support. A maths assessment and reinforcement package for grades 1 to 7 has already been released, and the next few months will see programs in problem-solving and vocabulary building.

I always feel a bit uneasy when giants collaborate. At least it's not IBM.

automatic positioning of manually fed single sheets and envelopes.

According to NECISA's Jolyon Bone, the success of the Spinwriter is largely attributable to its 'Thimble' printing element. Compared to a daisy-wheel's 96 character capacity, the 'Thimble' carries 128 characters. Two different fonts or pitch character sets can be had on the same print element without restricting available characters. There is currently a choice of over 70 typestyles.

NEC Information Systems Australia has also announced that it will be undertaking

direct sales and support of these products.

Training Pass

PASS, for Professional Authoring Software System, is a software package enabling non-programmers to produce programs. It guides the author with English language prompts and questions, assuming no knowledge of programming languages.

The point of the package is to develop training programs tailored to specific training

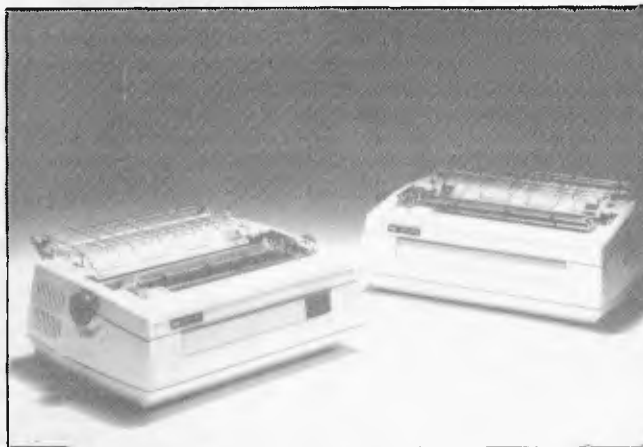
objectives. PASS will interface the resulting program with a laser video disk player, giving random access capability for video material. This ability, coupled with high resolution colour graphics, creates dynamic and interactive training material, speeding the learning process, according to its creator Bell and Howell Australia.

It has been three years in development and is designed to run on an Apple II with 48k of RAM, two 5¼ inch floppies and a colour monitor. A specially designed interface card is supplied.

Souped-up Spinwriters

NEC has two new Spinwriter ranges. The 7700 series are letter quality printers with a print speed of up to 55 characters per second suitable for high speed, heavy duty operation. Models include Qume, Diablo and Centronics compatible parallel interfaces, RS232C serial interfaces. A wide range of print styles is available.

The 3500 series offers a lower speed, lower cost alternative. In addition to the usual single and dual sheet feeders and a variety of tractor feeds, these models also feature



Model 7700 Q/D fitted with standard Qume or Diablo parallel interface for direct compatibility, or as a base level model for OEM's and systems builders. Space and power are available for custom built interfaces.

Inevitably Brief

I've been asked to give a brief plug to a new company in Geelong, and have been given pretty brief information.

Ego Games have only been going for a brief period of time, writing their own games. They have a brief list of products - in fact, only one, U Boat Commander, with two more on the way. You can contact them by dropping a brief line to P.O. Box 740, Geelong, Vic 3200.

Moving House

The Microcomputer House is

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moving to larger premises at 119-123 Abercrombe Street, Chippendale and may also be adding to the thin ranks of stores on the Apple Isle in the near future.

The Microcomputer House MD, John Guidice, is the founder and president of the NSW Commodore Computer Users Association. You can contact the association by writing to P.O. Box 4271, Sydney, 2001.

Modular Business

A new range of commercial program modules is now available in Australia. Padmede Commercial Services, in Sydney, is importing "Europe's largest selling micro software" from Padmede Computer Services (UK).

Modules include standard commercial operations such as invoicing, debtors ledger, inventory, etc, and there are further applications in time cost recording, incomplete records accounting, cheque writing and others.

Each module will stand alone or can be incorporated with others. The software has been adapted for Australian conditions, and is supported by software and field training

services. The software runs under CP/M 2.2, and is suitable for Apple, Sharp, NEC, Ibox, Atari, and other machines.

Padmede Commercial Systems can be found at 275 Alfred Street, North Sydney, NSW 2060; Tel: (02) 920 5136.

Computer Centre in Dandenong

Located at 295 Thomas Street, Robs Computer Centre specialises in Hitachi "Peach" Computers, as well as the new Osborne.

The proprietor Rob Kloester said that they have been Hitachi Peach dealers since the release last year, and are very pleased with the response to the machine and software packages such as HI-WRITER. "We are also excited by the Osborne which we feel aims at a different market to that of the Hitachi, that is, the business-man on the go, who wants to work at home as well as work, or who needs to take these powerful financial tools with him, wherever he goes."

More on Monroe

Some more details on the Monroe computer, finally . . .

The OC 8820 has a Z80A processor and 128k of user memory, including 48k of RAM. It is a single unit computer and comes equipped with built-in dual-track, double density disk drives, a 9 inch screen, and a keyboard with separate 15-key numeric keypad. The 93 keys include a five-key cursor control, six special editing keys for increased programming efficiency, and eight dual function program definable keys.

There are three RS232 ports with programmable baud

rates and protocols for communication with mainframes.

Standard machine features include Monroe's own extended Basic, the Monroe operating system, and an indexed Sequential Access Method, which allows users to access data files in any sequence and to inquire into an account by name or number. The machine will also support CP/M.

The basic OC 8820, with two disk drives, DVU and inbuilt keyboard sells for \$4825, plus tax.

From Business Control Systems, I Angel Place, Sydney 2000; Tel: (02) 233 1302; and Suite 4, 75-76 Bay Street, Brighton, Vic 3186; Tel: (03) 596 6366.

TOP 30 PROGRAMS - APRIL 1982

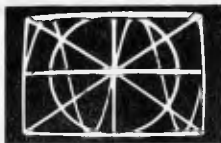
Position:	Name:	Position last month:
1	Visicalc	1
2	D Midnight Magic	4
3	PFS	3
4	Apple Cillin Diagnostic	15
5	Wizardry	2
6	Time Zone	-
7	* Star Blazer	-
8	Master Type	8
9	Snake Byte	13
10	Utility City	-
11	Track Attack	5
12	* Kabul Spy	-
13	General Manager	12
14	Superscribe II	11
15	Horizon	7
16	Ultima	14
17	Olympic Decathlon	22
18	* Casino	-
19	Sargon II	23
20	Typing Tutor	25
21	Raster Blaster	26
22	Genetic Drift	16
23	DB Utility Pack	21
24	Zork II	24
25	* Foosball	-
26	Dos Boss	18
27	Visifile	-
28	* Visi Schedule	-
29	Micro Soft Tasc	28
30	Beer Run	30

* Denotes New Product

This list was provided by *Imagineering* as the thirty top selling programs for the Apple II in April. We'd be interested to hear from readers if they would enjoy a similar list published monthly to follow the rise (and fall) in popularity of micro programs for the Apple and other machines.

SUPEREZ-80

HI-RESOLUTION GRAPHICS FOR THE TRS-80 & SYSTEM-80



Introducing **SUPEREZ-80**, the ultimate in high resolution graphics with world first features. Installs out of sight within the computer to give true 384H x 192V independent pixel resolution, each being individually addressable, thus **SUPEREZ-80** is not repeat NOT a programmable character generator system (such systems suffer seriously in complex screen graphics applications).

SUPEREZ-80 does NOT use any precious main memory and yet an extra 16K becomes available (using the bank select technique as used in minicomputers along with Tri-multiplexing) allowing multiple intermixable operational modes including high resolution of any screen location whilst any others are "normal" alpha-numeric or low resolution characters, thus P.C.G. mode operation is possible if required; Page mode operation is supported where 16 independent video pages are available and by sequentially "switching" each page to the screen, complex real time animation is feasible at rates up to the 1000's of frames per second.

Programming **SUPEREZ-80** is as simple as the SET/RESET/POINT statements but FASTER.

For other products and services we provide, see page 73 of this magazine.



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THE FASTEST AND MOST EXCITING GAME EVER DEVELOPED FOR THE TRS80

PENETRATOR features amazingly fast firing action; accurate bomb release; incredibly smooth graphics and arcade type sound that you have never before seen or heard on a TRS80! Your mission is to penetrate the enemy defenses, blow up their illegal neutron bomb store and return safely to base, an almost impossible feat!

The console above shows the actual view from your TRS80. The four stages present continually new challenges, and increasing enemy defense means each stage is more difficult than the previous one! Enemy radar stations constantly track your movements unless you destroy them. You will need all your skill and cunning! To aid you on your mission, Control Center has provided you with a training Simulation Chamber; where you may practice your skills.

PENETRATOR is a game that will challenge you time after time, hour after hour. The unique customizing feature allows you to change the conditions of the game at will. This means that each PENETRATOR package actually contains hundreds of different games to keep you challenged and stimulated.

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 OTHER _____ I enclose a stamped self addressed envelope.

Please rush me

PENETRATOR for my TRS80/SYSTEM 80 @ \$35.50 (includes \$1 post).

I enclose a cheque/money order for \$35.50
Please debit my bankcard A/C for \$35.50

A/C No. From To

Name

Address

Postcode

Signature

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VISICALC
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Powerful W. P. System. \$199.00

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Caverns of Mars
Crossfire
Dodge Racer
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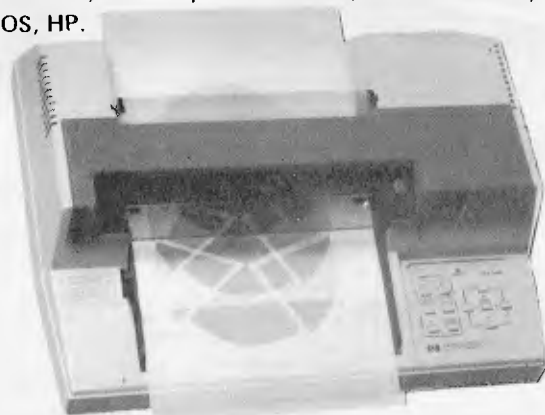
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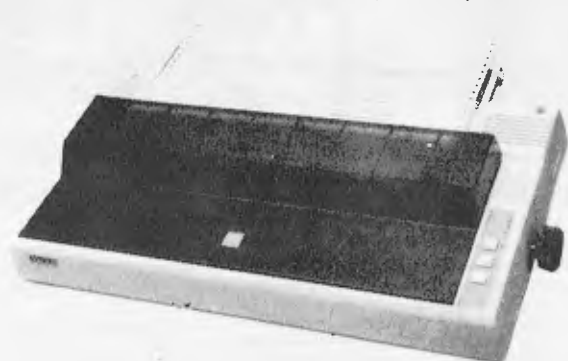
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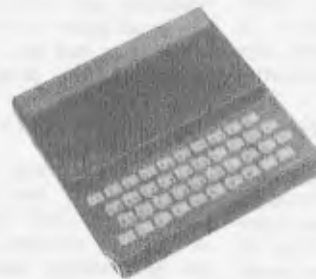


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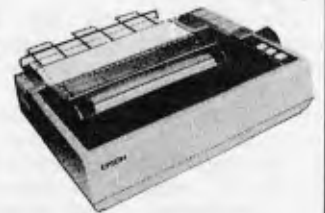
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Vincent Tseng tests TI's relaunched home micro, the 99/4A.

TEX

Way back in 1978, Texas Instruments, the giant of the electronics industry, announced (with all the attendant rumours) that it was going to enter the personal computer market. The plan then was to bring out an upward compatible range of personal and home computers.

As you now know, what arrived was the TI-99/4 Home Computer in 1979, and, although it worked competently, it was nothing particularly outstanding — it was over-priced, especially with the mandatory US standard colour TV, and it was generally regarded as a damp squib.

Texas Instruments has now brought out the second version of its home computer, the TI-99/4A. An in-joke in the electronics industry is that components with a subscript 'A' are the versions that have finally been made to work properly! Perhaps it is a little unkind and unfair to apply this quip here, but has Texas Instruments finally got it right?

The TI-99/4 and the TI-99/4A have always been sold as home computers and named as such; no attempts have been made to promote them as anything else (e.g. as a business computer, as is so often the case). One of the most significant changes in the move to the 'A' version is non-technical, but nevertheless a vast improvement, and that is the price — at around \$800 including tax. (It is interesting that machines designated as 'home computers' are now priced inclusive of tax.) This puts it squarely into competition with computers such as the

VIC, Tandy Color Computer etc.

Hardware

The TI-99/4A arrived well packed with a whole host of peripherals and accessories in a very large cardboard box. The items supplied for test were the TI-99/4A main console unit, and its power supply, a PAL modulator, a speech synthesiser unit, a disk controller unit with one minifloppy disk drive, an RS232 serial interface unit, a thermal printer, a cassette lead and various plug-in ROM cartridges called 'Solid State Command Modules'. These modules included TI Extended Basic, disk manager, speech editor, terminal emulator I, household money management, video chess, blackjack and poker, addition and subtraction 1, and Teach Yourself Basic on disk.

As you can see, there's quite a number of items supplied, and to keep this Benchtest manageable I will concentrate on a few and briefly report on the others.

Unpacking and setting up the main console unit was no problem. Texas Instruments had thoughtfully provided a leaflet entitled 'Read This First' to give simple instructions on setting up and getting started. Unfortunately the sheets supplied were for the original 99/4 and not for the 'A' version, so there were a few points which did not tie up, but at least none were damaging or dangerous. The correct setting-up procedures were in fact in the TI-99/4A User's Reference Guide and no

doubt Texas will correct this oversight.

The main console unit's casing is virtually identical in shape and size to the original 99/4, being approximately 37.5cm wide, 26cm deep, and 7cm high, taking up a base area about the size of this magazine opened out. The casing material is black plastic with a brushed aluminium fascia (with a slight bronzed tint). The most noticeable difference from the 99/4 is the typewriter-style keyboard, which is of standard pitch but looks more compact. The layout is qwerty, with only 48 keys in all, so some of the punctuation marks are in non-conventional positions and are accessed by a FunCTioN key as opposed to the normal SHIFT, which could become annoying. The punctuation marks (as well as the cursor keys) accessed by the FunCTioN key are inconveniently marked on the lower side face of the keys, but there is an alpha lock key which does latch in the down position. But more disappointing is the feel to the keyboard, which is spongy and seemed heavy — so much so that, without realising it, I found that I had reverted to two finger and one thumb typing and could not manage to type fast with all fingers. To the right of the keyboard is a recessed area with a spring-covered slot to accept the command modules (plug-in ROM cartridges). All in all, the main console unit seemed very attractive to my eyes and would not look out of place on the shelf or even on the coffee table at home.

Unfortunately the same can't be said of the ugly power supply unit,



AN REVAMP

which is wedge-shaped (to match the sloping front of the main console, I suppose) but is black and looks like a sewing machine foot pedal and is best kept hidden out of sight! The other unit which had to be attached to the console was the PAL modulator which enables the 99/4A to work with a standard 625 line colour or monochrome TV. The black metal box is attached to the console by a reasonably long cable; the box connects to the TV by a short co-axial lead.

On opening up the main console unit you find that there are three boards packed quite tightly; for keyboard, power regulation and the main CPU. The main CPU board is well shielded in a sheet metal casing to conform to the US FCC regulations. Removing and opening the shielding (which is a feat in its own right) reveals the enormous 64-legged TMS 9900 chip in plastic packaging, a cluster of 4116 dynamic RAMs and a couple of Motorola 6810s (128 x 8 static RAMs — which I assume are used to system store as well as for the 9900's CRU — control register unit for I/O). The board looked well laid out but there was no spare room for any internal memory expansion (perhaps just as well, considering the difficulty in dismantling to get to the unit).

The TI-99/4A worked competently; there was virtually no difference between this and the original TI-99/4 (reviewed in *APCV* vol 1 No 4, August 1980) except that the second option on the main menu on start-up no longer exists; i.e. the unique 'Equation

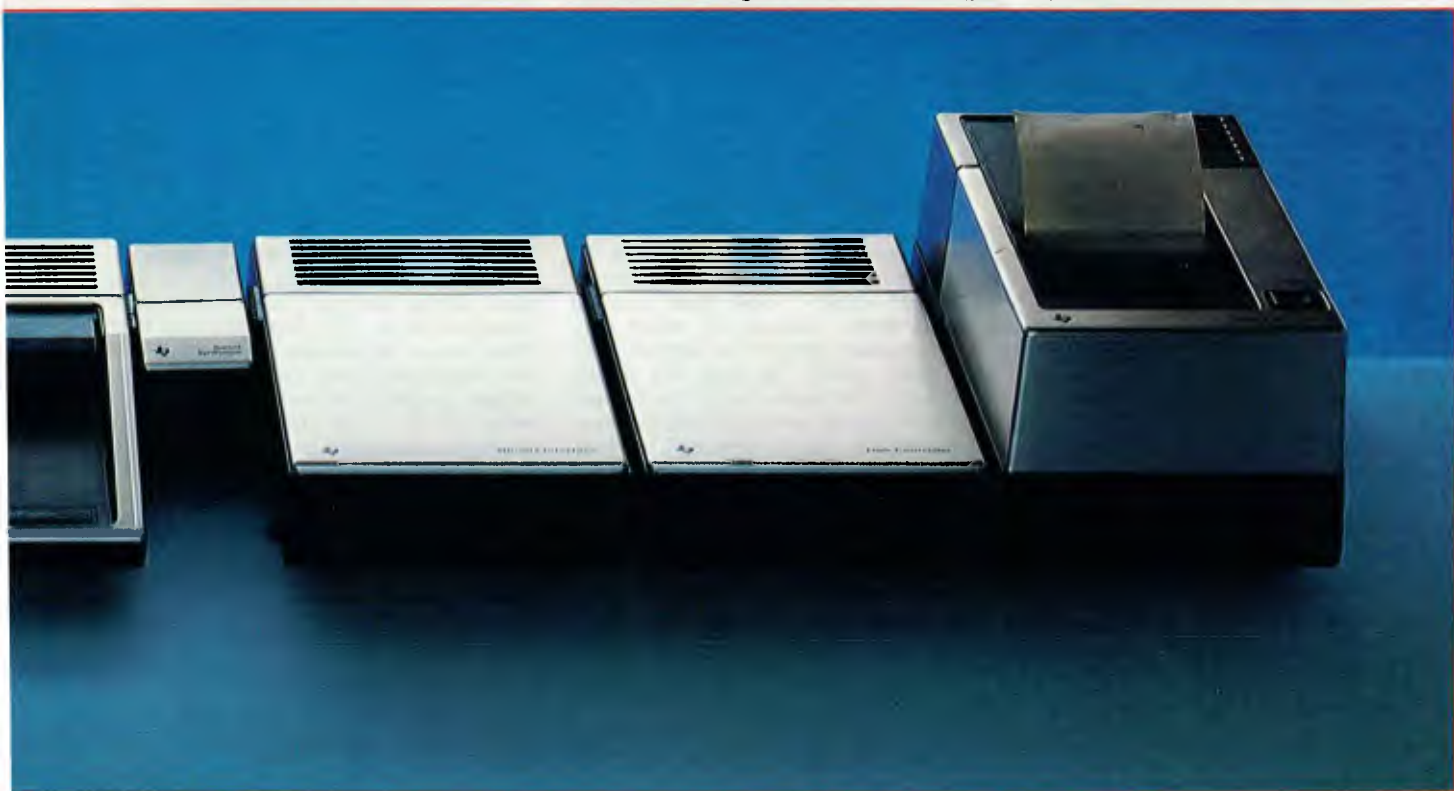
Calculator' is no longer available. The display on my colour TV was steady and the clarity was good, due mainly to the large characters (which tend to look a little clumsy). The character set under TI Basic is now 32 to 127 (decimal) inclusive in ASCII, which should include lower-case alphabets, but instead they are displayed on the screen as small capitals — a pity. There are also control codes in the range 129–159 dec, but these are not the conventional ASCII codes (the function keys take up some of the conventional ASCII control codes).

The screen can display 29 columns of 24 lines under TI Basic; the user's guide, however, says that there are only 28 print positions, which is also correct, because the first column is only used for the prompt character '>'. In graphics mode, the display is capable of 32 columns by 24 lines. Sixteen sets of eight graphics characters can be user-defined over the standard ASCII codes (ie, 32 to 127 dec), plus the range 128 to 159 dec. Each graphics character is in an 8 x 8 matrix, making the screen resolution in graphics mode 256 x 192. There are 16 colours, and the screen, character and character background can be defined by sets. The colours include transparent, which allows shapes to appear to walk 'behind' other shapes. Graphics screens have a border all round to allow for fall-off in edge definition on TV sets.

Peripherals and accessories are connected mainly by an edge connector behind a sliding shutter on the right

side of the console. Each accessory has a well-shielded edge connector socket on its left to mate with the console's edge connector, as well as its own right-hand edge connector behind a similar sliding shutter, allowing accessories to be connected in a tandem fashion. Connection and cascading the accessories was straightforward, with very little chance of error. With only one or two accessories attached the system still looks quite reasonable as the units are well matched cosmetically, but with three or more the set-up begins to look silly as well as occupying quite a wide area. I could not find anything in the documentation on any limits to the number of accessories one can connect in cascade, and the only rule appears to be to connect the speech synthesiser (if you have one) as the first item. The apparent unlimited length of attachments, apart from being physically cumbersome, could give some room for worry in terms of signal fan-out and shielding. On opening up two other accessories, I found that the signals were conducted through the units by a sort of 'motherboard', and both this and the logic boards were as well shielded as in the main console.

The accessories are the same as ones produced for the 99/4. The most interesting item is the speech synthesiser, which has a vocabulary of approximately 373 words including some phrases, numbers — represented both numerically as well as by the actual words — and the alphabet. The alphabet is 'spoken' as the names of the letters



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Speech synth has limited vocabulary

and not as the phonetics, which makes construction of words not already included in the vocabulary very difficult. I believe that the components used are those in the 'Speak and Spell' game. It would have been much better to have the phonetic alphabet as well as some of the more commonly used combinations such as 'ch', 'th', 'ing', etc. As it is, making up some words from a combination of the existing vocabulary is a very contrived effort and the results sound so, too. Apparently Texas has a new Emulator Command Module which should be able to give an unlimited vocabulary, but this was not supplied for the test.

The TI-99/4(A) Disk Controller module can control up to three mini-floppy disk drives, recording single sided, single density disks with a capacity of approx 90 kbytes per disk. The Disk Controller and each disk drive require a separate mains lead (as do most of the accessories) which makes for a high number of spaghetti-like mains leads on an expanded system. The disk drive connects to the controller by a ribbon cable with an edge connector

socket on the end; there's also a similar connector in the middle of the cable with an adaptor board to the existing drive to be daisy-chained.

Although the edge connector on the disk controller unit for the drives had a polarity cut-out in it, there was no polarity key in the connector socket on the drive's cable — and there was no mention in the manuals of which way the connectors should be aligned. The connectors could, in fact, be joined either way. The correct way was to have the cable coming upwards from the connector, which can be deduced by careful scrutiny of the diagram shown in the manual; of course, if the polarity pin was in the connector there would have been no problems. The drive supplied sounded very noisy, but it worked with no problems and with reasonable access times. Supplied with the controller was a command module, 'Disk Manager', which gives an operating environment for the disk system (but not quite to an operating system standard).

A thermal printer is also connected in the same manner to the system. This item I found very unimpressive, mainly

because of the print quality — or the lack of it. There appeared to be a strip toward the middle of the 9cm wide thermal paper where the matrix of the characters printed did not come out well. The printer prints 32 characters across the roll paper, and seemed of reasonable speed despite the fact it was rated at only 30 cps. There is a default character set of 128 characters and this time there is lower-case (although without descenders) and there are 32 predefined graphics characters using ASCII codes of 0 — 31 dec. User-defined characters can also be printed in code 32 — 159 dec, but these are restricted to a 5x7 dot matrix. A good point for the printer is that it is quite quiet.

The cassette cable supplied is again the same as the one for the original 99/4. It connects to the main console by DIN-type plug, and at the other end there are connectors for two cassette recorders; one of these is allowed to record and playback and the second is for recording only. The connectors are standard mini jacks which fit the microphone and earphone sockets of most commonly available cassette recorders.

TEXAN REVAMP

For each recorder there were provisions for remote start/stop control via sub-mini jacks, again the most commonly used fitting on domestic recorders. I tested the cassette interface/cable with a really cheap and fairly poor cassette recorder (which I keep specifically for equipment testing) but with good quality recording cassette tape. This combination worked well with the TI-99/4A once the volume level had been adjusted. I was impressed by the acceptable range of the volume level — it was around halfway (which was as recommended in the user's guide) with a tolerance in level adjustment of about a quarter each way. On playback a reasonably muted sound of the tape is relayed via the TV's speaker — a nice touch to give users confidence. There was detailed prompting from TI Basic when the cassette was called up by the SAVE and OLD commands, which I found a little pedantic, but it has the advantage of leaving very little chance of operating error.

A serial RS232 interface was also supplied for test. It connects to the main console or in cascade with another accessory by the same method as described for the others. The interface requires (yet another) mains lead, and provides two serial ports via standard D-type connectors. The interface used only seven out of the 25 pins, which is obviously a sub-set of the full RS232C spec. The ports are configured as for a computer/processor (ie, pin 2 is signal in, pin 3 signal out, 6 data set ready, 20 data terminal ready). Baud rates are from 110 to 9600 and these, as well as the number of data bits, parity, stop bits, null characters, checking of parity, echo (half/full duplex), are all selectable

by programming in TI Basic. There are also options to suppress carriage return and/or linefeed. For quick use there are default values for all the options (the default baud rate was 300). The command module — Terminal Emulator I — was designed to set up these options by commands and prompting. Also, as the name implies, it turns the TI-99/4A into a terminal. The set-up could then input via the RS232 interface and relay data to disk, cassette, thermal printer or out via the other RS232 port.

TI Basic

The main console works under TI Basic when there are no command modules plugged in. The version for this TI-99/4A looks identical to the one on the original 99/4. Running the standard Benchmarks show the timings are virtually the same as the APC Benchtest of the 99/4. Although the Benchmarks looked slow in comparison with most modern home computers, on balance the numeric accuracy and range is high, being accurate to 13 digits and with a range of $\pm 1 \times 10^{+/-128}$. This is as accurate as, and with a wider range than, even top of the line scientific calculators. The Basic is also quite comprehensive for setting up graphics; it has many sub-programs. This is evidence against reading too much into Benchmarks alone, without reference to the features and power of the language. A nice touch, retained from the original, is that in command and program entry mode the screen is a cyan colour; when a program is running the screen colour turns to green, then reverts to cyan once the program execution is stopped.

rity on the screen, so that when two sprites are coincident the higher priority covers the other. Sprites also pass over other (fixed) graphics characters on the screen. The MAGNIFY sub-program can enlarge all the sprites so that the moving objects can change size easily. I was very, very impressed. Two of the three sample programs listed in the Extended Basic manual for illustrating the use of sprites can give you an idea of the power of this feature. One of the programs generated several (up to 28) star-shaped objects on the screen which emerged from a first central 'star' in five colours, and all moved in different directions at different speeds on a black screen. The result was spectacular, but all this required only eight lines of Extended Basic! The other program was not as spectacular, but those of you who program moving graphics/animation will appreciate what could be involved in setting up the following sequence: two different coloured people walk across the screen, both swinging arms and legs; one of them walks through a stationary barrier while the other jumps over it. The jumping person walks faster and eventually catches the other, whereupon they are both reduced in size and continue to walk (when they reach one end of the screen they reappear at the other end) until the faster figure catches up again; it then disappears, leaving the other figure walking until the screen edge is reached and the program ends. Only 55 lines of Extended Basic were required for the whole sequence.

Other Modules

The Disk Manager module was supplied with the disk controller unit, as mentioned earlier. It provides commands or functions related to the disk system which are either not possible or inconvenient under TI Basic. A sort of enquiry and change environment is provided, allowing the expected functions for disk handling such as initialising disks, copying/backing up disks, directory, renaming, deleting, and protecting files. And there were some destructive and non-destructive (to existing files, that is!) disk tests. The only remarkable item was that the disk initialisation process took well over four minutes, whereas the manual says it takes about one. The disks I used were a couple of Verbatim disks and it didn't matter whether I specified 40 or 35 track initialisation.

The Speech Editor command module allows direct access to the speech synthesiser unit without having to execute the TI Basic commands of CALL SAY. One merely has to type in the required words with the correct separators/punctuations, press ENTER and the words displayed on the screen are spoken through the TV's speaker (that is, if all the words used are valid ones in the synthesiser's vocabulary—as mentioned, on the basic unit this was rather restricted). Unrecognised words are beeped and flashed at the bottom of the screen. One method which I found useful is to use ENTER on each word as it is inputted on the screen, followed immediately by a required separator; this way each word is confirmed, and correction by editing is only needed on the last word/phrase entered.

T1 BASIC WORDS

ABS	END	RANDOMIZE
ASC	RDF	READ
ATN	EXP	UBEM
BREAK	FOR-TO-STEP	RESEQUENCE
BYE	GCHAR	RESTORE-with files
CALL CHAR	GOSUB	RESTORE-with DATA
CALL CLEAR	GOTO	RETURN
CALL COLOR	HCHAR	
CALL GCHAR	IF-THEN-ELSE	RND
CALL HCHAR	INPUT-with files	RUN
CALL JOYST	INPUT-with keyboard	SAVE
CALL KEY	JOYST	SCREEN
CALL SCREEN	KEY	SEGS
CALL SOUND	LEN	SGN
CALL VCHAR	LET	SIN
CHAR	LIST	SOUND
CHRS	LOC	SQR
CLEAR	NEW	STOP
CLOSE	NEXT	STR\$
COLOR	NUMBER	TAB
CONTINUE	OLD	TAN
COS	ON GOSUB	TRACE
DATA	ON GOTO	UNBREAK
DEF	OPEN	UNTRACE
DELETE	OPTION BASE	VAL
DIM	POS	VCHAR
DISPLAY	PRINT-with files	
EDIT	PRINT-with screen	

T1 EXTENDED BASIC WORDS

ABS	INIT	PRINT USING
ACCEPT	INPUT	RANDOMIZE
ASC	INPUT (with files)	READ
ATN	INT	REC
BREAK	JOYST	REM
BYE	KEY	RESEQUENCE
CALL	LEN	RESTORE
CHAR	LET	(RETURN (with GOSUB))
CHARPAT	LINK	(RETURN (with ON ERR))
CHARSET	LINPUT	RND
CHRS	LOC	RESTORE
CLEAR	LOAD	RUN
CLOSE	LOCATE	SAVE
CONIC	LOG	SAY
COLOR	MOTION	SCREEN
CONTINUE	MAX	SEGS
COS	MERGE	SGN
DATA	MIN	SIN
DEF	MOTION	SIZE
DELETE	NEW	SOUND
DELSPRITE	NEXT	SPCET
DIM	NUMBER	SPRITE
DISPLAY	OLD	STR\$
DISPLAY ...USING	ON BREAK	STOP
DISTANCE	ON ERROR	STR\$
END	ON GOSUB	STOP
ERR	ON GOTO	SUBEND
EXP	ON WARNING	SUBEXIT
FOR-TO-STEP	OPEN	TAB
GCHAR	OPTION BASE	TAN
GOSUB	PATTERN	TRACE
GOTO	PEEK	UNBREAK
HCHAR	PI	UNTRACE
IF-THEN-ELSE	POS	VAL
IMAGE	POSITION	VCHAR
	PRINT	VERSION

TI Extended Basic

TI Extended Basic was supplied on a Command Module, which added an extra 36k bytes of ROM to the TI-99/4A. The TI-99/4A has 16k RAM as standard, expandable to 48k; there is 26k of ROM. Now, add the 36k of ROM and you have a possible total memory of 110 kbytes, whereas the normal maximum addressing range of the TMS 9900 is only 64k. The large memory is achieved by memory paging so there are quite a few command modules which are not accessible by TI Basic. TI Extended Basic retains all the features of TI Basic and adds around 40 extra commands or sub-programs. There are also enhanced or added features such as higher dimensions for arrays (up to seven from three), better and more informative error handling, protection on SAVE and LISTING, and others.

The most significant addition is the programming of 'sprites', which are programmable moving characters. These sprites provide very smooth movement on the screen, in contrast to the usual erratic jumping. Some 28 independent moving characters can be defined; all with different (or the same) velocities and directions (defined by horizontal and vertical components of velocity) and all on the screen at the same time. 'Internal' movements of a defined sprite character (eg, in a character 'walking', the movements of its arms and legs) can be achieved by changing in a PATTERN sub program, without having to redefine the whole sprite. Sprites are given priority, with the lowest number having the highest prio-

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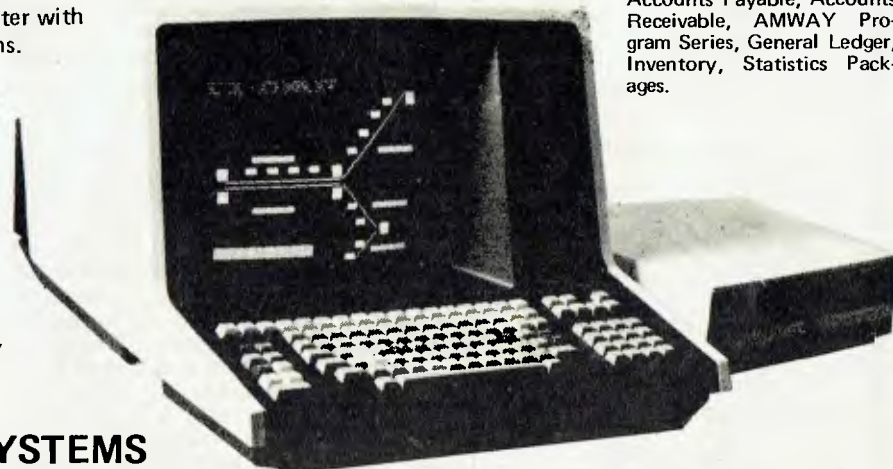
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TEXAN REVAMP

The rest of the command modules and software supplied were not tested in detail due to the lack of both time and space. Nevertheless, here is a very brief account of each.

Household Money Management — I looked at this in detail on the original 99/4 and this time round I found no significant changes — even the manual was the same. The module does what its name suggests; it sets up a budget account which allows cross referencing of up to 34 active categories (although up to 99 categories are available for you to select the active categories). Information regarding the budget can be displayed in tabular form or by coloured bar charts (useful for seeing trends). Detailed instructions are given in the manual for saving and backing up data, which is good, although only cassette was given as the recording device; I don't see any reason why disks could not be used though.

Video Chess, Blackjack and Poker are obviously games and are what the titles say. I am not expert or enthusiastic enough to give any valid comments on these, but I would venture to say that the Video Chess probably plays a reasonable beginner's game, as I had to resign when playing the beginner game in a late night session!

Addition and Subtraction 1 is a teaching program using colour graphics for illustrations, designed for youngsters. I was not very impressed with the disk-based Teach Yourself Basic course. It is basically a book on disks, lot of text with some interactive examples (good), but with no way of controlling your own rate of progress or skipping sections within 'chapters' — there is much to be said for the genuine random access of a conventional book.

Documentation

As you'd expect from Texas, almost all the documentation was of a high standard. Most was suitable for someone starting out, as well as for quick reference. This is really what's needed, and I hope other manufacturers will take a lesson from this. The exception is that some of the manual needs updating from the 99/4 to the 'A' version, although once the new function keys have been noted there's very little change from the original 99/4. Also, as already mentioned, the 'Read This First' leaflet requires immediate updating as it would give a bad first impression of the system and the documentation. The only real criticism is the lack of machine/hardware details (for example, a memory map) and explanation of the way the CRU is structured for the computer would be useful. As it was, and with the lack of facilities to get down to machine code level (although there is apparently an assembler available but not supplied), I was unable to get a memory map for the 99/4A.

Users

The TI-99/4A is aimed at the home user and hobbyist (I say the latter with reservations) and it is promoted as such. The reservation on hobbyists is the fact that the TI-99/4A works at quite a high level and was not really intended to be

used at machine code level; for example, absent are the usual PEEK, POKE and USR (or USER) commands, thus making any user modification/customising to the operation of the TI-99/4A almost impossible. Also the good construction but difficult dismantling does not encourage any hardware changes (which I suppose Texas would call 'tampering!').

But, having said that, the TI-99/4A is very suitable for those who do want to work at a high level with Basic (and Pascal is promised), and I would recommend anyone interested in moving graphics or animation to use it with the Extended Basic for a much easier life!

Competition

The price of the 99/4A puts it into the bracket of the new home computers such as the VIC and the Tandy Color Computer. In terms of money, the VIC is the cheapest of this group even when expanded up to 21k RAM; VIC colour graphics are about the same as the 99/4A in terms of resolution and the Basic is faster in the Benchmarks although not necessarily more powerful or accurate. But the TI-99/4A is the only one with sprites (with Extended TI Basic) and at the moment is the only one with convenient speech synthesis (probably only worthwhile with the speech emulator command module).

Prices and availability

Most items tested are already available, since the accessories were produced for the original 99/4. The machine is expected to be available in June or July of this year.

The price for the TI-99/4A main console is reasonable and competitive; the accessories, although again reasonable, tend towards the high side.

TI-99/4A around	\$800
Speech Synthesiser	\$149
Disk Controller	\$329
Disk Drive	\$699
32k RAM expansion	\$359
Thermal Printer	\$439
RS232 Interface	\$249
Wired Remote Controls	\$44
Cassette Cable	\$29
Command Modules or plug-in ROMs	vary in price according to program, range is approx \$20 to \$100 (no price for Extended Basic).

All prices inclusive of tax.

Conclusions

Despite the chequered history of the 99/4, I liked the TI-99/4A — especially for the Sprite facilities in Extended Basic.

All accessories and command modules worked without fuss, even if they may not have been the best I have come across. The exception was the thermal printer and I can see no advantage of this printer over a cheaper type like the ZX-81 or the ones for the new Casio pocket computer. The problem-free operation is the sort of high standard users expect and want.

Documentation was generally excellent and users should not accept less from other manufacturers.

Speech synthesis was novel but restrictive in the basic unit; it would probably be much better value with the speech emulator command module, provided this plug-in ROM is not priced too high.

The most significant improvements to the 'A' version over the original are the price and the keyboard (which is more robust and suitable for home use — it was extensively tested by my three year-old son!).

Whether I would buy one at the price is debatable; it is reasonable value for money even in comparison with the latest home computers, but the facilities offered (and the lack of low level access) are probably not what I would look for in a computer. Nevertheless, for the moment the sprite facility and the speech synthesis make the TI-99/4A something special, and it may be just what you are looking for.

END

Benchmark Timings

for TI Basic (timings in seconds)

BM1	3.0	BM5	26.2
BM2	9.0	BM6	61.9
BM3	24.0	BM7	84.6
BM4	24.8	BM8	38.4

for extended Basic

BM1	6.5	BM5	42.0
BM2	18.5	BM6	98.4
BM3	40.0	BM7	140.3
BM4	40.1	BM8	24.0

(note despite the fact Extended Basic runs slower than TI Basic, BM8 actually runs faster with Extended.)

Technical specifications

CPU	: TMS 9900 16-bit micro
ROM	: Internal 26K (TI Basic takes 14K), command modules can add up to an extra 36K
RAM	: 16K internal, using 4116 dynamics. Expandable with an extra 32K,
Keyboard	: Typewriter style with 48 keys
Display	: Uses domestic TV, gives 29 x 24 lines under TI Basic, 32 x 24 (or 256 x 192 resolution) plus three layers of 16 colours in graphics. (under Terminal Emulator I the screen is 40 ch x 24 lines)
Cassette	: Domestic audio recorder
Ports	: Edge connector for accessories (can connect in daisy chain), cassette, and for remote controls.

FMS80 – A FILE MANAGEMENT SYSTEM

Continuing her series of database Benchtests, Kathy Lang reviews another CP/M-based system

FMS80 provides a wide variety of data management facilities for CP/M systems plus a number of others including CP/M-86 and Unix. It may be used either through the supplied programs, which give most of the common requirements, or through a special programming language called RFM, which gives the user 'building blocks' with which to assemble programs to meet pretty well any data management need. When used through the supplied programs FMS80 can process just one data file at a time; using EFM the user may access up to 19 files in a single processing run. For each file FMS80 must know the data structure, which must be the same for each record, and the way in which it is primarily to be indexed. This index is used for writing records in the file; it may be read by using this index, or by others constructed from any field in the data record. FMS80 originates in the US, but full support is available in this country from John F. Rose Computer Services and distributors.

Constraints

FMS80 stores data using one record for each set of data items; a record may contain a maximum of 255 items, each up to 255 characters long. All data items except the last in a record must be fixed in length; the last may be variable length, with the maximum length specified when the file is defined. Data may be characters or numbers; numbers are stored as integers. No special data format is provided, so dates have to be stored as Year-Month-Day for them to be sorted properly. There is no need to specify the number of records required when filing is created, and extra records may be added at will. Not so with extra fields, however; there is no supplied program to add fields to an existing file definition, although it is reasonably easy, using EFM, to create a new file with extra data items and to copy an existing file into it under EFM — an example EFM program to do this is given in the manual.

FMS80 uses a rather curious method of allocating files to disk drives. The system normally uses a special file called LOCATE.SYS, which tells it what drive to use for files of every kind of suffix known to FMS80. For instance, data files are created with a .DAT suffix, and

all such files are created on one drive, specified by LOCATE.SYS. The user can change this destination but only for all files of that suffix. To be sure, this is an improvement on systems which put all the user's files on the B drive willy-nilly, but it has real limitations for users who want neither to write their own EFM programs nor to use the facility for manual specification of the disk to be used for every file.

Data input and updating

Before data can be input to an FMS80 file, the record structure must be defined. This is achieved using a crude screen editor, which allows you to enter the name, type and length of each record; for numeric data, you may also supply a 'picture' which shows how it should be printed. For instance, a number is always stored as an integer but it may be printed with a decimal point in any desired position. The screen editor displays the data items defined so far in the top half of the screen, while you enter the next data item in the bottom half. Once complete, the item is moved up into the middle of the list of data items, not appended to the end. I found this a bit confusing, especially when I was defining a large record — not all the items could be displayed at once, and I was shown the first five and the six most recent items, rather than having a sequence displayed. During editing, the cursor is moved by pressing letters — D for Down, etc, as the installer is not given the option of providing the codes for cursor movement even if the terminal has them.

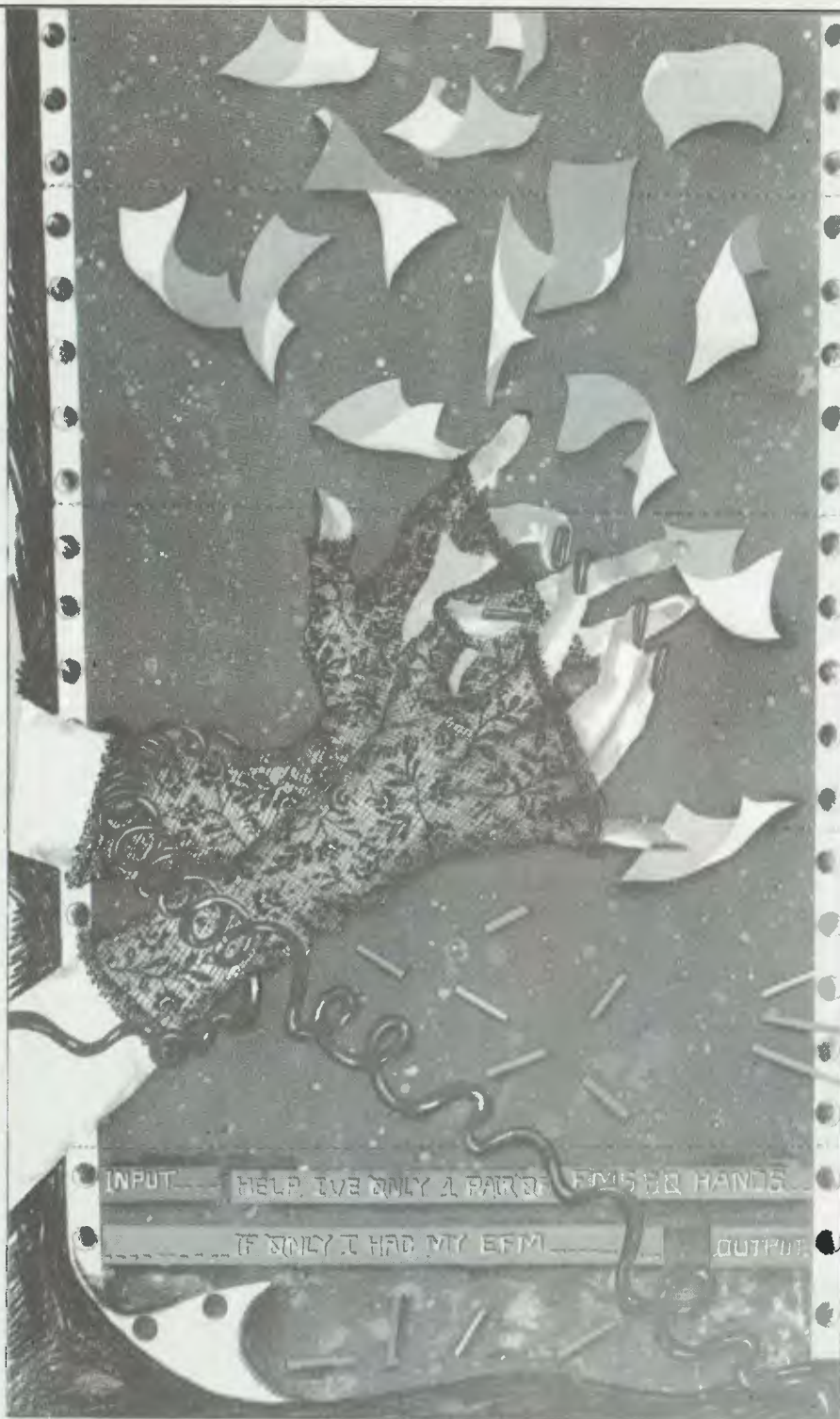
The data definition file may be edited at will until data is entered into the file. Once the file contains data, you can only change the definition by copying the data into another file via an EFM program, to safeguard you against accidental corruption of live data. Before you can input data initially, you must define a control file to specify the keys to be used to index the file for input, initial sorting and updating purposes. One field must be the primary key, and others may be used as secondary keys; none need occupy any special position in the record. The values of

these key fields in combination must be unique.

The index thus created for updating purposes may also be used for retrieval in reports, or you may create other indexes on any fields you wish for reporting purposes. The indexed records may be accessed in ascending or descending order. The ways in which the data file is indexed are quite separate from the order in which the data is stored; you may keep the records themselves sorted in any desired order or you may simply use the indexing function to access them in any order you need. If you rely solely on indexes for ordering, there will be some limitations on your ability to access the data in a particular order, as you will see from my comments on reporting.

Initial data entry and updating are usually done using the TRANSACT feature. Records may be marked for addition, change or deletion; the system forms a transaction file from these instructions, which is then used to modify the master file as a batch operation. Any records for which an appropriate instruction has been given — for instance, a record marked 'delete' which did not exist in the master file — are written to a reject file, which may be edited and subsequently resubmitted to TRANSACT. The user can input data either by using the system's own prompts, or by means of a screen definition which can give additional prompts or restrict access to parts of records only. If the procedure supplied by FMS80 is used to carry out the full updating process, then the master index is updated as the data file is amended.

This combination of interactive data entry with batch updating of the master file is used to prevent errors at a crucial time; the data file is open for writing for the minimum possible time. However, there is also an online updating facility, which uses the same QUERY program that gives the user the ability to display records on the screen. The documentation advises against using direct updating because it is less safe, and FMS80 allows you to disable this function. You might well want to do this, since there is no transaction logging for online updating, ie, no printing record is made of your amendments when you make changes using the QUERY feature. QUERY can in any case be used only to



change existing records — no additions or deletions are allowed — but you could change key fields in existing records, and thus render the master index inaccurate unless subsequently reconstructed and resorted in key order.

Displaying your data on the screen

The main method of screen display uses QUERY. This gives access by key to any file, by any key or keys for which you have constructed an index. Access is very fast — not more than three seconds for any record in the file of 1000 records I used for testing. Individual records can then be displayed by giving the key or keys for the index you are using. You don't have to know the whole of each key for character fields but you must know at least the

first character of each, and for numeric fields you must be exact. For instance, I used as my test file a set of records of products, which included the price of the product and its type. I produced a subset of my data which included records of a particular type, whose price was greater than a specified amount, and indexed it on the price key in order to inspect the records in ascending order of price. However, as price was of course a numeric field, I could only persuade QUERY to display a record to get started if I knew the exact price of at least one product. Once begun, one can scroll forward and backward through the file at will. But it does put rather a premium on understanding exactly how selection and indexing interact with the display procedures to get the desired effect.

The only alternative to indexed access for screen display is to use one of

the printing programs to display on the screen instead. However, diverting printed output to the screen can only be done by changing an entry in LOCATE.SYS. and that affects all the printing routines until the entry is changed back again.

Reporting on your data

FMS80 provides two ways of getting printed reports on files. One is a 'quick and dirty' routine, which simply prints each record using the item titles given in the data description file. The more sophisticated REPORT program involves setting up a report definition file to describe the layout needed for a particular report. These definitions can be reused and edited as necessary — a great time-saver. As is common with such facilities, the layout of the printed page is described in terms of absolute row and column numbers, so that it is a bit tricky to insert new items in the middle; the screen definition facility used with TRANSACT and QUERY describes the screen in the same way. The report generator uses a quite sophisticated set of accumulation procedures, enabling you to produce reports consisting of accumulated totals, or reports which print parts of each record and give summary totals at break-points in the records. This is particularly valuable where you have several subsets of data — information about, say, people in several different departments in a company. You can supply headings or titles for anything you can print.

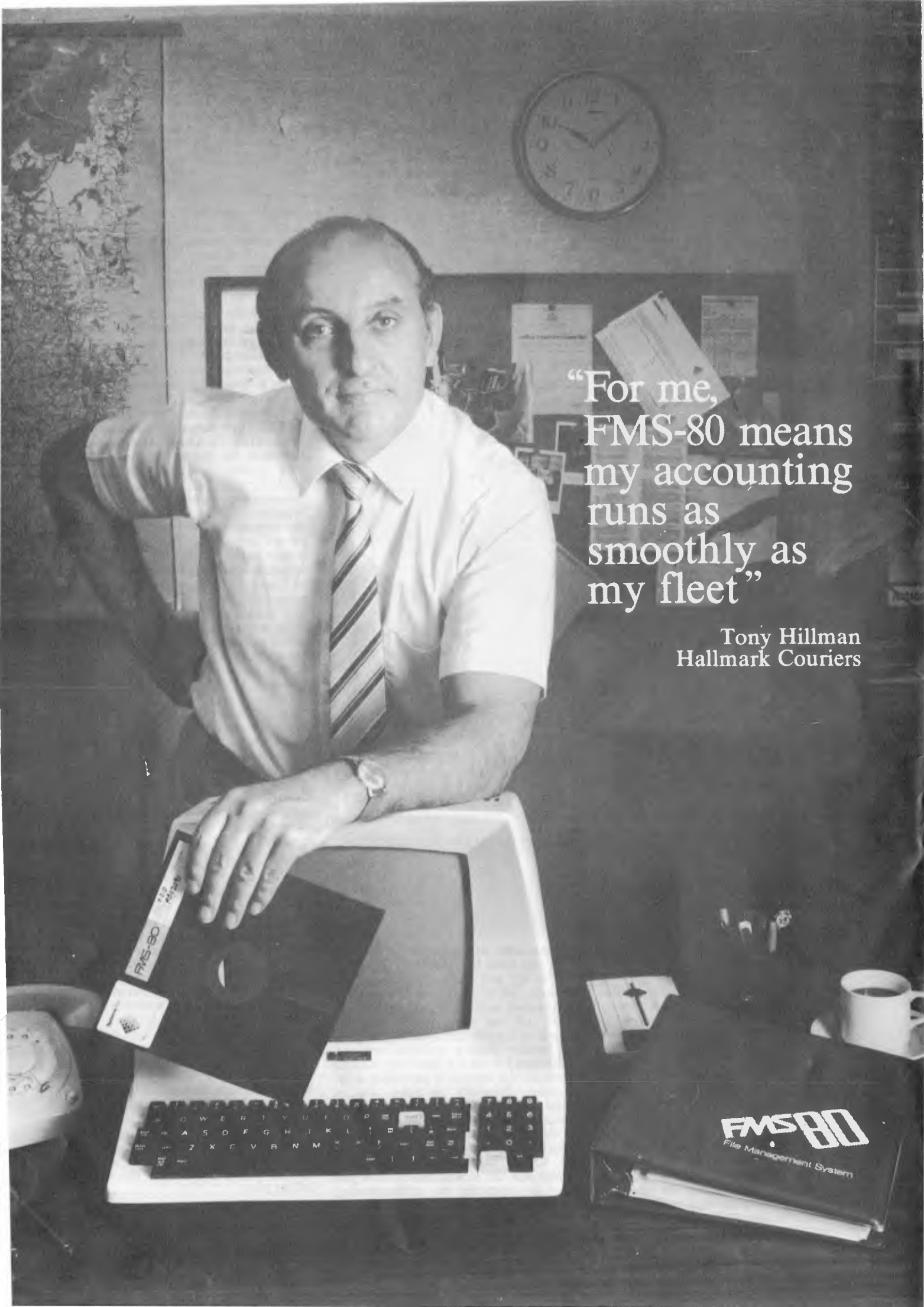
Like most FMS80 facilities, the report generator can be invoked via one of the menus within FMS80, or direct from CP/M. When run from CP/M, you may specify an index file rather than a data file as the 'subject' of the report, and your report will appear in the order specified by that index. In either method of running, if there is a selection file (specifying a subset of the data) which has the same name as the report definition file, it will automatically be used and the report prepared using that subset.

Selecting sets of records

I've mentioned the selection facilities already: you can set up a file containing a set of selection criteria to be applied to a data file before it is processed by the programs which produce printed reports, sorted files and subfiles. Depending on the circumstances, the selection is used to select records for processing or actually to produce a file containing the required subset. Selection is done by combining tests into groups to give the effect of bracketing, with the ability to apply AND and OR tests between groups. Individual fields can be selected if equal to a constant (not another field in the record) or within a range of values. You can't edit a selection definition — if you give the editor the name of an existing selection file, it simply reuses the file without telling you.

Sorting records

The sorting procedure can be used either to sort a complete file, or to sort



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my accounting
runs as
smoothly as
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Hallmark Couriers

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By early last August, Tony Hillman had problems. Tony heads the fastest growing courier service in Sydney. In just over 2 years his turnover had grown over 700%. Servicing the advertising industry, he knew speed, service and efficiency were crucial. He knew time meant money and he knew he was wasting it. A manual job record and accounting system was holding the company back; he and all the staff worked back until 1am to get out the month's invoices. And because he had to pay his drivers fortnightly, his cash flow situation was getting difficult. He had to invoice fortnightly. Tony needed a solution. One which could cope with 387 clients and over 15,000 transactions per month and run his invoicing and accounts. And have the flexibility for future growth.

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Or maybe tailoring reports to have just the information in them that you want, or it might be FMS80's ability to work in

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FMS80's inbuilt maths function can provide you with summaries, price extensions and line totals.

If you already have an accounting program FMS80 will very likely tap straight into your existing files. This means flexible financial forecasting with complete control of future variables. Answer all those 'what if' questions straight off your existing files. No rekeying of data. So if you think you have an application, contact us right away. We will show you how FMS80 will run in your application.

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Glower & Assoc. JFR/6



FMS80

a particular index. Sorting may be in ascending or descending order, on any combination of fields in a record, but these must be complete fields — you can't for instance, sort on the first three characters of a field when sorting a data file. In most circumstances, it is sufficient to produce a sorted index and use that to access the data file. Indexing and sorting are related facilities but are not explicitly tied together in most circumstances. I got in quite a muddle early on by not realising this — the fact that the procedure to set up a control file for indexing and sorting purposes is called DEFSORT doesn't help — and accessed a file via QUERY which I had indexed, but I had not sorted the index. As a result, QUERY couldn't find large chunks of my file, much to my consternation! A user would be well advised to set up a command file to tie the two together — a simple and flexible process.

Calculations

Manipulation of totals and fields can be done readily and flexibly within the report generator, provided you don't mind doing arithmetic without brackets — perhaps in most commercial applications this wouldn't be a serious problem. If you want to calculate changes of fields within records and store these changes — you might, for instance want to increase all your prices by 5% — then you must write a short EFM program to do it. I found this quite straightforward to accomplish.

Security

The modular structure of FMS80 makes it quite a simple matter to build subsets of the facilities so that people have access only to the functions they need, as well as just the data files they need. As far as the access to data is concerned, there is no password protection for data files, but you can have people use the query facilities via the special screen masks which let them see only the data items you want them to see. The need to specify keys fairly exactly, which can, as I've noted, be a nuisance for the data manager, becomes a virtue in helping to curb unauthorised access to confidential data.

Tailoring

The facilities for tailoring FMS80 to meet the user's special needs are among the best I've seen in standard packages. There are three reasons for saying that. Firstly, there is the programming language EFM, which has a Basic flavour — but has statements specially designed for data management applications. EFM allows you to have up to 19 files in use at once, so you could use a field in records in one file to index records in another. Files can be read sequentially, or by using indexes built by FMS80. There are three types of conditional statement (although you can't nest the IF... THEN... ELSE type) and you can make use of existing FMS80 files such

as file descriptions to speed up data declaration. There are a few nuisance points — you must have an input file and an output file statement, even if they're null; you can't use brackets or decimals in arithmetic; and fields are, as everywhere in FMS80, referred to by number which makes it difficult to make minor changes. A more serious deficiency is the absence of parameters for subroutines. But I have yet to think of something I might want to do to my data that I couldn't accomplish in EFM, albeit with some juggling in some cases. I also found it easy to use; I never took more than two runs to get a program compiled, and they all ran correctly first time, which is a personal all-time record. I don't know, though, how someone with no programming experience would get by — I found the tutorial on EFM much harder to understand than the reference chapter, mainly because it dived straight in to examples without giving me any idea of EFM's purpose or structure.

The other tailoring features I haven't yet mentioned are the user-supplied menus and the command files. You can add complete menus of your own to FMS80, and use them to call up not only FMS80 functions but also other CP/M programs as well. So you could have a menu which used FMS80 to set up a subfile in a particular format (using EFM) and then invoke WORDSTAR, say, to send those selected people a standard letter. The command facility allows you to set up a file of FMS80 commands for use either from CP/M or from user-defined or FMS80 menus, and gives the ability to substitute parameters, such as file names, when the command file is invoked.

User image

I have distinctly mixed feelings about the user-friendliness of FMS80 — 'tries hard' about sums up my overall reactions. My main problem was the lack of any attempt in the documentation to give a model of the way the package worked, a peg on which to hang the detailed information about the facilities. There were lots of examples in the tutorial sections of the manual, and also drawings of what the screens looked like, both essential features. But, after the tutorials, the manual dives straight into the reference material, which consists of a description of each element of FMS80 in alphabetical order — so some feeling for structure is essential by then. The manual also had several Application Notes, which I found quite helpful, but they were much more Function than Application oriented, and I thought a user would have some trouble relating them to real problems. However, the manual did appear to be comprehensive, itself not a universal trait — I did manage to find pretty well everything I needed to know by reading it carefully. The package itself provides an overall menu, from which one accesses three sub-menus dealing with different functions. They were divided rather arbitrarily, and I sometimes found it hard to remember where a particular facility was. A diagram showing how the menus related would have been very helpful. Almost all the functions can also be invoked from CP/M, often giving access to a wider variety of facilities

within the program in that case. That makes it easy for new users to get started with the menus, then to move on to greater sophistication as they become experienced — unusually considerate. All the menus are in capitals, which I don't like — and nor do the reading buffs. I also found the frequency with which I was asked to confirm my responses a bit overpowering — confirmation needs to be used sparingly to avoid crying 'Wolf!'. There are several circumstances in which one must 'confirm with Y or N' on one line, and then on the next confirm with a file name or say 'no' by pressing RETURN. Several times I typed N then instead of pressing RETURN, and later found myself in trouble because the system tried unsuccessfully to locate a file called N!

Stability and reliability

FMS80 has been available in this country for some time but has not until recently been much publicised or supported, so there are few users as yet; in the States it is in widespread use, and the American reviews I've read speak highly of its reliability. Upgrades to the system come out from time to time, and are distributed to existing users at a cost, at present, of \$US50 — which includes, I'm told, a complete reissue of the manual. As far as my own efforts to use the package are concerned, I didn't come across any complete failures in the system, though I did manage to find what seemed to be a bug in the sort routine, which didn't fail gracefully when I tried to sort out a file on a disk without enough space for the merged output.

Costs

FMS80 costs \$1100 for the complete package, supplied programs together with EFM, and some support and training.

Conclusions

FMS80 might be called a Fairlane at Falcon prices: using EFM you can achieve most things you might need to do in data management if you had some programming ability, but if you buy the complete package it is among the most expensive data management packages on the market. I found some excellent facilities mixed in with rather poor presentation, and some areas in which the package of supplied programs was rather weak, notably the manipulation of numeric data. I would expect it still to be of more interest to the larger organisation wanting to tailor a package to suit a variety of applications, than to the very small concern without either specialist staff of its own or outside help to tailor the package to their needs.

FMS SOFTWARE AND HARDWARE FOR CP/M BASED SYSTEMS

Agent for: Lifeboat Associates, Sigma International, Compuviv, Westico, Memtech, Anderson Digital Equipment, AWA.

Software Available

New products appear in green.

System Tools:

BUG and uBUG
DESPOOL
DISLOG
DISTEL
EDIT
EDIT-80
FILETRAN
IBM/CPM
MAC
MACRO-80
MINCE
PASM
PLINK
PLINK II
PMATE
RAID
Reclaim
SID
TRS-80 Model II Customization Disk
Unlock
WordMaster
XASM: 05, 09, 18, 48, 51, 65, 68, FB, 400
XMACRO-86
ZAP80
ZDT
Z80 Development Package
ZSID

Telecommunications:

BSTAM
BSTMS
MicroLink-80
RBT-80

Languages:

ALGOL 60
APL/V80
BASIC Compiler
BASIC-80

baZie II
BD Software C Compiler
CBASIC-2
CIS CDBOL (Standard)
CIS COBOL (Compact)
COBOL-80
FORTRAN-80
KBASIC
muLISP/muSTAR-80
Nevada COBOL
JRT Pascal
Pascal/M
Pascal/MT
Pascal/M +
Pascal/Z
PLI/80
STEEL UPPER LISP
S-BASIC
Tiny-C
Tiny-C Two
UCSD Pascal
Whitesmith's C Compiler
XYBASIC

Language and Applications Tools:

BASIC Utility Disk
DataStar
FABS
FABS II
Form 1 for CIS COBOL
Form 2 for CIS COBOL
MAGSAM III
MAGSAM IV
M/SORT for COBOL 80
PSORT
QSORT
STRING/80
STRING BIT
SUPERSORT
ULTRASORT II
VISAM

Word Processing Systems and Aids:

Benchmark
MicroSpell
Letterlight
Magic Wand
Scribbler
TEX
Textwriter III
WordIndex
WordStar
WordStar Customization Notes

Data Management Systems:

CONDOR
HDBS
MDBS
MDBS:DRS, QRS, RTL
dBASE II
PRISAM/LMS
PRISAM/MS
PRISAM/ADS

General Purpose Applications:

CBS
Selector III-C2
Selector IV

Mailing List Systems:

Benchmark Mailing List
Postmaster
Mailing Address
MailMerge for WordStar
NAD

Financial Accounting Packages:

BOSS Financial Accounting System
Peachtree Financial Packages

Structured Systems Group Financial Packages

GLocator

Numerical Problem-Solving Tools:

T-MAKER II
Ipi
PLAN80
Analyst
Microstat
muSIMP/muMATH
Statpak

Professional And Office Aids:

Angel
American Software Property Management Package
Cornwall Apartment Management
Datebook
ESQ-1
Guardian

Professional Time Accounting
Property Management
PAS 3 Medical
PAS 3 DENTAL
Sales Pro

Univair 9000 Series Family Medical Management
Univair 9000 Series Family Dental Management
Univair 9000 Series Insurance Agency Management
Univair 8000 Medical Management
Univair 8000 Dental Management
Wiremaster

Books, Periodicals, Accessories

APL—An Interactive Approach
Accounts Payable and Accounts Receivable-CBASIC
The CP/M Handbook (with MP/M)
The C Programming Language
8080/Z80 Assembly Language Techniques For Improved Programming
Fifty BASIC Exercises
General Ledger-CBASIC
H.W.Sams Crash Course in Microcomputing
Introduction to Pascal
Lifelines
Pascal User Manual and Report
The Pascal Handbook
The Pascal Primer
Payroll with Cost Accounting—CBASIC
Structured Microprocessor Programming
Using CP/M—A Self-Teaching Guide
Smartmodem
DC Data Cartridges
Flippy Disk Kit
Floppy Saver
Diskette Drive Head Cleaning Kits
Vari Clean Cleaning Kit

Disk Operating Systems

Software Bus Family
SB-80
CP/M-80
MP/M

Hard Disk Integration Modules

Media and Formats

These are diskette, cartridge disk and cartridge tape format codes, to be specified when ordering software for listed computer or disk systems. All software products have specific requirements in terms of hardware or software support, such as MPU type, memory size, support operating system, or language.

New formats appear in green.

ADDS Multivision RT
Altair 8800 B1
Altos A1
Apple CP/M-80 13 Sector RG
Apple CP/M-80 16 Sector RR
BASF System 7100 RD
Blackhawk Micropolis Mod II Q2
CDS Versatile 3B Q1
CDS Versatile 4 Q2
Columbia Data Products 8 in. A1
Columbia Data Products 5.25 in. S4
COMPAL-80 Q2
Computer Ops N.C. HQ S2
CPT 8000 A1
Cromemco System 3 A1
Cromemco System 2 SD/SS R6
Cromemco System 2 DD/SS RX
Cromemco System 2 DD/DS RY
CSSN Backup T1
Data point 1550/2150 A1
DEC VT 18X SD
Delta Systems A1
Digi-Log Microterm II RD
DTC Micro 210A RC
Durango F-85 SL
Dynabyte DB8/2 R1

Dynabyte DB8/4 A1
Exidy Sorcerer + Lifeboat CP/M-80 Q2
Exidy Sorcerer + Exidy CP/M-80 5.25 in. RW
Exidy Sorcerer + Exidy CP/M-80 8 in. A1
EXO A1
Findez P6
Heath H8 + H47 A1
Heath H89 + Magnolia CP/M-80 P7
Heath H89 + Heath CP/M-80 P7
Helios II B2
Hewlett-Packard 125, 5.25 in. SB
Hewlett-Packard 125, 8 in. A1
IBEX 7100 RQ
iCOM 2411 Micro Floppy R3
iCOM 3712 A1
iCOM 3812 A1
IMSAI VDP-40 R4
IMSAI VDP-42 R4
IMSAI VDP-44 R5
IMSAI VDP-80 A1
Industrial Microsystems 5000 RA
Industrial Microsystems 8000 A1
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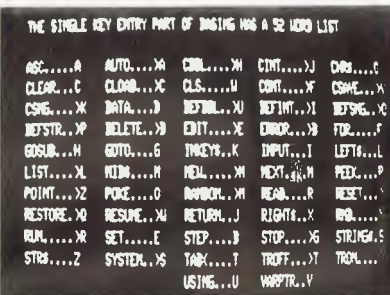
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Since the benchtest of FMS-80 was conducted, there have been several alterations worthy of note. Graeme Domm speaks to John Rose, MD of the Australian supplier of FMS-80.

A number of corrections must be made to APC's benchtest article, according to Mr Rose. First, FMS-80 is not available for CP/M-86 and Unix at this stage. At present, it only provides data management facilities for CP/M systems though expectedly it will also cater for CP/M-86 by October.

As for the system having no special data format, Mr Rose says he has developed a special set of Julian data routines, available for \$180.

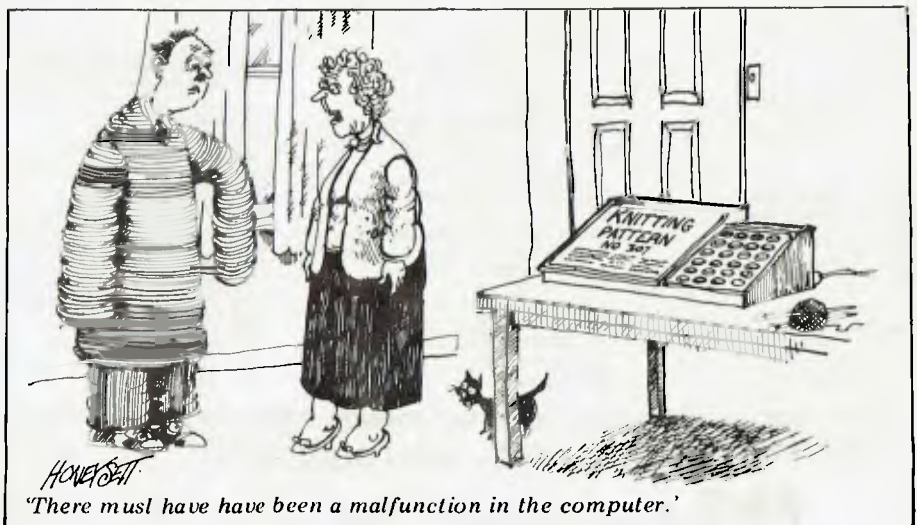
Mr Rose says a new manual is now out, which will dispel criticism of the tutorial on EFM.

While Mr Rose accepts the criticism that some other packages are better for particular applications, he argues that FMS-80 offers flexibility across several applications.

John F. Rose will supply complete turnkey systems for those who want them. A typical price for a complete turnkey system using FMS-80 would be \$10,000 - \$14,000, not including the software price. The system offered by Rose is the company's own Opal 4000, with double density disk drives.

Mr Rose's company will customise FMS-80 for a fee of \$35 per hour, or \$350 per day. Mr Rose also conducts one day seminars on FMS-80, at a cost of \$350.

More information on the product is available from Mini Micro Supermart at 33 Atchison Street, St Leonards (ph: [02] 439-1628). Dealer inquiries can be made to John F. Rose Computer Services at the same address. The 'phone number for John F. Rose is [02] 439-1220.



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SCREENPLAY

This month Dick Olney reviews

games for the TRS-80 Model I.



The games I've been looking at this month all run on the well-established Tandy TRS-80 microcomputer. I was supplied with a basic Model I carrying 16k of RAM (it uses the Z80 processor) and including a CTR-80A cassette deck. This configuration would cost \$668.95 (inc tax) and plugs into a domestic television. The TRS-80 was an early entrant in the micro scene and has built up a considerable share of the market. It is a fully expandable and

versatile machine and, though the lack of colour or high resolution graphics severely limits its capacity as a games unit, it has built up a considerable stock of this type of software.

Tandy has more recently brought out its colour computer, which I shall be

looking at later on in the year, but on the Model I the graphics-oriented games are necessarily much less sophisticated than on the machines I have previously reviewed. Many of the games include simple sound effects which can be directed through a standard hi-fi system or — as in my case — you can use a mini-amplifier box. I have looked at a varied assortment of games which I believe is fairly representative of the vast selection available.



GAME: Pyramid of Doom
SUPPLIER: Compshop Australia
PRICE: \$24.50

This is a standard Adventure game set (as the name suggests) in and around an ancient pyramid. I have to admit it took me five hours even to get inside the pyramid, though the frustration of this served mainly to increase the satisfaction of my eventual success. Most of the objects and rooms inside the pyramid are much as you'd expect (a notable exception being the giant oyster!), though there are plenty of original problems for you to wrap your mind around. I would have expected a slightly more extensive configuration for the money and the 'astral guide' is a bit ingratiating and humourless compared with others I've seen, but

nevertheless this is a well designed program from what must be considered an expert in the field. The package gives an 'average completion time' of one month. I've no idea of exactly how this is arrived at — but either way its an exaggeration, I would think about 50 hours' continuous play is nearer the truth.

PRESENTATION: ****
COMPLEXITY: *****
VALUE FOR MONEY: ***

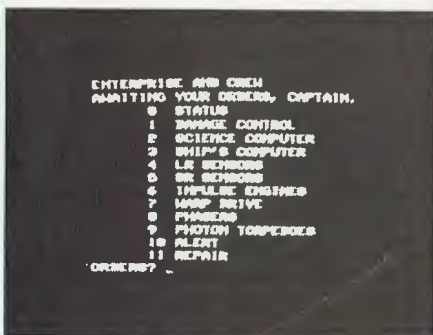


GAME: Dancing Demon
SUPPLIER: Tandy
PRICE: \$14.95

More of an entertainment than a game really — but unusual enough to demand a mention. Using simple alphabetic codes, you develop dance routines for a character looking more like a friendly alien than a demon, who inhabits a simple stage (the graphics are basic but effective). Fundamental tunes are superimposed on the performance, again using an alphabetic code (which is simple once you get used to typing 'A' for 'C' and 'B' for 'C#' etc). All in all you have 25 notes and 26 different stops to concoct a string of 248 action/note elements, and its quite easy to create all sorts of bizarre results (hence giving your support to the

'Inane uses for new technology' lobby!). This one looks like it was originally written for sales demonstrations and later marketed to prevent salesmen giving it away with the machine. It does inspire overwhelming desires to give demonstrations to friends (neighbours, traffic wardens, cats — well anybody really!) and this, along with its novelty value, probably makes it worth the seven quid; although I'm sure I'd get heartily sick of it before very long.

USE OF GRAPHICS: ****
PRESENTATION: *****
ADDICTIVE QUALITY: **
VALUE FOR MONEY: ****



GAME: Star Flite
SUPPLIER: Compshop Australia
PRICE: \$19.50

The latest version of the old favourite. Your mission is to explore all 'M-type' planets in a section of the galaxy divided into 192 quadrants, killing any Klingons you might meet on the way. The galaxy is conceived as three-dimensional, thus giving an 8x8x3 matrix. All of the standard Star Trek features are included — short and long range scan, computer facilities, warp and impulse engines, phasers and photon torpedoes. You also have an option for 'alert stations', which in fact determines the power given to the deflector shields. The long range scan representation of a three-dimensional galaxy is confusing to begin with, as

are the headings you use with the impulse engines (running zero through nine anticlockwise, where zero is west). Still, there's plenty for both novice and expert to get their teeth into with good graphics and limited sound effects. If you use a TRS-80 and don't yet own one of the many versions of this game available I'd recommend this one — well worth the money.

USE OF GRAPHICS: *****
PRESENTATION: *****
VALUE FOR MONEY: *****

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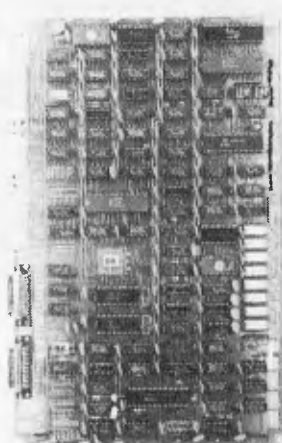
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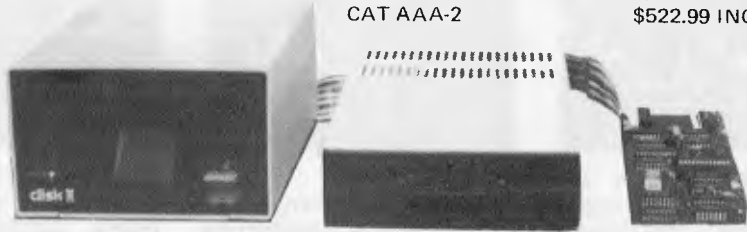


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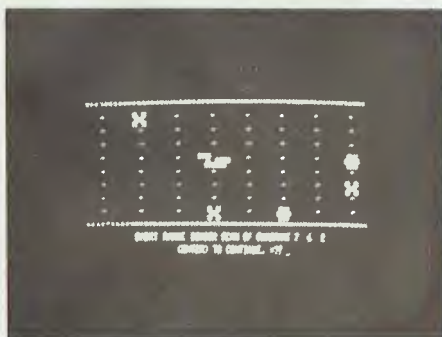
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GAME: Invasion Force
SUPPLIER: Tandy
PRICE: \$24.95

Tandy's version of Star Trek combines all the standard features with limited

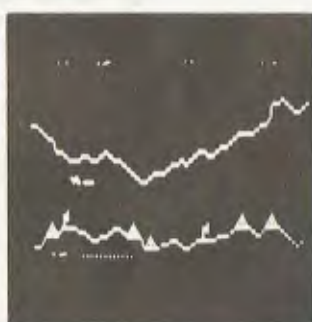
real time action and rather poorly designed graphics. Status reports, long and short range sensor scans and power distribution are all displayed at the same time on a rather overcrowded screen — nice idea, but my feeling is that it makes the game less interesting. The battleground is a two-dimensional 10 x 10 matrix of 100 quadrants, and the object is simply to destroy as many 'Jovians' as possible. The standard beam and projectile weaponry (here referred to as 'Masers' and 'Triton' missiles) are complemented by 'Antimatter' pods and an experimental ray which — if you're lucky — can be used to destroy groups of enemy craft. One other interesting feature is the ability to control the power distribution between *all* the major ship's functions — thus making

the most economical use of your energy. Movement and battle happen in real time, but because of the design I'm not sure that the game is necessarily enhanced by this attribute. All in all, if you want a game of this genre (which is undoubtedly the case), then you can probably do better than this one.

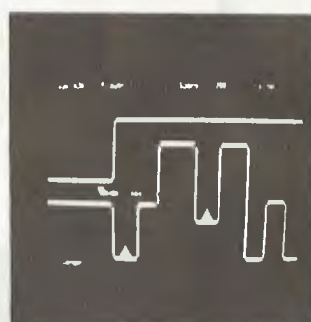
USE OF GRAPHICS: ***
PRESENTATION: **
RESPONSE SPEED: **
VALUE FOR MONEY: **



Stage One: Enemy defense rings loom in rugged mountainous countryside! **Warning** — a strong network of radar stations are sending guided missiles to destroy you!



Stage Two: Enemy defenses underground! Penetrate the treacherous caverns but watch out you have limited maneuverability.



Stage Three: Fly through hazardous vertical corridors. **BEWARE!** Enemy missiles in silos. You'll need all your skills!



Stage Four: Few of our Fighters have survived but rumours are of shifting missile sites and enemy paratroopers waiting in ambush!

GAME: Penetrator
SUPPLIER: Beam Software
PRICE: \$34.50

Penetrator is an exciting, fast moving "shoot-em-down" game produced by Beam Software for TRS-80s and System 80s. The game is modelled on one of the more popular arcade machines, and is very convincing despite the lack of high resolution and colour graphics.

The game is fought in four stages, taking the form of a complete adventure. Stage one sees our intrepid pilot flying over hill and dale killing everything in sight. In stage two, the battle moves underground and the fighting tactics change completely. In stage three, the conflagration continues in verticle missile silos and passages. Stage four is again in caverns, but with the addition of vicious paratroopers. Once through stage four, you get a chance to destroy the cache of illegal neutron bombs. I won't give you any details of this phase of the game, as part of the lure is to fight your way through just out of curiosity to see what it looks like. Suffice to say that it is worth the trip. Once the cache is destroyed, you have then got to fly out to safety. This involves going through all four

stages again, but in reverse.

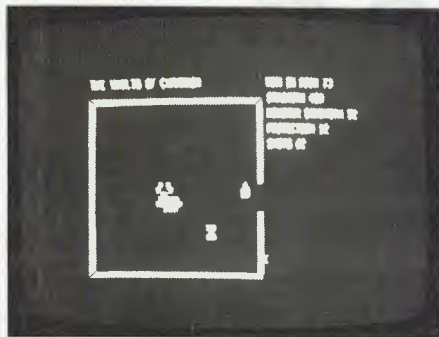
The enemy fights back using missiles fired in your general direction. Additionally, enemy radar bases are distributed along the countryside. These do not attack, but gather more and more information about you. So the more of these you leave intact, the greater the accuracy of the missiles.

The game is played using full four directional movement, either through the cursor keys or via a joystick. I thoroughly recommend the joystick, as it is much easier to get full manoeuvrability. Your craft is equipped with downward dropping bombs and a forward shooting laser. The laser is activated by pressing the right arrow key very briefly, and this is one of my two criticisms of the game. The same key is also used for rightwards motion, and it is often hard to differentiate between the two functions in the heat of conflict. My only other criticism is that at various points throughout the game, little tunes are played. This is fine for the first half dozen times you hear it, but after that, you want to cut it short. No provision has been made for this and so you've got to sit through the whole thing. It doesn't take long, but gets to be a drag.

The game is also equipped with a training simulator, and I found this to be very good value for game familiarisation. The landscape you fly over is the same every game which sounds like it would be very easy to memorise set manoeuvres, but this is not the case. The random actions of the aliens is such that the same landscape remains entertaining for many many games. If you do eventually get tired of the same environment, or decide certain sections are too hard (like I did), then you can create your own customised landscape and save it on tape or disk. This means the game is potentially infinite in its variations, and it is possible to create environments completely different to the one supplied, almost entirely new games.

The standard of documentation is excellent, the game is exciting and extremely challenging to play and, in terms of games for these two machines, I would say it is one of the very best available and certainly worth a look.

USE OF GRAPHICS: *****
PRESENTATION: *****
ADDICTIVE QUALITY: *****
VALUE FOR MONEY: *****



GAME: Vaults of Cymarron

As the name suggests, this is an adventure game — but with a difference in that much of it is graphics-oriented real time action with sound effects. The instruction manual, though clearly produced on a low budget, gives an amusing background to the game with illustrations that look like they belong in a 'head bangers' broadsheet. The game starts on the pleasure planet 'Babylonia' where, having sampled 'many of the grosser forms of self indulgence' available there, you find yourself heavily in debt (apparently exacerbated

by the massive inflation rate). You are presented with a simple menu representing the planet's 'Presto' information service. Using this you discover the size of your debt and are made an offer by the 'Cred Mutual Assoc' allowing you to pay it off by retrieving some of the valuable artefacts contained in the Vaults of Cymarron (the remains of an ancient shopping precinct). You are allowed a limited amount of cash with which to purchase supplies from the pawnbroker, where a certain amount of bargaining takes place. Your choice of supplies is critical to the main part of the game, and above all it's essential to buy plenty of food. After visiting the pawnbroker you go on to the spaceport from where — having chosen the direction from which you will enter the vaults — you set off for Cymarron. At this point the second part of the program is loaded in from the cassette.

After choosing a skill level (which determines the strength of the monsters) you are eventually plunged into the first room. Commands are entered using single keys such as 'L' for look and 'F' for fight, covering a fairly standard range of adventure vocabulary. All of the rooms are square with up to four exits and contain various obstacles,

monsters (only ever one per room) and useful or valuable artefacts. You move your character with the arrow keys and can fire missiles with the space bar (assuming you bought a gun and needle pak from the pawnbrokers). I would suggest that you save the game as soon as possible after entering the vaults, since otherwise if you get killed quickly you'll have to go through all the preliminaries again, which can be very irritating.

The vaults are quite extensive, so there's plenty to explore, though the game does rather lack variety. It is of course not as cerebral as your average Adventure game, and hence much less demanding; but the real-time action makes it less predictable the second time around, perhaps giving it a more lasting attraction. Vaults of Cymarron is nicely presented and well designed, if a little pricey.

USE OF GRAPHICS: ****
PRESENTATION: *****
RESPONSE TIME: ****

Conclusion.

Undoubtedly the best offerings available for the TRS-80 are the classic adventure and Star Trek variants, of which there are many. These are rather more serious games than the arcade type real-time

affairs and, as a result, tend to be aimed at a more adult audience. Nevertheless, many of the latter are available for this machine and, though of course not nearly as impressive as their high resolution colour counterparts, they tend also to be comparatively inexpensive. This is obviously not a machine

one would buy for its games alone, but it still has plenty to offer the prospective 'screenplayer'. Next month I shall be amusing myself with Commodore's colourful gamey machine, the VIC-20.

ARCADE ACE



At first sight Scramble bears some similarity to our first Arcade Ace, Defender (see March issue) but the principles are, in fact, quite different. You control a craft moving at a steady horizontal speed over a colourful landscape which presents a variety of different obstacles and hazards. A simple joystick is used to position the

craft on the screen, providing quite good manoeuvrability — though, unlike Defender, you cannot reverse or accelerate. The idea is to penetrate the various defenses, destroying as much as possible along the way, in order to eliminate a key figure at the end of your journey.

The game is quite simple to start with. You travel across mountainous terrain scattered with ground-to-air missiles (which are constantly being fired at you), fuel dumps and other installations. These can be destroyed using a 'machine gun' firing volleys ahead of you, or with bombs which will fall to the ground slightly ahead of your firing position. It is essential to destroy as many fuel dumps as possible at this stage since this adds to your own fuel supply; and if you run out of fuel you're dead. As you progress, other obstacles appear — starting with a series of bobbing fireballs which you must either shoot down or

attempt to navigate past. Eventually the area you have to fly in decreases in size until you find yourself in a maze containing completely vertical stretches which are very difficult to negotiate. At the end of this is your goal — a sort of robot-like figure — and if you destroy this the mission starts all over again.

This game relies much more on flying ability than destructiveness, and it takes some time to learn how to use the horizontal movement properly. The graphics are very colourful (though rather lacking in crispness in comparison with some of the game's contemporaries) and there's a wide selection of unusual sound effects. Although Scramble is not a particularly fast game, there's certainly plenty to keep you occupied. The game enjoys a high popularity and although it's now disappearing from the arcades it can be found in many pubs and cafes.

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FRAMES OF REFERENCE



A DP MANAGER'S GUIDE TO MICROS

By Alan Wood

For the first time in the history of computing, hardware is being designed around available general purpose software; in microcomputing we are at last learning to put the horse before the cart. When IBM decided to launch a personal computer it went to the micro software manufacturers and consulted them about the best approach to adopt to both hardware and software. Microsoft, who supplied the operating system, MS DOS, influenced the design of the IBM personal machine. Similarly, the wide following for Unix encouraged semiconductor manufacturers Zilog, Intel and Motorola to take that operating system to get their new 16-bit systems quickly to market. The expanding bank of CP/M software led established companies such as Hewlett-Packard and DEC to announce CP/M machines; and the new microcomputer manufacturers who have released 16-bit machines with CP/M-86 are making more rapid progress in the market than those with their own operating systems.

The standard software flag should fly above all others in microcomputing, whether you intend to use a selection of available packages or develop your own systems. The rule applies if you are a computer manufacturer bringing a new machine to market, a computer user developing in-house systems, or a software developer aiming to build and sell packages. New and second-time-around computer users have learned to choose programs first before selecting the 'micro centre' on which they want to play them.

The origins of standard software

In 1971 Intel introduced the first microprocessor, the 4004, and followed this three years later with the 8080 processor. In January 1975 MITS, a small company in Albuquerque, New Mexico, released the first microcomputer, the Altair. Based on the 8080, the Altair was sold for \$400 in kit form. Advertised in *Popular Electronics*, it achieved a totally unexpected mass response. But with the 8080 assembler language, the Altair was usable only by real buffs. Two young software writers, Bill Gates and Paul Allen, wrote a Basic language interpreter for Altair. That Basic, now in its sixth release, has become a *de facto* industry standard Basic and is available in one release or another on

virtually all microcomputers. It was the start of Microsoft Inc, the first source of machine independent languages in the micro industry.

The success of the MITS Altair encouraged other companies to start making computers to compete in the new market. Early members of the industry were Imsai, Processor Technology, Cromemco, North Star and

PART 4 SOFTWARE STANDARDS

Vector Graphics. The first machines used cassette recorders but a few innovative companies started making floppy disk units. The arrival of the floppy disk took the market for microcomputers beyond the hobby and educational field to business and scientific applications. While these developments were taking place, Gary Kildall, author of the CP/M operating system, was working for Intel on the PLM language. He secured a floppy disk drive and, while a friend set about developing a disk controller, implemented the software file manager which was to become part of CP/M. Imsai approached Kildall and expressed interest in the file manager. Out of those discussions came the concept of CP/M as a core operating system with all the hardware dependent portions in one section, so that anyone could buy a copy of CP/M and make his or her own modifications. Kildall started Digital Research in 1976 and since then CP/M has spread rapidly.

Many of the manufacturers took on CP/M directly, although some retitled and extended it. In 1978, a young Englishman, Tony Gould, recognised the potential of CP/M as a common operating system to run the same programs on many different machines.

He encouraged the setting up of a CP/M user group and started a company, Lifeboat Associates, expressly to distribute CP/M software products. The ready availability of CP/M and its \$150 price tag encouraged enthusiasts starting new hardware and software companies to adopt it. At about the same time, two other significant languages became available on microcomputers using CP/M - CBasic from Compiler Systems (now part of Digital Research) and CIS-Cobol, from the micro software manufacturer Micro Focus. The next three years saw the emergence of a stream of software products using Microsoft Basic, CBasic and CIS-Cobol, so that by 1981, as mainframe and mini computer manufacturers started their response to the micro industry, they automatically turned to the industry standard software to provide the market with usable microcomputer systems.

Fuelled by the success of MBasic, Microsoft started work on Fortran and Cobol. In 1978, it was offering to implement all three languages for microcomputer manufacturers for a fee of \$100,000. The price was irresistible compared to the in-house cost of developing even one compiler, although some purchasers had to wait quite a long time for all three languages to come through. Micro Focus, structuring CIS-Cobol to make it easily portable as well as interactive, overtook and passed the Microsoft version of Cobol.

With their 8-bit products successful in the market, the software manufacturers turned their attention to the emerging 16-bit market. Semiconductor and computer manufacturers also turned to them to produce versions for new processors and machines. In a quite unprecedented sequence, CP/M was endorsed by IBM, Wang, Hewlett-Packard and DEC in successive months in 1981. Not surprisingly, industry analysts were projecting CP/M as the dominant operating system by the mid-eighties. New manufacturers leapfrogging into the market with 16-bit offerings recognised and further extended the place of the industry standard software. Sirius, the new machine from PET designer Chuck Peddle and several others all came through with CP/M-86 machines.

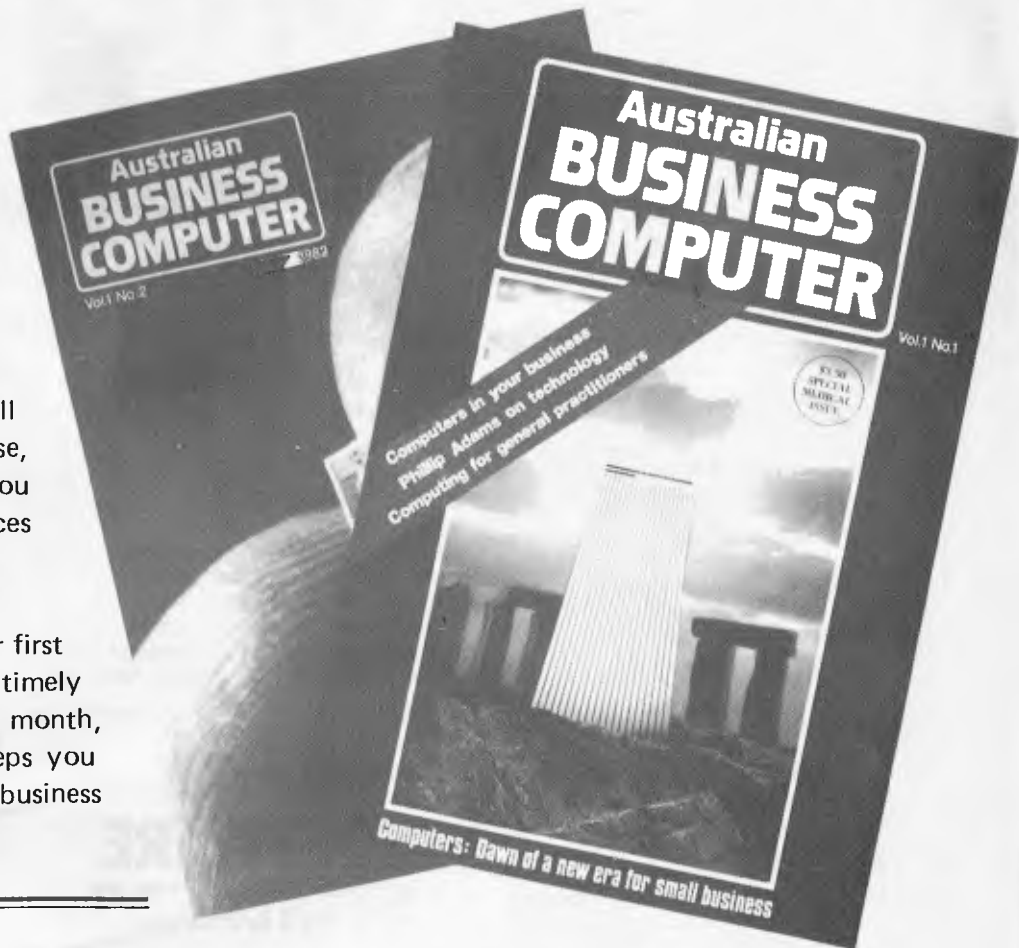
The trend towards standard software to run on many (apparently) different machines continued down the line with system development aids, office automation products, timesharing

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Features of CP/M operating system

Manufacturer: Digital Research, Box 379, Pacific Grove, CA 93950. Tel: (408) 649 3896.

Support languages: 8080, Z80 Assemblers: APL, Basic, Forth, Lisp, Fortran, C, Pascal, PL/1, Cobol.

Language system: 8080 assembler.

Network support: No

Minimum hardware: 20 kbytes RAM, console, floppy or hard disk drive.

Processor allocation/management: not available.

Peripheral management: CRTs, character and line printers, floppy and cartridge drives, modems. Device independence, DMA, spooling, mixed storage devices.

Memory management: Single contiguous allocation, overlays and chaining.

File management: Named file system, sequential and random organisation; allocation types — extents.

replacement software, general and specific business packages.

Below the level of operating systems and languages come all those aids and utilities that make it easier and quicker to develop systems. The first versions of these to appear were text editors and sorts. The text editors in turn bred the first word processors on microcomputers and the sorts were later to be embedded in more sophisticated information management and reporting systems. By 1980, a set of three products was to become as standard to microcomputers as operating systems and language. They were what virtually every office wants: an electronic word processor, worksheet and file cabinet. Today no microcomputer worth buying comes without these products. One of the first companies to tackle the need for system development and office aids was Micro-Pro. It first produced a text editor, WordMaster, and a sort, SuperSort. In 1979 it announced WordStar, a word processor which has become a best-seller on CP/M systems. This was followed by an equally successful file cabinet or information manager, DataStar. Since then, Micro-Pro has enhanced its product range with the SpellStar and Mail-Merge extensions to WordStar, CalcStar rows and columns electronic worksheet and StarBurst, a product to link all the others together to perform combined applications.

The ultimate system development aid is one which can be used to generate a complete system. These come in broadly two forms, program generators which automatically generate code, and system generators which are self-contained parameterised systems. None of the products have yet established the credibility or position of the standard languages. But some promising products have appeared, including Pearl from Computer Pathways (code generator) and Configurable Business System (no code) from Lifeboat. In 1981, all the ballyhoo around The Last One, a code generator from DJAI Systems, attracted a lot of attention, although the excessive claims implied even in its title did nothing for the credibility of this type of product.

Beyond the system generation tools come the general scientific and business packages. Several companies in the USA took up CP/M and either MBasic or CBasic and produced simple business

systems. Graham Dorian chose CBasic, Structured Systems and Peachtree chose MBasic for their ledger, payroll, order processing and stock control systems. These packages are aimed at the first time computer user who often does not have very good manual systems. A second wave of packages has also emerged for the more sophisticated user offering facilities that overshadow many accounting packages on mini-computers. A range of vertical market packages are also starting to flow from different sources, as yet with no clear leaders.

Timesharing replacement products are the latest of the standard software offerings on microcomputers. These are very attractive to users who spend considerably on timesharing services and who can readily justify the expenditure on a replacement microcomputer system. The trend was

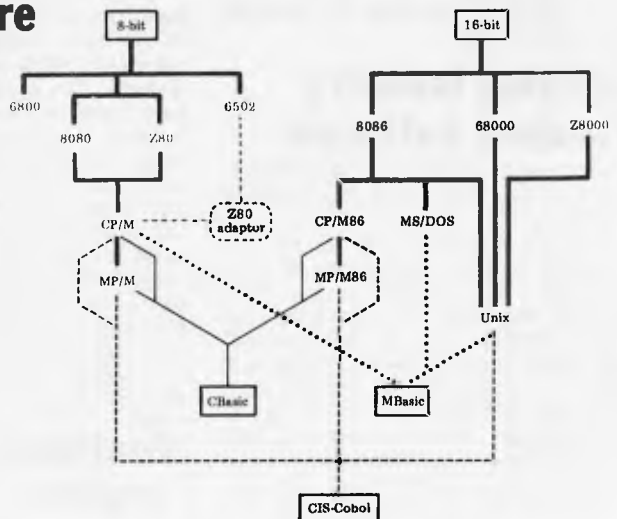
started by Visicalc, a rows and columns product that has created new users of the electronic worksheet technique as well as appealing to existing users. Visicalc whetted the appetite for more sophisticated products such as MicroModeller, an FCS-like financial modelling package. These have been followed by other timesharing replacement products. More will follow, especially on the new 16-byte machines which offer a megabyte of memory on the desk top and are ideal for number crunching programs.

The need for standard software

Adopting hardware standards provides obvious benefits in compatibility, communications, expandability and purchasing. However, because it is easy to specify a preference for the machine of one or two manufacturers, compared to establishing software standards, companies too frequently adopt preferred hardware as a simplistic solution to setting standards.

The objective of describing the history of software development on microcomputers is to provide an understanding of how we got to where we are today and to indicate where the industry is going tomorrow. If past performance is taken as a strong indicator to future trends, industry standard software is going to dominate microcomputing. In mainframe and minicomputing there has been a steady increase in the ratio of software/hardware costs. With micros there has been a quantum leap such that software and service costs now often far outweigh the hardware costs. The adoption of sensible standards can substantially reduce short and longer term

The software family tree



The illustration shows a simplified version of the micro software family tree. Like ordinary family trees it will change with each generation as different branches spread and mix. Until recently Digital Research and Microsoft developments have been closely aligned. The move by Microsoft into operating systems with MS-DOS and Xenix has brought a counter move by Digital which has acquired CBasic and Pascal MT. Microsoft is officially not supporting MP/M although market pressures may change its mind. Digital, on the other hand, may not make its language available on MS-DOS and Xenix. Micro Focus officially supports all operating systems except MS-DOS and it probably won't be long before CIS-Cobol is available on that OS as well. Consequently Micro Focus offers the safest gateway to the future for software developers.

Features of MP/M 11 operating system

Support languages: as CP/M
Language system: 8080 assembler
Network support: Yes.
Minimum hardware: 64k RAM, etc.
Processor allocation/management: Multi-tasking; unlimited number of tasks can start/stop other tasks via queue-based intertask communication.
Multi-usage; up to 16 users. Synchronising: flags, queues, poll list.
Peripheral management: Single contiguous allocation, chaining and segmentation; static and dynamic relocations; memory protection.
File management: As CP/M with the addition of password security protection; time and date stamping on files.
Note: MP/M-86 implemented in 8086 assembler provides the same features with the facility to manage up to 256 users.

software costs. Standard operating systems, standard languages, standard development tools and standard application packages should all be adopted.

Establishing the use of standard software not only creates portability of software but portability of skill and portability of data files. For example I started using WordStar on a North Star in 1979, transferred the same files and package onto a Cromemco in 1980, switched files and WordStar to Dynabyte and Communicator in 1981, using Rair and Superbrain in passing, and am now into WordStar on 16-bit machines. The beauty of using standard software is that no new application skills have been necessary to take advantage of more powerful machines and costly files have been transferred using the BSTAM facility under CP/M. WordStar looks the same on all machines, although it performs better on some than on others. This example can be repeated for many packages, eg, the Spellbinder or Magic Wand word processors and, of course, for all the common languages.

When you consider the cost of file creation, coupled with the cost of learning new software, as well as writing and documenting it, you should never want to work on anything but industry standard software.

Applying industry standard software

When you approach a requirement, there are two ways you can consider fulfilling it: 1, by use of an existing package or packages and 2, by full or partial systems development. The first will be cheaper and faster to meet requirements, providing the package largely fits or the user will bend towards its facilities. There will always be cases where packages are not suited and then the choice lies in what language and development aids can be applied. But once the requirement is clearly understood, the first question to ask is, 'What package will fit?' If there are no suitable packages, the next question to pursue is, 'What development aid will cut development costs and timescales?' This will lead you towards languages and their facilities, at which point existing available skills and subroutines may be more important, eg, you run a Cobol shop. Finally, once the software approach is established, you select the computer with the most suited software set.

The Requirement-Down approach contrasts with the Hardware-Up standard traditionally applied in the main-

frame environment. Having selected an IBM machine and PL/1 as the language to support, all user requirements are translated in terms of these facilities. It is especially difficult to turn people bred in this environment over many years towards adopting a standard software approach. Only training and experience leading to an inner conviction will achieve the transition for those who want to make it. The consequences of not adopting standard software can be very costly indeed.

Pressure points on standard software

You have been hearing about standards for years and could be forgiven for being somewhat cynical about the continuation of software standards as the big boys come into the business. Surely IBM is not going to make it easy to migrate from their micros to those of its rivals? Surely it is not. But a number of pressure points have emerged which have modified the approach of even the world's largest computer manufacturer whose literature actually includes acknowledgments to Visicalc.

Many users are fed up with their data processing departments because of the cost, timescale and inflexibility associated with monolithic mainframe systems. On their own initiative, they have been the forerunners in going out to seek micro solutions to their problems. Equally, many new computer users not used to mainframe costs have come into the fold as a result of low cost hardware and software. Both these groups represent a vast, almost untapped, market for computer suppliers to maintain their growth in the eighties and nineties. They both have one thing in common: they insist on readily available cheap software. For example, one prospective pur-

chaser of Hewlett-Packard micros insisted that he should have one of the industry packages on his machines and the manufacturer responded by arranging it for him.

The next pressure points in the chain are the computer dealers, the shops and systems companies that are the major outlets for micro products. Dealers are becoming more and more aware that it is software that sells machines and not vice-versa. Newer manufacturers approaching experienced dealers without software simply do not get in the door; those with their own special software don't get much further; whereas those offering industry standard software on advanced hardware are generally well received. From a dealer viewpoint, it is considerably more expensive to learn a new software package than it is to learn to operate a new machine. Dealers who have made an investment in a software set are understandably very reluctant to change to another unless it is much better... and available on a wide range of machines.

The market is so large (there are over two million microcomputers in use) that it has fostered a host of new software manufacturers, some of whom have produced excellent low-cost software. The software manufacturers want to reach the widest possible market and are attracted only to the best selling systems. Inevitably, CP/M attracts the biggest following, with Tandy, Apple and PET also popular targets for software. The software product vendors sell strongly to dealers, to end-users and to microcomputer manufacturers. The computer manufacturers have been quick to realise that if they go their own way, producing software will be much more costly and slower than tapping into available products. They have also witnessed the trend of users going out to buy Visicalc first and then choosing the machine on which they want to run it.

Some computer manufacturers have opted to go their own way on software and some manufacturers have produced CP/M versions of their products. There are not many who do not in some way or other support the industry standard software at least at language, if not at operation systems, level. Where the choice has been made to go it alone, the signs are that the manufacturer is restricting his growth largely to his existing customer base. Data General, one of the early specialist minicomputer suppliers, has chosen

Features of Xenix, the Unix based operating system

Support languages: C, Microsoft Basic, Cobol, Fortran, Pascal.
Language system: C
Network support: Yes
Minimum hardware: 192k RAM
Processor allocation/management: System vs user mode. Multi-tasking: 100 tasks restricted by table size. Multi-usage: up to 25 users.
Peripheral support: CRT's, character and line printers, floppy and cartridge drives, modems, magnetic and paper tape drives.
Memory management: Segmentation; swapping; dynamic relocation; binding during assembly/compilation, linking and loading times; memory protection.
File management: Named file system, multi-level directory, sequential organisation; allocation type; linked list of sectors; password/security protection.



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FRAMES OF REFERENCE

this route, its micro offering being based on its own chip with no access to industry standard software. The eighties is an era in which open architecture is coming through strongly to correct some earlier deficiencies and create new possibilities. It may well be those pursuing a policy of closed architecture will suffer loss of market share as users refuse to get tied in to one manufacturer again.

At the beginning of the chain, the semiconductor manufacturers are investing vast sums in developing new products. Their interests lie in getting their products to market quickly and in quantity to recoup their investment and to fund the next development programme. While they all produce their own development languages, tools and operating systems to help customers build products using their chips, semiconductor suppliers are finding repeated implementations time consuming and costly. Zilog, which sells computer systems as well as chips, was the first to adopt industry standard software. On its MCZ 2 8-bit machine it has implemented CP/M and a CP/M interface to its Ethernet-like network. It has followed this move by adapting Unix (it calls it Zeus) for the Z8000, one of the first new 16-bit machines to market. Intel and Motorola have also taken to Unix for 16-bit processors and to provide a route through to their new 32-bit offerings. Intel announced CP/M-86 when it brought out its first general purpose computer near the end of 1981. Software developers will be encouraged by these moves to produce the packages that will make the new devices useful. Customers, both dealers and end-users, will in their turn take more quickly to powerful machines offering familiar software. In fact, the best cushion against future micro shock is standard software.

What then are some of the standard options available?

General-purpose operating systems

There are many ways of classifying operating systems: development operating systems, realtime process control operating systems, timesharing operating systems, single user and multi-user operating systems. For the purpose of this section we are looking primarily at single and multi-user general purpose operating systems.

CP/M is the recommended single user operating system, not because it is the most sophisticated or technically excellent, but because it is the most popular. It is a sound, proven, functioning operating system, the primary virtues of which are its low cost and the access it provides to a bank of programs in which new deposits are made every day. There are many who will tell you their XYZ operating system is better; and indeed it must be to sell at all. CP/M is also improving with each

release; like sound wine it is maturing. Furthermore, it has sired two other products in the family. CP/Net and MP/M, of which more later.

You should have CP/M as your main single user operating system, or at very least as an option. Failure to adopt a standard operating system will result in programs and files which are not transferable from one machine to another, difficulties in linking machines to exchange data, dilution of expertise across many systems, more expensive software developments costs, and no access to the software bank of inexpensive packages.

Among the manufacturers that support CP/M directly are Hewlett-Packard, Intertec, NEC, Osborne, Rair and many others.

Among the machines on which CP/M runs in addition to the operating system supported by the manufacturer are: Apple (with Microsoft Softcard), Commodore (with Softbox), DEC, IBM, Intel, North Star, Sharp, Tandy, Vector Graphics, Wang.

Among the machines on which CP/M is not presently available are: Data General, SWTP, Texas Instruments.

Two other machine independent operating systems merit attention, MS DOS from Microsoft in the USA, and BOS from Microsoft Products (CAP Microsoft as was) in the UK. The latter is especially interesting in the UK because of the access it provides to a range of business software. In Australia there is no such locally acceptable standard and business software developed here has generally used CP/M. Microsoft MS DOS leapt to attention when IBM announced that they had taken it for their own personal computer; the fact that it has hooks to enable CP/M programs to run under it is another attraction.

A number of manufacturers have their own operating systems, not all derived from CP/M, in particular the leading personal computer suppliers. Apple, Commodore and Tandy, for which there are a substantial selection of programs.

A variety of multi-user operating systems are competing for wide acceptability in the market. Part of the competition comes from a new way of achieving multi-use through networking micros together. Two of the general purpose operating systems are set to take the lion's share of the machine independent market, MP/M and Unix derivatives.

Until the arrival of MP/M 11, which added file and record locking along with some other facilities, grave reservations were being voiced about the wisdom of using MP/M much beyond a simple two-station machine. The new release has changed views and further iterations are likely to achieve good market penetration for MP/M, especially as a multi-user successor for the CP/M user. Once the number of terminals is promising to build from a few to double figures, other solutions, including networking, come into contention. Digital Research, which has had a substantial injection of funds, can be expected to develop MP/M to a more sophisticated level, in conjunction with its OEMs, especially on 16-bit machines.

The Bell Systems Laboratories operating system, Unix, has been about

for over 10 years and is a proven system with some very attractive features, especially as a development system. A few 8-bit versions are about, notably Cromix from Cromenco, but the operating system is really expected to come into its own for double-figure terminal systems on 16-bit machines. Microsoft and Morrow have developed versions for micros respectively known as Xenix and mUnix. The policy of supplying Unix virtually free to colleges has resulted in a big following in academic circles. Unix prices were high compared to CP/M until the end of 1981, when Bell announced very substantial reductions which will help Unix penetrate the commercial marketplace. It is also being used as a development route from 16- to 32-bit micros. A number of mini manufacturers have added Unix to their systems, such as Tektronix and Perkin Elmer.

Other multi-user operating systems

There are several less popular machine independent operating systems which nevertheless include some features superior to both MP/M and Unix. There are 8-bit and 16-bit implementations of both Multi-User BOS and Oasis. The latter, from Phase One Systems, is favoured by some computer manufacturers and end-users. The record, file locking and password protection systems in Oasis, essential to multi-user work, are superior to those in MP/M. Both BOS and Oasis provide ISAM access to files, a highly desirable feature in data processing applications. Various suppliers are now implementing hooks in their operating systems to make them behave in part like CP/M. For example on Cromix, the Cromenco version of Unix, you can run CP/M programs as one of the tasks.

There are problems in synchronising operating systems so that sometimes you can find difficulties in running all CP/M programs under an adapted system. For example, the CP/M system is too big to run because of the additional overhead in RAM taken up to accommodate it. As RAM sizes increase with 16-bit availability, these problems may occur less frequently. Manufacturers supplying alternative operating systems may also take on the responsibility of directly supplying CP/M programs which do not run under their offerings. You should not assume that all computers with a CP/M facility can run or have access to all CP/M programs.

Microcomputing languages

The most popular of all languages on microcomputers in Basic. Two-thirds of the available operating systems, both independent and machine dependent, support Basic. Fortran and Pascal are available on 50 per cent of available operating systems. Cobol is available on one-third of the operating systems and, with the emergence of more powerful processors and the call for data processing facilities, it will become generally available on 16-bit and widely available on 8-bit. C, the language of Unix, is now available on 20 per cent of the operating systems.

Now what?



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PA5

FRAMES OF REFERENCE

Forth is also gaining in popularity and APL and PL/1 have emerged to satisfy their select band of followers.

There are a number of dependencies which dictate the languages you should choose for developing software. For example, if you are developing packages, a good case can be made for UCSD Pascal because it is structured and fairly portable across machines. If you run a data processing department and employ a gang of Cobol programmers, one of the machine independent Cobols is a likely choice. However, most companies find it pays them to support Basic plus one or two other languages.

The two popular machine independent versions of Basic are CBasic and Microsoft Basic.

The advantages of Basic are that it is widely available on a choice of machines, is relatively easy to learn and provides rapid implementation of conversational applications. Its disadvantages include the fact that it is an unstructured language, it's difficult to maintain Basic programs, and it has limited file handling capability.

Cobol is widely used for serious data processing tasks. It has the following advantages: it's common in computer departments, it's a structured language and it has good file handling suited to data processing. The disadvantages of Cobol are its slower development than Basic if not used with good tools and that it requires typically more machine capacity than Basic.

There are several versions of Cobol, including Ryan McFarland, Micro-Products, Microsoft and Micro Focus. The last mentioned is now the leader with its CIS Cobol established on CP/M, MP/M and Unix as well as a host of manufacturers' own operating systems for both 8- and 16-bit machines. CIS-Cobol is widely used in the USA, Japan and Europe as well as other places in the world where micros have penetrated. It has been adopted by Intel in the USA as iCIS-Cobol and purchased by a host of Silicon Valley 8-bit and 16-bit manufacturers. It is ANSI 74 compatible and has passed the US Navy standard Cobol tests.

Other languages

A variety of other high level languages is available. Many are subsets of languages on bigger machines and the absence of some features cause frustrations, for example with APL and PL/1 users on micros. These languages are improving and the general availability of 128k RAM machines with hard disks will provide the hardware to support full implementations.

Pascal is a structured, portable language, growing in popularity, but unfortunately with many variants. UCSD Pascal is the most generally available, and Pascal M is very popular with software products builders such as

SuperCalc and MicroModeller.

APL is widely used in timesharing and consequently in timesharing replacement on micros; 8-bit implementations are usually a subset so that features need to be compared with your favourite APL.

Fortran is widely used in timesharing and scientific work and favoured for similar tasks on micros. Fortran IV soldiers on and is generally available; Fortran 77 is now becoming more widely available.

PL/1 is the language of many IBM installations and is implemented by Digital Research on micros.

C, the language of Unix, is growing in popularity as a development language, especially with colleges and software houses.

Compilers and interpreters

For serious applications users should be provided with a run-time system with which they cannot tamper. This provides control over the software and makes maintenance easier. While development can be slower in a compiled language, execution is faster. Microsoft has both a Basic interpreter and compiler. CIS-Cobol compiles to an intermediate code and has an interactive development capability. Retention of the source on a central machine in the data processing department is one of the standard control mechanisms in managing multi-site micro systems.

Development aids

There are a variety of development aids on micro computers that can substantially reduce development time and cost; Basic is the language provided with the widest choice of development aids but a number are also appearing for use with Cobol. Unix includes a variety of utilities that are a great help in systems development. At their most sophisticated, development aids can be used to produce virtually a complete system without the necessity of writing any program code, or at least reducing coding to the barest minimum.

The fourth commandment of microcomputing

In microcomputing, software takes precedence in the line of succession. Ideally, you will limit the variety of machines on software standards. *The fourth commandment of microcomputing is: thou shalt commit software development to the industry standard operating systems and, especially, to the standard languages.*

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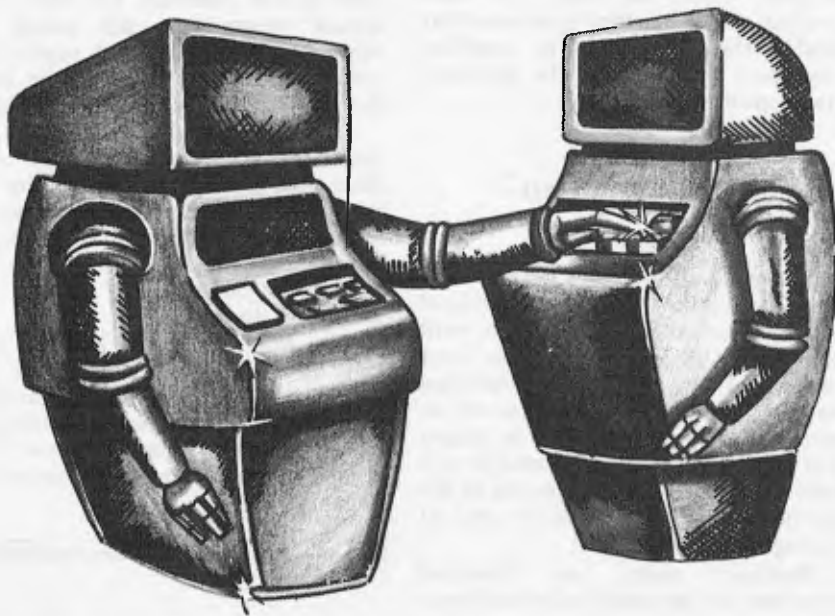
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HOW COMPUTERS COMMUNICATE.



Part VII

INTERRUPT I/O: GETTING THE ATTENTION OF THE PROCESSOR

by Hewlett Packard's Steve Leibson

What do you think is the most important part of the telephone? The dial? The receiver? The cord?

I submit that it is the bell. If the telephone had no way to summon you when a call came in, you would have to check it periodically to see if there was someone on the line.

The inconvenience of lifting the receiver every few seconds would quickly make the instrument seem very irritating. Fortunately, telephones do have bells, which interrupt you when someone calls.

WAITING FOR PERIPHERALS

Early in this series we discussed the relative speeds of computer processors and peripheral devices. The mismatch in speeds necessitated the creation of handshake lines that the processor

could check to see if the peripheral was busy. Without these lines, the speedy processor would inundate the poor peripheral with data.

The use of these handshake lines is the simplest form of I/O. The computer spends much of its time patiently waiting for the peripheral to get ready for the next transaction.

INTERRUPTING

The above situation is quite satisfactory if there is nothing else for the computer to do. Frequently, however, there are many other things the computer could be doing, and the use of handshake I/O is inefficient. Fortunately, an alternative exists in most modern computers. It is interrupt I/O.

First, let's decide what it is that we

will be interrupting. The computer is continuously executing a program in its memory. If there is no user program currently running, then at least the operating system is executing.

Thus, we have two levels of programs in the computer. The highest level is the user program, usually written in a high-level language such as Basic.

Microprocessors currently cannot run a Basic program directly, and so have a second, lower-level program which interprets the Basic statements. This lower-level program is written in machine code, instructions that can be directly executed by the processor. This program is called an interpreter.

Interrupts are hardware mechanisms for forcing the processor to leave the part of the program it was executing just before the interrupt and start execution at a different location in memory. This interruption takes place at the machine-code level. It is a very useful mechanism for synchronizing external events with the computer program, but it must be used carefully. Let's take an example.

Suppose that a user program asked the computer to compute the value of $2.5 + 2.5$, print the answer on a teletypewriter and then compute the value of $3 + 3$. The computer would first execute the routine in the Basic interpreter that performs floating point addition to produce the result: 5.00.

This creates a total of six characters to print: 5.,0,0, carriage return and line feed. We can assume that the addition takes two milliseconds. Teletypewriters print ten characters per second, so the printing of six characters will take approximately 600 milliseconds (actually a little longer because the carriage return requires extra time).

Handshake I/O requires the computer to wait out the full 600 milliseconds before performing the second addition. The alternative offered by interrupt I/O is that the characters to be printed can be placed in memory somewhere, in an area designated as the I/O buffer.

INTERRUPTING MACHINE CODE

The first character to be printed then is sent to the teletypewriter, causing the interface to the peripheral to "go busy", transferring the character to the printer. Now the computer can proceed to the next Basic statement, confident that when the teletypewriter has finally printed the first character it was given, it will become ready for the next one. At that time the interface will interrupt the processor and ask for another character.

Note that it is the machine code interpreter that is interrupted and not the Basic program. The flow of execution of the Basic statements is not changed, but the interpretation of the program into machine code is stopped while the computer outputs

another character. This illustrates I/O.

The writer of the Basic program does not have to write an interrupt service routine for Hewlett-Packard desktop computers, for instance, because the routine has been provided in the interpreter. This is quite convenient because many factors must be carefully handled in such a routine. The interrupt forces a branching in the machine code program to a different location.

If the processor does not remember where it was before the interrupt, it cannot return and will be "lost", unable to continue operating properly. Most processors automatically save the address of the location being executed before the interrupt, and a return from the interrupt is sufficient to restore that address.

If the interrupt service routine uses any of the internal registers in the processor, it must first carefully save the contents of these registers and then restore them at the end of the interrupt service routine. This must be done, because it is difficult to tell what information in these registers was important to the program that was interrupted. By saving and restoring the registers, the processor is left as it was found and the interrupted program will not be affected.

INTERRUPTING BASIC

Sometimes, the buffered I/O routines

are not sufficient for handling the problem. Some problems require more complex action from the computer than the transfer of a piece of information. In these instances, it is necessary to interrupt the Basic program itself and branch to an interrupt service routine written in Basic.

Interrupting the Basic program is considerably more complex than interrupting the machine code program. Basic statements can affect large portions of memory such as those used to store the values of variables. If a variable is being changed just as the interrupt comes in, and the Basic interrupt service routine also uses that variable, the wrong value or a garbled value may be used in the interrupt service routine.

WAITING FOR THE END OF THE LINE

To prevent such problems from arising, some computers force Basic-level interrupt service routines to wait until the end of the current line has been reached before the actual branching occurs. This is called end-of-line branching. The interrupt can be logged in at any time during the execution of a Basic statement, but the granting of the interrupt is withheld until the end of the line.

Machine code, or low-level interrupts, are generally called hardware

interrupts because the processor hardware performs the interrupt request granting and the subsequent branching. Interrupts of the Basic, or high-level program, are called software interrupts because several instructions in the operating systems are required to log in the low-level interrupt, request the end-of-line branch and then take control of program flow at the end of the line.

Finally, let's consider what is actually meant by the interrupt. A classic example of misunderstanding interrupt occurs whenever a first-time writer of interrupt service routines tries to use interrupt for input. The typical programmer will enable the interface to interrupt and expect that when the interrupt comes, the interface will have the desired piece of data.

Unfortunately, the interface actually interrupts whenever it is not busy. Since the interrupt service routine did not make the interface go busy by requesting acquisition of the data before enabling the interrupt, the interface interrupts immediately, as it had nothing to do.

The interrupt service routine then ends up with no data or old data. The key is that to properly use interrupts, the first data transfer is performed before enabling interrupts, and subsequent transactions are performed under interrupt.

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Happy returns I

W.E.Thompson (March, 1982) may assure himself that some interpreters treat RETURN sensibly. For example, even the crummy old ROM interpreter for the PET saves both a line number and an absolute address for a GOSUB, and so does RETURN without searching. Probably any interpreter that allows multi-statement lines will do the same, but it is easy enough to check.

Enter this program:

```
1 GOTO
2 RETURN
200 T=TI:FORJ=OTO999:
  GOSUB2
210 NEXT:PRINT TI-T
220 END
```

This uses the TIME facility of the PET - with other machines you may have to print something before and after the loop and use a stopwatch. On the PET you get either 133 or 132. Now change line 2 to GOTO 210 and GOSUB 2 in line 210 to GOTO 2 and run again; on the PET you get 164 or 165. Now comes the crunch: fill lines 100-199 with REMs, thus:

```
100 REM
101 REM
102 REM
....
....
199 REM
```

Run to get 540 and show that GOTO does search; change back to GOSUB and RETURN to get 133 or 132 again, thus showing that RETURN does not search.

If you have to print and use a stopwatch you will probably need to go more than a thousand times round the loop.

Dr E.H.Porter

Happy returns II

In answer to W.E.Thompson's letter (in the March issue), my Ohio Scientific version of Microsoft Basic (therefore all

Microsoft's?) does do what he suggested:

1. A 'GOSUB' stacks the line number of the GOSUB and the memory location of the next instruction.
2. A 'FOR' also does this, and also stacks the STEP value for the loop, the limit value, the count direction (+ve or -ve), and the loop-variable's name; with obvious speed improvements!

Better still would be to also stack the memory address of the variable's value, but this is not done, perhaps because then each FOR would stack 18 bytes!

The interpreter also has a line number search trick for 'GOTO'/'GOSUB' - if the high byte of the line to be found is greater than the current, the search starts from the current line rather than the first line.

Ian Cull

Another ZX maths bug?

I read with interest N.Angell's 'Graphplot' program for the ZX81. It works on a similar basis to my own graph program, and I wonder if any users will discover that they cannot enter "x**2" without getting an error code at line 130. On my ZX81, x² has to be entered as x times x ("x*x"). I thought at first that this was something to do with the VAL command, because it does do a few unexpected things, e.g. VAL "" will give an error code. After experimenting, however, I also discovered that VAL "-4**2" gave a result of -16 and that VAL "(-4)**2" gave an error code. Using PRINT instead of VAL and omitting the quotes gave the same results.

Being one of apparently few who informed Sinclair of the original ROM fault, I wonder if this is another, as it seems a strange thing to be

built in. Incidentally, I tried my original ROM (the faulty one) with similar results. Can anybody enlighten me?

By the way, anybody who thinks they can expand their 16k ZX81 to 17k by adding a 2k RAM chip should be reminded that many RAM packs cut off the internal 1k chip altogether.

J.Empton

Factors freak

Please could one of your readers with a home computer factorise:

```
15293518160231307603862
76509477643365614730477
12553495266976441932790
52024278131931528938627
92332341403827419821839
56525343383529990056038
266487484839 with or
without the help of APL?
```

D Hunter

More to the point, can anyone suggest why he wants to factorise it? - Ed.

What use are they?

Each month you publish a page of basic information for the beginner. May I suggest that in addition to, or alternating with, this page you publish a list of uses for the microcomputer, rigidly excluding games and commercial programs.

From personal experience I know that potential buyers are deterred by the apparently limited home uses. After all, not everyone runs his/her own business or wants to own a \$500+ TV games player. But both articles and advertising in computer magazines suggest that professional and amateur programmers concentrate on those markets.

Back copies of your magazine (and your com-

petitors!) should provide a data base which would-be buyers could use to justify their purchase to themselves and others.

Perhaps you might consider extending the idea to provide new directions for existing users who have run out of steam. A column into which ideas (way out, half-baked or full-blown) could be thrown may provide the base for a wide range of general interest programs.

Changing the subject, is there a rule of thumb which will allow you to estimate whether a given program will fit into a given number of kilobytes?

J.White

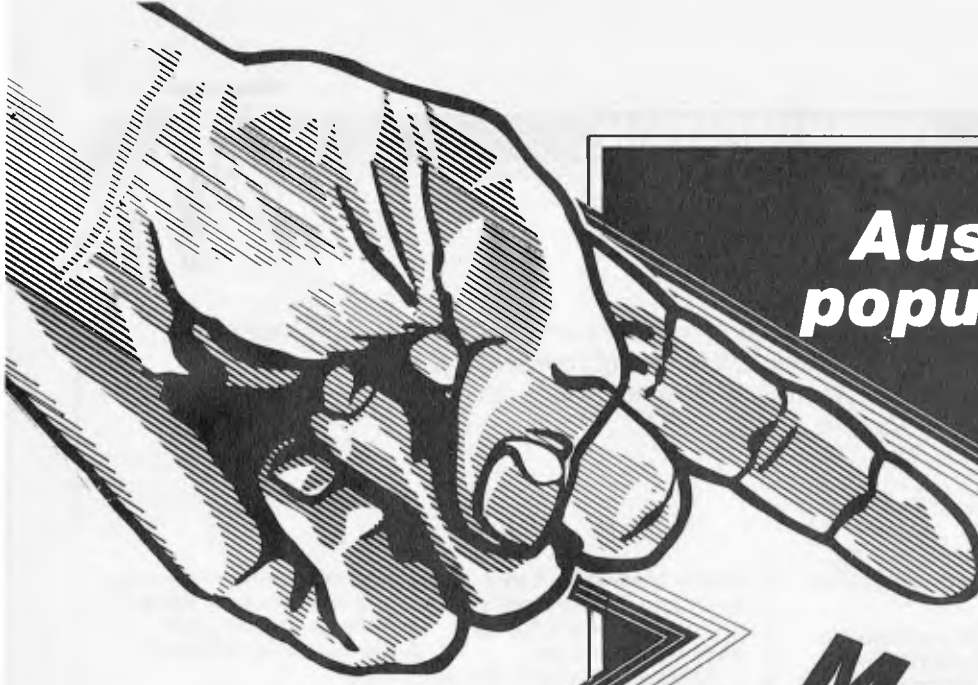
APC is always looking for general interest programs for home users but we suspect that, in the end, most home users buy their machine in order to learn about computers - this is the principal justification for the purchase. As to your last query, there is no single rule, if your Basic stores programs as ASCII characters then you can count the number of characters in the program and add five bytes for every line to get a rough byte count. If your Basic stores programs in token form then you count one byte for each reserved word, not for each character in the word. But you have to know how your interpreter works. ZX81 and PET Basics for example use single byte tokens. - Ed.

VIC talk

Is it possible to get my VIC to speak?

P.Richardson

If you are thinking of trying to program the sound generator to produce speech, then forget it. Speech in humans is produced as a result of not only sounds from the vocal cords but also movement of the air cavities in the mouth. Electrically, this means passing the sound through a filter



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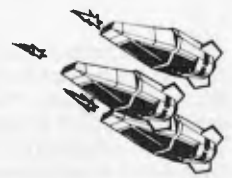
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whose characteristics are quite complicated and can be varied at a rate and manner which is extremely difficult to follow. The way it is normally achieved these days is to use a dedicated speech synthesis chip. These are designed to be programmed by the computer to produce the desired words. — Ed.

APC-80 ideas

I have just read your 'APC-80' rides again in the February copy of APC (which I have only just received as it takes a little while for books to get to our part of the world).

I have not as yet tried out APC-80 as I have ordered all the back copies so that it can be made up a section at a time which should make my typing errors easier to find.

However, I have taken you up on your offer of sending in an idea which may or may not be of interest to other users.

Having spent a considerable amount of time writing my own Word Processing Program I have found one problem that it is not possible to solve in Basic, at least I don't think so. While running the program the CPU will go off in a different direction every now and again and no longer responds to the keyboard. This appears to be due to the large amount of string handling it has to do. I have read somewhere that its known as 'Garbage Collecting', and that it is the CPU reorganising the memory area.

I have found that the number of times and duration can be kept to a minimum by CLEARing as large amounts of memory as possible. However, it still happens from time to time so its something you learn to live with.

Not being a professional typist, I have to look at the keyboard rather than the screen, so here I am bashing away at the keys only to look up and find that for the last few seconds the computer has not been taking any notice of me.

So my idea is that the system will give me a little BEEP so that I hold on for a few seconds. A second BEEP when its ready for me again would come in handy but I don't consider it important.

For my own use I would prefer a stand alone program as the sort of applications would mean using it with other lengthy programs such as

DS's WORP-1.

I hope you find the idea of some use, and I look forward to getting APC-80 running in my machine.

S.Springett

Relative calls

I noticed the letter from B.Lavery in the April issue of your magazine in which he uses "CALL OBH" to answer his "Where are we?" question. I have a different ROM call which does the same job, without destroying the HL register pair.

At 13E5H in the TRS-80/ SYSTEM 80 ROM the following code can be found:

```
EX (SP),HL
JP (HL)
```

A call 13E5H saves the HL register on the stack and returns with the callers address in the HL register.

I have included an example based on B.Lavery's code for a "RELATIVE CALL".

```
CALL 13E5H
LOCN1 JR SUBR1
LOCN2 (RETURN TO HERE
      FROM SUBR1)
.....
.....
SUBR1 INC HL
      INC HL
      EX (SP),HL
      ; INSTEAD OF
      "PUSH HL", — pops
      HL and pushes
      return address
      ; (SUBROUTINE
      CODE)
      RET
```

I have taken the time to write because I think relocatable code can be quite important in some situations.

D.Bareis

Brain sort

I find sorting very slow on my SuperBrain. Could you tell me how to speed it up to an acceptable level, using MBasic.

P.Harrison

Firstly, use a good algorithm; 'Quicksort' is probably the best. Secondly, compile your program where possible. If you compile it and you make maximum use of integer variables, you will improve the speed by a factor of 20. (I

have done it); you can sort 1000 numbers in about five seconds.

Another alternative is to buy a package like 'Supersort' which runs under CP/M. This is very versatile indeed and, provided your records are arranged so that the fields are either 'comma delimited' or are 'fixed length', it will sort a file on any field or fields. So you send your data to a file and then sort that using Supersort. You can always link Supersort into a package by using SUBMIT and XSUB CP/M utilities. — Ed.

Wanted: Peach users

I am interested to contact other 'Hitachi Peach' users to exchange programs, discuss problems, etc.

Please contact: Donny Korman, 9 Thomas Street, Hampton, Victoria 3188.

D.Korman

Color computer club

I would be interested to hear from any of your readers who have the TRS-80 Color Computer, and would like to form a user group. With so little information and expertise currently available for this unit, such a group would be invaluable to its members. Interested parties can contact me on (03) 609 3096 (BH) or (03) 580 5521 (AH).

A.Shiffman

A.T. users wanted

Due to the interest in the applied technology DGOS Z80, the 'A.T. Micro Computer Club' has been started. Numerous programs have been converted into Microworld Basic, with several more still in the pipeline.

The first official meeting has yet to be set, so could all interested parties contact the writer to help get the club off the ground.
Home: (03) 879 2257

Business: (03) 699 2888.

G. Forest.

Color computer offering

Congratulations on an excellent magazine — I have been a subscriber for some time now and have been pleased to see your continued growth and improvement. The balance of articles specific to particular computers and general computing is the most attractive feature. However two aspects do seem to weaken the magazine's potential.

1. The preoccupation with games
2. The absence of articles on newer computers

I don't intend to say much on my first Pet hate (to each his own) and really there IS something to be gained from games — well in writing them at least. But I cannot overlook the second issue. There have been many new computers on the market recently but apart from the odd review when a new machine is released nothing is printed for the users of these new machines. Now I know it takes time for users to get familiar with these new whizbangs but surely it is time for the ideas to start coming in. Well I guess I had better put my pen where my mouth is, attached is an offering for the TRS-80 color computer. I also want to say that the TRS-80 has been much under rated by many. It really is quite a dark horse but the more I use it the more I appreciate the efforts the designers put in. The cost is also pretty impressive — about \$2100 for 32k, disk, printer and one of the best graphics basics around. Still this is not the place to try and convert the world, but at least it might spur the Atari, Vic 20, Peach, etc users to contribute their newfound knowledge and so improve the magazine for all of us.

Now to the program I have submitted. Whilst I have just given the TRS-80 a great song of praise it is not perfect. (I once heard the perfect computer described as cheap enough for all to own, programmed by normal speech and installed by painting it onto a wall). For TRS-80 disk users one annoying feature is the directory listing.

COMMUNICATIONS

More than 16 entries and it is impossible to see all the directory at one time. Also it would be nice to have a hard

copy of directories but TANDY don't provide this feature with their DOS. The program offers an alternative directory list that

enables up to 48 files to be listed in one screen full, and allows hard copy. The program is not a complete answer but it

is easy to change and is commented.

S.Gray

```
10 ' DIRECT LIST
20 ' COPYRIGHT A R GRAY 18 APRIL 1982
30 ' ALL RIGHTS RESERVED
40 ' THIS PROGRAM MAY BE REPRODUCED ONLY FOR PERSONAL USE
50 ' AND CANNOT BE SOLD OR MARKETED WITHOUT PRIOR CONSENT
60 '
70 ' Directory information is stored on trak 17 sectors 3 to 11
80 ' 8 entries / sector
90 ' A#+B# used to read data in
100 ' C# built from A# + B#
110 ' DISKI reads sector
120 ' &H used to denote hex notation
130 ' Each line on screen contains up to 3 entries
140 ' CU is cursor control
150 ' S used to indicate if screen(0) or Printer (-2)
160 ' BASIC files marked with *
170 ' BINARY files marked with !
180 ' All other types marked with first character of file extension
190 CLEAR 1000
200 CLS:INPUT "PRINTER(P) OR SCREEN(S)"Y$
210 S=0:IF Y$="P" THEN S=-2
220 FOR SC=3TO11:REM DIRECTORY SECTORS
230 DISKI$(0,17,SC,A#,B#)' Read sector
240 C#=A#+LEFT$(B#,127)' Build C# but dont exceed 255 length
250 CU=20' Make sure CU starts at lhs
260 FOR EN=0 TO 7' 8 entries / sector
270 IF ASC(C#)=0 OR ASC(C#)=&HFF THEN GOTO 320:
    ' If not a Valid entry then skip
280 CU=CU+11:IF CU>29 THEN CU=0:PRINT#S:' screen Position
290 IF MID$(C#,12,1)=CHR$(0) THEN MID$(C#,9,1)="*"' MARK BASIC PROGRAMS
300 IF MID$(C#,12,1)=CHR$(2) THEN MID$(C#,9,1)="!"' MARK BIN FILES
310 PRINT#S,TAB(CU);LEFT$(C#,9);' Print entry
320 C#=MID$(C#,33):' Shorten C# to next entry
330 NEXT EN:' next entry
340 NEXT SC:' next sector
350 END
```

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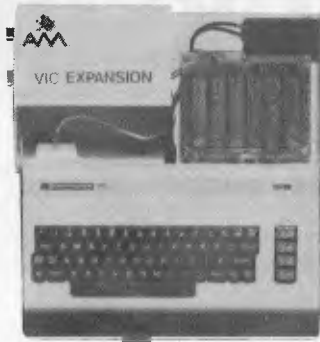
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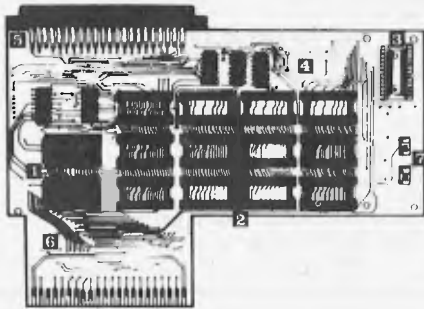


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TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: 'TJ's Workshop', APC, 462 Burwood Road, Hawthorn, 3122. Please keep your contributions as concise as possible. We will pay \$10 for any tips we publish (think how much solder and/or sticky tape that would buy).

SUSPEND PRINTING OPTION FOR NORTH STAR

Many systems use control S to suspend screen output during a listing to the screen. North Star DOS does not have this facility but a similar option may be provided. Upon examination, it becomes apparent that there are several advantages in installing such an option not in COUT as one might expect but in CONTC, with the obvious disadvantage of being dependent on the program running testing

CONTC regularly (Basic does).

The program shown is a generalised version for use with 5.1 I/O routines with DOS located at 2000H. In my own case I have been able to include the CONTS routine inside the allocated DOS I/O space.

To use — control S to suspend machine processing, any character to resume processing.

S.Sondergaard.

```

29F1    CONTC      ; almost identical to original version
29F3    MVI A,O
29F6    CALL IST
29F7    STC
29F8    CMC
29F9    RNZ
29FC    CALL CONTS; patch in new address (originally CALL CIN)
29FE    CPI 3H
29FF    STC
        RET
    
```

```

CODE    CONTS      ; new routine (A=O on entry)
CD1020  CALL CIN   ; get character
FE13    CPI 13H
CO      RNZ        ; return if not control S
33      INX SP     ; throw away return address
33      INX SP
3E00    MVI A,O    ; for CIN
CD1020  CALL CIN   ; get next character, wait if not ready
C31620  JMP CONTC ; and try again
    
```

ZX81 POINT

When moving a character on the ZX81 display using PRINT AT, it can be useful to know whether any other character is being printed over, for instance, a moving missile in a space invaders type game. This can be done by PEEKing the system variable held at 16398 and 16399, which is the present address of the cursor in the display file. When this has been found it can be PEEKed to give the character code of the character at the present screen position, as in Listing 1.

A useful routine which can be derived from this is a point routine, similar to the POINT(X,Y) in TRS-80 Basic. This says whether a point has been plotted by giving a 1 if X,Y has been plotted, 0 if it has not, as in Listing 2.

By the way, in the Sinclair manual, character code 135 is shown as an inverse square with the bottom right quarter missing; code 135 is in fact inverse of this character.

Andrew Esmond

```

1000 REM ROUTINE TO FIND CHARACTER AT THE
      PRESENT SCREEN POSITION
1010 PRINT AT X,Y;
1020 REM X & Y ARE THE CO-ORDINATES TO BE
      TESTED
1030 REM THE SEMICOLON STOPS THE CURSOR
      MOVING TO A NEW LINE
1040 LET P=PEEK(PEEK 16398+256*PEEK 16399)
1050 REM P CONTAINS THE CHARACTER CODE OF
      THE PRESENT SCREEN POSITION SET BY X
      & Y
1060 REM REST OF PROGRAM
    
```

Listing 1

```

1000 REM POINT (X,Y) ROUTINE. X & Y ARE
      THE CO-ORDINATES
1010 LET P=0
1020 REM P IS THE VARIABLE IN WHICH THE
      POINT'S CONDITION IS RETURNED
1030 LET X1=INT(X/2)
1040 LET Y1=21-INT(Y/2)
1050 PRINT AT Y1,X1;
1060 REM X1 & Y1 ARE THE PRINT EQUIVALENTS
      OF THE PLOTTING CO-ORDS X & Y
1070 IF PEEK(PEEK 16398+256*PEEK 16399) THEN
      LET P=1
1080 REM P NOW CONTAINS THE CONDITION OF X,Y
1090 REM REST OF PROGRAM
    
```

Listing 2

PET EPROM MOD

I would refer to the item 'EPROM Programmer for PET' in the April 1982 APC, as some of the advice given differs from that given in the Intel 1979

Component Data Catalog.

The circuit diagram in Fig 3 shows V_{pp} as 26 volts whereas Intel gives the DC programming characteristics for V_{pp} as 25 ± 1 volt; note that care must be taken when switching V_{pp} to prevent overshoot exceeding this maximum specification.

The sequencing of the application of the voltages to the 2716 is the reverse of that quoted by Intel, which states ' V_{cc} must be applied simultaneously or before V_{pp} and be removed simultaneously or after V_{pp} '.

Intel also states the 2716 must not be inserted into or removed from a board with V_{pp} at 25 ± 1 volt.

It is appreciated that other

manufacturers may have 2716s with slightly different characteristics, and I would suggest that a check on the data sheet is advisable.

The problem can be overcome by rearranging the switching as shown in Fig 1. The second switch in the V_{pp} line is provided in case the two poles of S1 do not make simultaneously.

It would appear that the circuit could be easily modified to program Intel 2732s (but not 2532s as the pin out differs from that of the 2716). To do this it is necessary to make use of the spare address output D of IC 6 as A11 and provide a double pole two way switch and a condenser of 0.1 microfarad from V_{pp} to ground. The addresses in the machine code program will need to be modified. The suggested arrangement is shown in Fig 2.

For anyone thinking of building the circuit it could be worth considering reducing the chip count by replacing the three 7493s with one 4040, a 12 stage ripple-carry

binary counter, and the two 6T26 with an octal bus transceiver such as the Intel 8286 or the 74LS242/3.

J H Whittaker

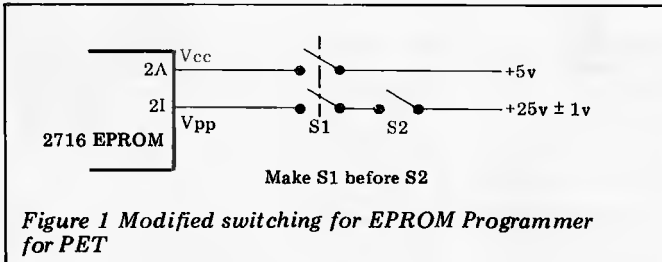


Figure 1 Modified switching for EPROM Programmer for PET

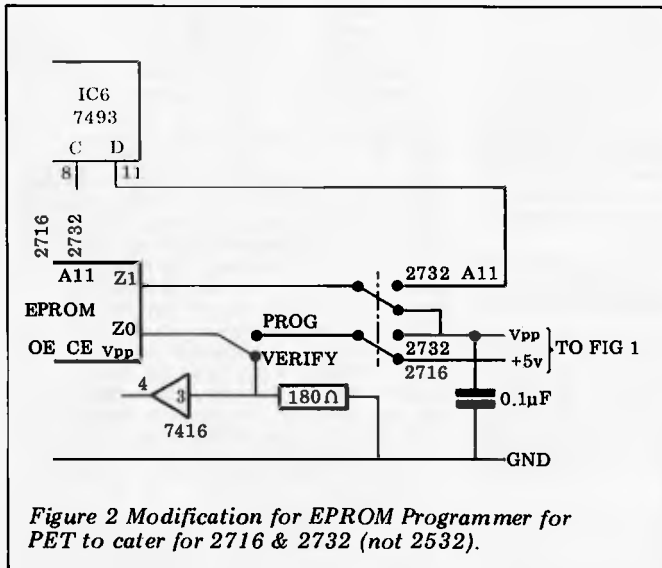


Figure 2 Modification for EPROM Programmer for PET to cater for 2716 & 2732 (not 2532).

TRS-80 SYSTEM TAPE AUTO-START

I guess that anyone who has used the editor/assembler for the TRS-80 or System 80 is aware of the way in which entry points can be specified when creating a system tape of the object module. By placing a label or address after the "END" statement, this declares the address to which the machine will jump if the system prompt ("*?") is replied to with just a slash ("/") after the tape has been loaded.

Few people realise, however, that it is also possible to convince the machine to start executing the program automatically as soon as it is loaded - without any action by the human operator. Careful disassembly of the system

tape load routine in the Level II ROM reveals that after a tape has been successfully read, and before the next system prompt is delivered, a call is made to address 41E2H in the system RAM area. This location normally contains a RETurn instruction which allows the system routine to continue normally. It is a simple matter to overwrite this vector to force automatic execution of the program being loaded. This is achieved by including the following statements at the bottom of your assembly code:

```
ORG 41E2H ;AUTO
        START VECTOR
        JP ENTRY
        END
```

Where "ENTRY" is a symbolic label or address corresponding to wherever you want execution to commence. Once the editor/assembler has been used to create a system tape of your program, the tape can be used in the normal way, with the

exception that the program starts execution automatically. Not only does this make it easier to load, but it also enhances program security, as no-one gets a chance to PEEK it before it starts running.

Ian Davies.

TRANSIENT CP/M BIOS PATCHING

If your CP/M BIOS does not implement the I/O byte, there can be problems when you wish to use an 'alternative' printer or other peripheral (perhaps your own printer has a parallel interface, but you have borrowed a daisy-wheel using RS-232 serial). There may be a suitable routine in the BIOS which you can access by simply patching the jump table, but you may find that a different driver routine is needed. The cleanest solution is to modify the BIOS (using SYSGEN, etc), but I have discovered the disadvantages of having a collection of disks containing

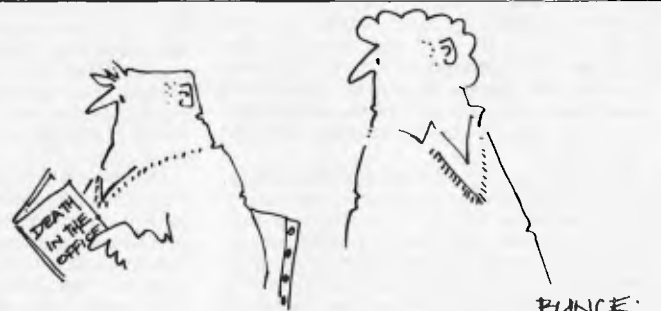
variable operating systems. This short program shows how you can patch a special driver over the one existing in memory (make sure you don't overwrite anything important!), but by changing addresses it can install the code any where you wish (providing you also patch the jump table). All sorts of frills could be added, but this is just to give you an idea. For instance, it might be useful to install a large driver at the top of the TPA, but as I haven't tried this, I shall say no more.

Steve Withers

```
ORG 100H
MVI B, 15 ; Number of bytes to be installed
LXI H, CODE ; Address of code to be installed
LXI D, 0D25DH ; Address of destination for code
LOOP: MOV A, M ; Get a byte
      STAX D ; Put into BIOS
      INX H ; Bump both...
      INX D ; Pointers
      DCR B ; Decrement byte count
      JNZ LOOP ; Repeat until finished
```

; This is where you may need to change the appropriate address
; field in the jump table if you are not overwriting the
; existing routine.

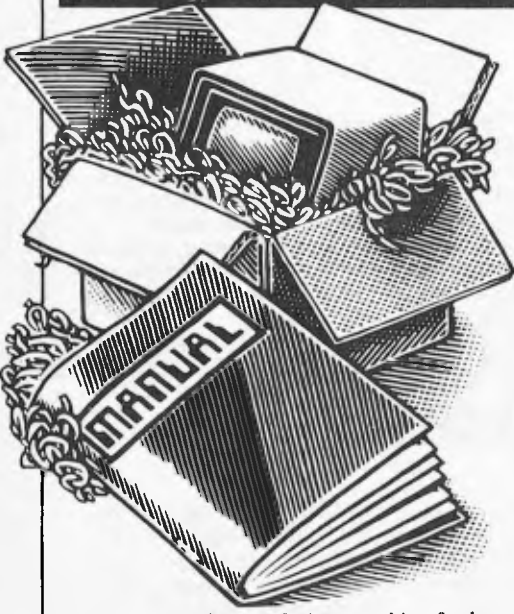
```
CODE: RET ; Back to CP/M
      IN 6 ; Code to be installed
      ANI 1 ; this is my normal driver
      JNZ 0D25DH ; Code is not relocated, so you
      MOV A, C ; must know where it is going
      OUT 0
      MVI A, 20H
      OUT 6
      RET
      END
```



'The computer did it'

NEWCOMERS START HERE

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



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

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

The microcomputer is capable of receiving information, processing it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary

or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the programming language is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an **interpreter** which picks up each English-type instruction, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

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

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

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

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

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

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer

won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

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

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

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

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

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

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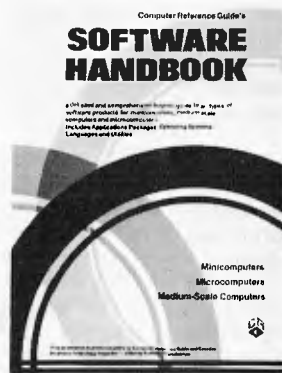
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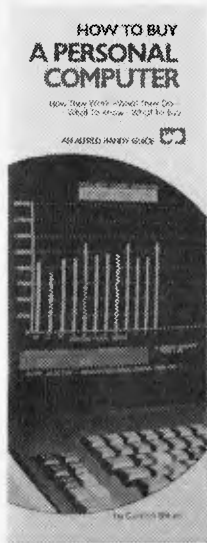
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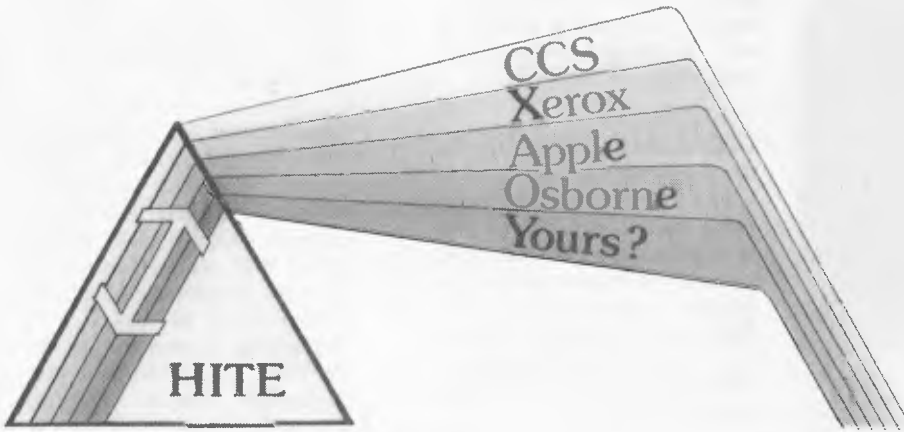
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3-D MADE EASY

Chris Horseman, author of several of those spectacular graphic games for the Atari, passes on some of his know-how.

Three-dimensional graphics are becoming increasingly used in many aspects of computing — simulation, animation, design and, more recently games. A certain mystique tends to surround the subject, although the mathematics involved are simple applications of trigonometrical equations. Often the mathematics corresponding to the spatial manipulations are represented in matrix form; this can be off-putting to those people without the mathematical background.

The sample program included demonstrates the elements of three-dimensional graphics described. It will run on both the Atari 400 and 800 and uses approximately 12k, including the high-res screen and the arrays. The program can be converted for use on other microcomputers providing that they have high-res graphics available. In the description of the program below, I have tried to point out all the parts that are Atari-specific. The program displays on the screen a line drawing of an Atari 800 console and, by moving the joystick, it is possible to view the object from any angle and distance.

In order to move an object drawn in three dimensions it is necessary to define its position in space relative to something fixed. For this purpose, a Cartesian coordinate set is used, with its X, Y and Z axes corresponding to the three dimensions. Various conventions dictate the labelling of the three axes; the one that I have used is shown in Figure 1.

Since the object is stored as a set of points with lines connecting them in a specific order, the individual points must be manipulated so that the new orientation of the object can be constructed.

There are three basic types of manipulation used in 3D graphics: translation, scaling and rotation.

Translation

The simplest of these types of manipulation is translation, which involves moving the object in one or more

planes without altering its size or shape. New coordinate values are calculated by:

$$\text{newx} = \text{oldx} \pm \text{distance to be moved in x direction}$$

with similar equations for Y and Z. Figure 2 shows a simple example of translation.

Scaling

Scaling has the effect of increasing or decreasing the size of the object. This can be done either uniformly or in just one or two dimensions. Figure 3 demonstrates the scaling of a cube. Mathematically, scaling takes this form: $\text{newx} = \text{oldx} * \text{scaling factor}$ in the X direction. Similar equations are used to define Y and Z.

In the program, only uniform scaling is used so that the object can appear to be approaching or receding from you, much like the effect of a zoom camera lens.

Rotation

Rotation can be applied about any of the three axes. The angles of rotation (that is, the degree of turn) are denoted throughout by THETA, PHI and PSI (Θ, ϕ, Ψ) and correspond to the Y, X and Z axes respectively. Rotating a point about one axis will change coordinates on the other two axes. For example, rotation about the Z axis can be written mathematically

$$\begin{aligned} \text{newx} &= \text{oldx} * \cos(\Psi) - \text{oldy} * \sin(\Psi) \\ \text{newy} &= \text{oldy} * \sin(\Psi) + \text{oldx} * \cos(\Psi) \\ \text{newz} &= \text{oldz} \quad (\text{ie, no change}) \end{aligned}$$

Figure 4 shows the Z rotation described.

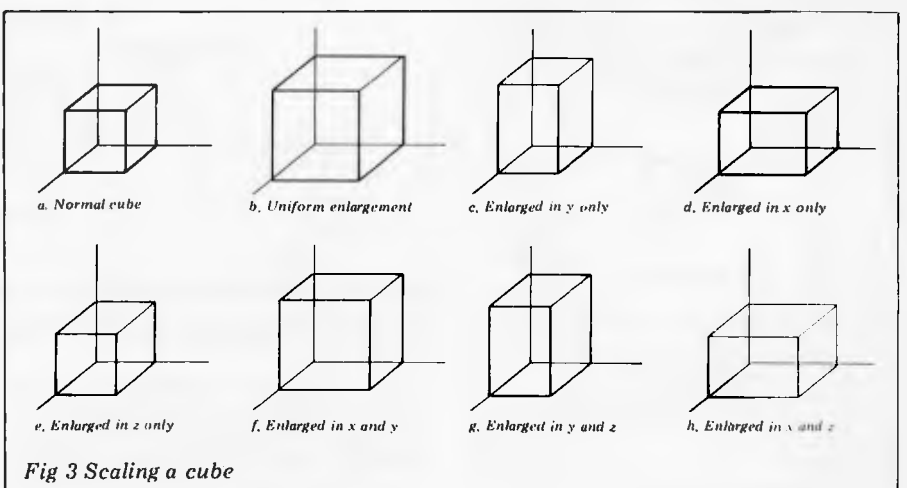
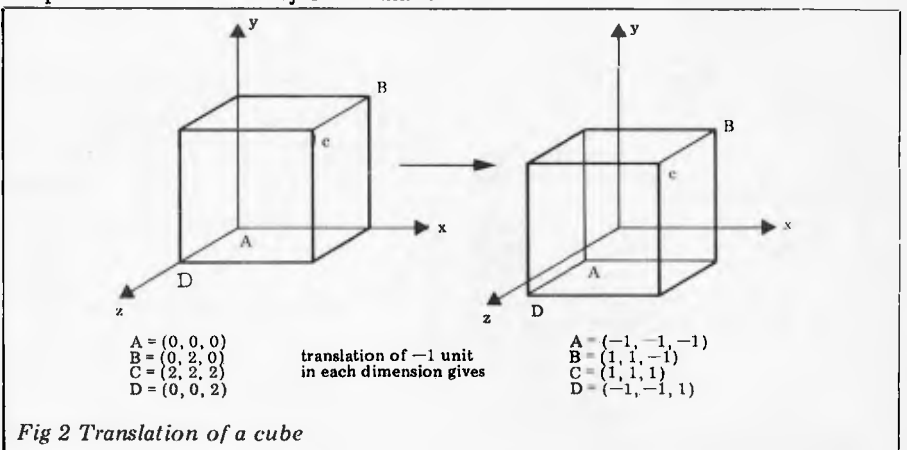
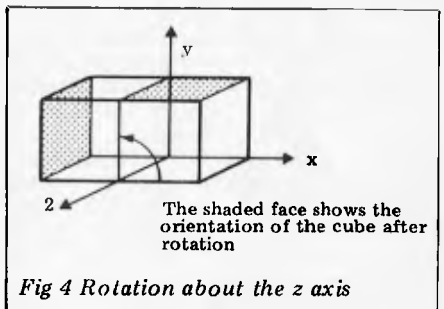
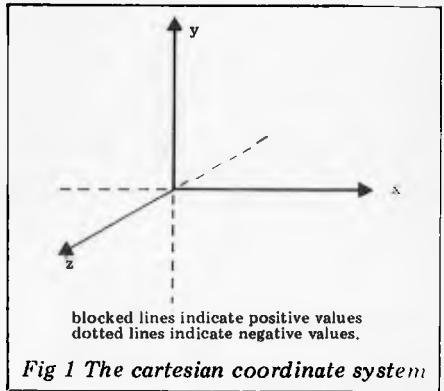
Besides these operations, there are some ancillary manipulations that must be performed on the object to make

the image appear correct when drawn on the TV screen. They are perspective transformation and clipping. Displaying a three-dimensional object on a two-dimensional screen makes it necessary to flatten the image. However, to avoid losing its three-dimensional effect, the Z coordinates of the points must be converted to offsets in the X-Y plane. This requires perspective transformation which is mathematically represented

$$\text{newx} = \text{oldx}/z$$

$$\text{newy} = \text{oldy}/z$$

This gives an object perspective from a point at zero on the Z axis.



3-D

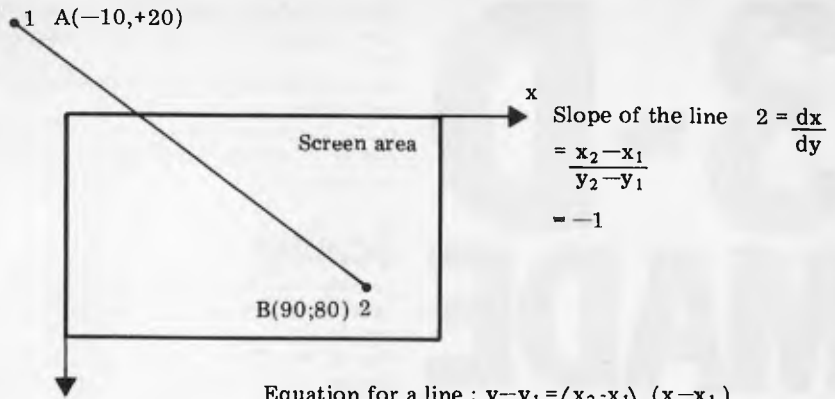
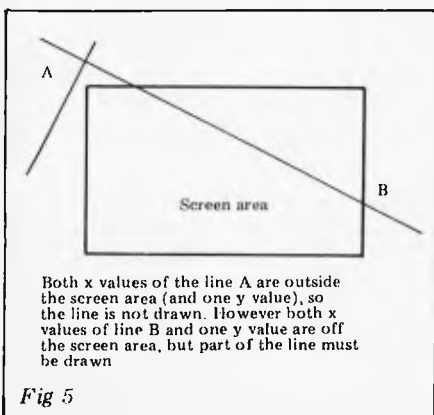
Because $Y=0$ is at the top of an Atari screen, it is necessary to change the sign of the Y coordinates at this point. The coordinate values of the points are now in the same coordinate system as the screen although some values may exceed the boundaries. In order to construct the image from these points, a data table or similar is necessary to indicate which points join to each other. Using this, a pair of points can be taken ready to draw a line. However, before drawing the line it is necessary to determine its position with respect to the observer. A line is only visible if it is in front of the observer, and at least partly on the screen area. Thus a test to see if the line is behind the observer must be performed.

If the Z coordinate of a point is negative it means that the point is behind the observer. A line is not drawn if both the Z coordinates of its points are negative, but if one of the Z coordinates is positive then the part of the line in front of the observer must be drawn. The line is drawn from the visible point in the opposite direction to the apparent position of the invisible point. The line is continued until it reaches one of the screen boundaries. This reversal is necessary because perspective offsets in the X-Y plane suffer a change of sign if the z-value is negative.

It is possible that a line is outside the boundaries of the screen, and a test must be performed to determine whether both X or both Y values of the points are off the screen in the same direction. If this is so then the line is not drawn. However, if both X and Y are off the screen but in opposite directions the line may cross the screen and still need to be drawn.

If the line is to be drawn but one or both points are outside the screen boundary, then the line must be clipped. To do this, the slope of the line is found and the boundary value that the line crosses is used to calculate the new coordinate. This is done first for the X and then the Y coordinates. An example of the use of this clipping procedure is given in Fig 6.

The line B2 now lies totally within the screen boundaries, but under certain conditions a line may still lie outside and



Equation for a line : $y - y_1 = \left(\frac{x_2 - x_1}{y_2 - y_1} \right) (x - x_1)$

Let the slope of the line be denoted by m.

$y - y_1 = m(x - x_1)$

$y = mx - (mx_1 - y_1)$

But $mx_1 - y_1$ is a constant denoted by c corresponding to the y intercept value of the line

$y = mx + c$

In the example the boundary value, $x=0$ is used to find the clipped value of y. Inserting numerical values this gives

$y = -1 * 0 + 10$
 $= 10$

similarly for $y = 0$
 $x = \frac{1}{m}(y - c)$

$= -1(0 - 10)$
 $= 10$

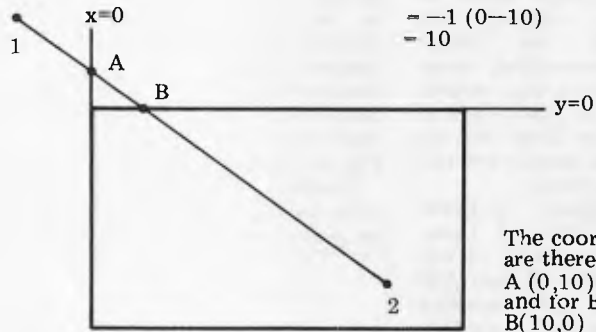
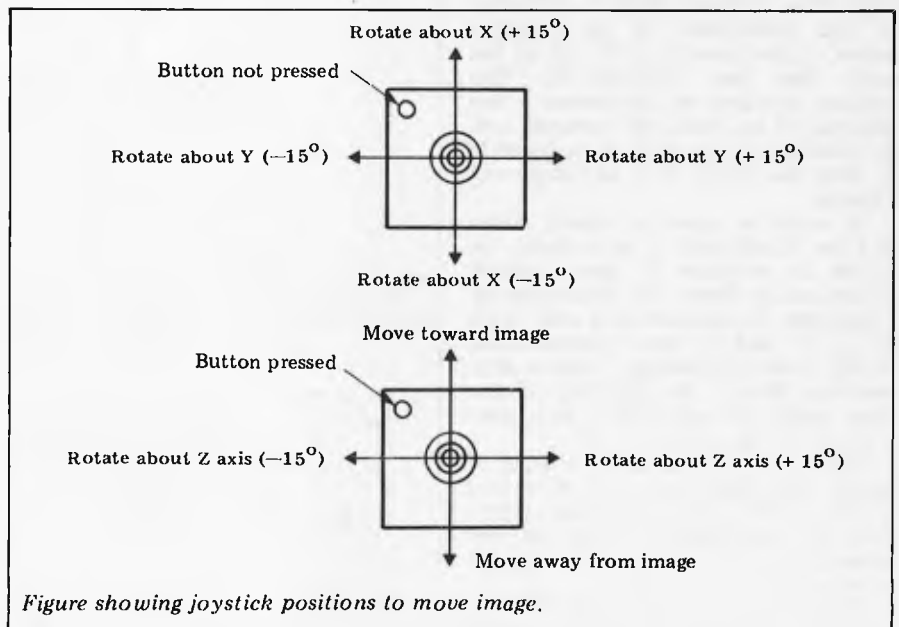


Fig 6 Example of clipping in the x-y plane.



a final test is performed before the line is drawn.

I have left out certain more complex aspects of 3D graphics such as colouring the faces of an object and hidden line removal. These are not impossible on a micro, but make the process of genera-

ting an image more time-consuming, and are out of the scope of this article.

The program

Initialisation (590-660): this routine dimensions the arrays and reads in their

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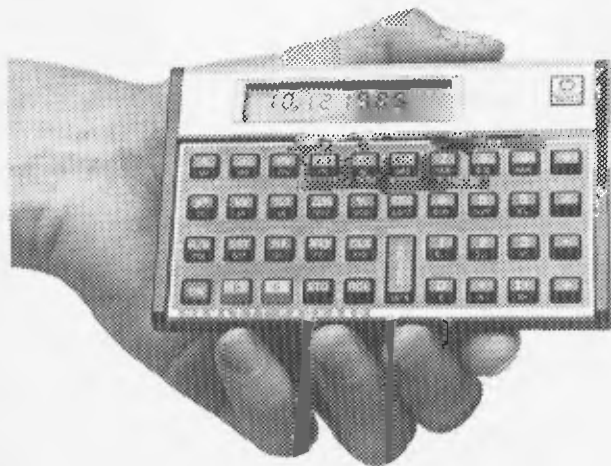
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3-D

initial values from data.

Manipulation of data (20-110): lines 30 to 76 perform rotations about the three axes; line 90 scales the image, carries out the perspective transformation and centres the image on the screen.

Line preparation (420-480): this routine contains the point connection table and, using this, it selects pairs of points and passes them to the draw routine.

I have used a shortcut here and sent the line to the draw routine without first clipping it. If the line is off the screen then Atari generates an error condition. If an error occurs, the trap statement on line 350 causes the program to jump to line 455 which sends the line to be clipped and redrawn before returning to the main routine. This 'shock horror' technique is used because Basic is able to test for an errant line much faster than I can and this cuts the routine down from 14 seconds an iteration to 6 seconds.

If you wish to use this program on a machine with neither trap nor ON ERROR GOTO statements then delete line 450, remove the POP statement from line 455 (POP just removes the top value on the stack and is used if a sub-routine or FOR...NEXT loop has been jumped out of). Also, remove the trap statement from line 350.

Control routine (500 to 570): most of this routine is Atari specific but it would not be difficult to rewrite for another machine. This routine takes a value from the Atari joystick and its trigger and from this performs the required modification to angle or distance.

The two POKES on line 510 make the keyboard speaker click when the joystick is moved and set the attract flag to zero to prevent the Atari from going into its colour cycling routine.

Clipping routines (120-410): this routine performs the clipping in the X, Y and Z directions and then sends the line to be drawn.

If you wish to change the image displayed you will have to change the point coordinate data on lines 610 to 630 and the connection data on lines 460 to 480.

If you use a different number of points you must change the array sizes on line 590 and the FOR...NEXT loops on lines 40 and 660. If you use a different number of lines then you must change the FOR...NEXT loop on line 430.

You will get the best results if you centre the image about the zero point in each axis. If your new object is very large or very small you may wish to change D on line 590; this is the initial distance of the observer from the object.

```
10 GOTO 590
20 REM POINT MANIPULATION ROUTINE
30 CTH=COS(-THETA) : STH=SIN(-THETA) : CPHI=COS(PHI) :
  SPHI=SIN(PHI) : CPSI=COS(PHI) : SPSI=SIN(PHI)
40 FOR I=1 TO 20 : X=X(I) : Z=Z(I) : Y=Y(I)
45 REM ROTATE ABOUT X
50 YP=Y*CPHI-Z*SPHI
55 ZP=Y*SPHI+Z*CPHI
56 REM ROTATE ABOUT Y
60 XP=X*CTH-ZP*STH
65 ZP=X*STH+ZP*CTH
70 REM ROTATE ABOUT Z
75 X=XP*CPSI-YP*SPSI
76 Y=XP*SPSI+YP*CPSI
77 X(I)=X : Y(I)=Y : Z(I)=ZP
78 REM PERSPECTIVE TRANSFORMATION
79 REM SCALING & CENTRE ON SCREEN
80 ZP=(D-ZP)
90 XN=X*100/ZP+160 : YN=- (Y*100/ZP)+96
100 XNEW(I)=XN : YNEW(I)=YN : ZNEW(I)=ZP : NEXT I :
  GOSUB 420
110 RETURN
120 REM CLIP ROUTINE FOR X & Y
130 N=0 : M=319 : R=191 : P=0
140 IF Z1<0 AND Z2<0 THEN RETURN
150 IF Z1<0 OR Z2<0 THEN GOSUB 370
160 X1=X1(1) : X2=X2(2) : Y1=Y1(1) : Y2=Y1(2)
170 IF (X1>M AND X2>M) OR (Y1>R AND Y2>R) OR
  (X1<N AND X2<N) OR (Y1<P AND Y2<P) THEN RETURN
190 IF X1=X2 THEN SLOPE=1E+30 : GOTO 210
200 SLOPE=(Y2-Y1)/(X2-X1) : IF SLOPE=0 THEN SLOPE=
  1E-10
205 REM CLIP X
210 FOR I=1 TO 2
220 IF X1(I)>M THEN C=M : GOTO 250
230 IF X1(I)<N THEN C=N : GOTO 250
240 GOTO 260
250 Y1(I)=SLOPE*(C-X1(I))+Y1(I) : X1(I)=C
260 NEXT I : FOR I=1 TO 2
265 REM NOW CLIP Y
270 IF Y1(I)>R THEN C=R : GOTO 300
280 IF Y1(I)<P THEN C=P : GOTO 300
290 GOTO 310
300 X1(I)=(C-Y1(I))/SLOPE+X1(I) : Y1(I)=C
310 NEXT I
315 REM FINAL CHECK
320 FOR I=1 TO 2 : IF X1(I)<N OR Y1(I)<P OR
  X1(I)>M OR Y1(I)>R THEN POP : RETURN
330 NEXT I
340 REM DRAW LINE
350 TRAP 455 : COLOR 1 : PLOT INT(X1(1)),INT(Y1(1)) :
  DRAWTO INT(X1(2)),INT(Y1(2)) : RETURN
360 REM CLIP Z
370 IND=1 : IND2=2
380 IF Z2<0 THEN IND=2 : IND2=1
390 X1(IND)=X1(IND2)-(X1(IND)-X1(IND2))*100
400 Y1(IND)=Y1(IND2)-(Y1(IND)-Y1(IND2))*100
410 RETURN
415 REM LINE PREPARATION
420 GRAPHICS 24 : SETCOLOUR 2,0,0 : COLOR 1 :
  RESTORE 460
430 FOR K=1 TO 26 : READ I,J : X1(1)=XNEW(I) :
  Y1(1)=YNEW(I) : Z1=ZNEW(I)
440 X1(2)=XNEW(J) : Y1(2)=YNEW(J) : Z2=ZNEW(J)
450 GOSUB 350 : NEXT K : RETURN
455 POP : GOSUB 130 : NEXT K : RETURN
460 DATA 1,2,2,3,3,4,4,1,5,6,6,7,7,8,8,5
470 DATA 9,10,9,5,10,6,1,5,2,6,3,7,4,8,1,
  0,11,11,12,12,9
480 DATA 13,14,14,15,15,16,16,13,17,18,18,
  19,19,20,20,17
490 REM CONTROL SUBROUTINE
500 A=STICK(0) : B=STRIG(0)
510 IF A<>15 THEN POKE 53279,0 : POKE 77,0 :
  GOTO 530
520 GOTO 500
530 C1=INC*(A=7)-INC*(A=11) : C2=INC*(A=13)-
  INC*(A=14) : THETA=C1*B : PHI=C2*B : PSI=
  C1*(B=0) : D=D+0.6*C2*(B=0)
570 GOSUB 30 : GOTO 500
580 REM INITIALISATION
590 DEG : DIM X(20),Z(20),Y(20),XNEW(29),YNEW(29),
  ZNEW(20),X1(2),Y1(2) : D=120 : INC=15
610 DATA -50,-40,0,50,-40,0,50,40,0,-50,40,0,
  -50,-35,20,50,-35,20,50,40,6,-50,40,6
620 DATA -40,-10,20,40,-10,20,50,0,13,-50,0,13
630 DATA -45,5,12.125,25,5,12.125,25,30,7.75,-45,
  30,7.75,30,5,12,125,40,5,12.125,40,30,7.75,
  30,30,7.75
660 RESTORE 610 : FOR I=1 TO 20 : READ X,Y,Z :
  X(I)=X : Y(I)=Y : Z(I)=Z : NEXT I : GOTO 530
```

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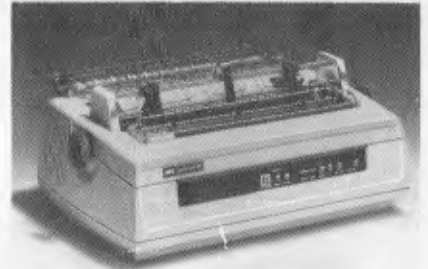
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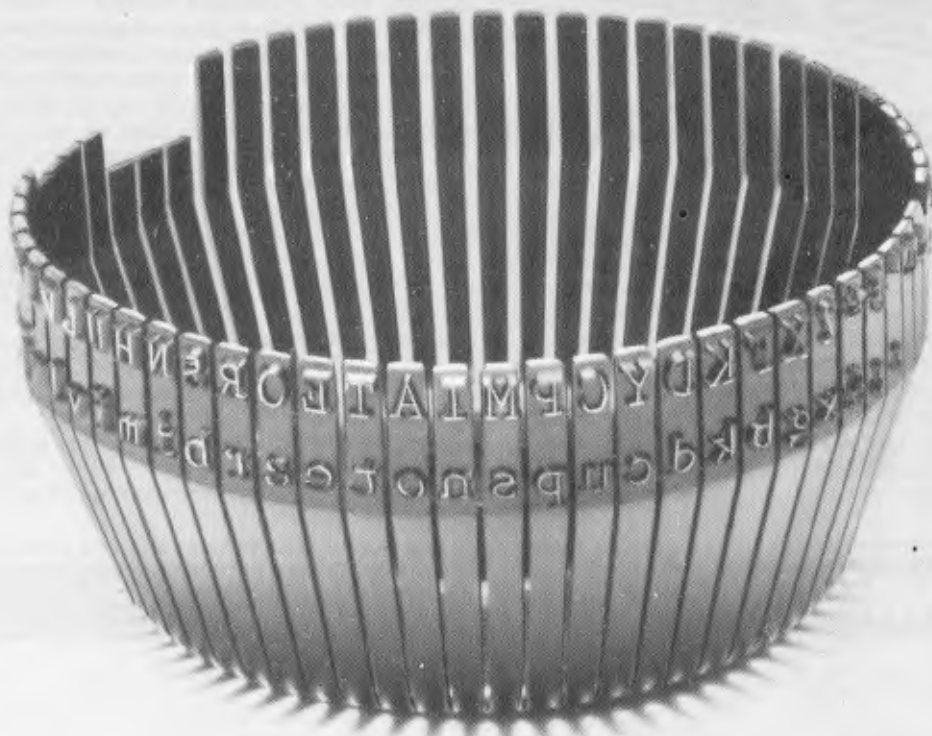
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GETTING TO THE ROOTS

Bev Mason presents a compact equation solving routine in Basic.

Many of us spend years at school learning how to solve algebraic and trigonometric equations in all their simple, simultaneous and quadratic varieties. The examples from the text books always seem to have the most beautifully simple integer solutions. Yet, when we enter the hard world to earn a living, the equations we are called upon to solve, those of us, that is, who chose to follow engineering and similar professions, are invariably monstrosities. By monstrosities I mean something like, for example:
 $\text{Sin}(3x^5 - 2x^3 + x^2 - 15) = 4x^2 - (x^2 + 3)^{1/2} - 5$; an example, by the way that is pure invention.

Such expressions can be tackled by methods of trial and error, or successive approximations, which tend to be very tedious exercises, particularly if a high degree of accuracy is required. Another method is to plot the graph of the function $y = f(x)$, where $f(x)$ is obtained by manipulating the original equation so that everything lies on one side of the equals sign, thus:
 $\text{Sin}(3x^5 - 2x^3 + x^2 - 15) - 4x^2 + (x^2 + 3)^{1/2} + 5 = 0 = y - f(x)$

By calculating y for various values of x and plotting the graph of y against x we can find the value, or values, of x for which $y = 0$. Such values are the required solutions. They are the values of x where the graph line crosses the x axis.

When it comes to tedious, this medium lacks nothing, and the accuracy leaves much to be desired. Fortunately, it is a simple matter to program a computer to calculate y values by the score ready for plotting. About three program lines would be needed. It seems an obvious next step to let the computer plot the graph and determine where the line crosses the x axis. However, this is not as simple as it appears. Microsoft Basic, which has been used for the program at the end of the article, has a POINT function which will 'look' at any graphic block on the screen and return a signal if that block has been 'lit'. By looking in turn at each block along the x axis one could soon determine the value, if any, at which the graph touched it. One would have to refrain from plotting the x axis itself, of course, otherwise all the blocks would be lit.

There are several reasons why this will not work. The System 80, for which the program was written, has 128 graphic blocks across the screen. Many micros have less. Therefore, the value of x where the graph touches the x axis can be no more accurate than $1/128$ of the distance or difference between the smallest and the largest plotted values of x . If the answer is required to an accuracy of (say) four places of decimals and it is known only that it lies between (say) 0 and 100, one would have to use a program something like this:

```
10 P=0: Q=0.0127
20 FOR X = P TO Q STEP 0.0001
30 Y = F(X)
.....
100 NEXT X
```

```
.....
150 P=Q: Q=0.0127 + Q: IF X<100 GOTO 20
```

The missing lines would include the instructions for clearing the screen, plotting the graph, and the POINT function, etc. But why use the latter function? Why not include a test such as if $Y=0$ PRINT X, X being the required answer? The reason is that computers have a limited accuracy. When the correct value of x is reached in the loop the calculated value of y is unlikely to be *exactly* 0. It may be zero, but one cannot guarantee it.

Also, the step of 0.0001 in x may be too large. One value of x may yield a negative y while the next value yields a positive y ; the graph shooting through zero in between. As there would be no graph point actually plotted on the x axis, the POINT function would not work either. One could perhaps overcome this obstacle by testing each value of y to see if a change of sign occurred. If a change occurred between x_1 and x_2 , these values could then be used to replace the original values of 0 and 100, in effect magnifying the significant part of the graph. The process could be repeated as often as required. There would still be no

guarantee that y would ever exactly equal zero or that a point would be plotted on the x axis. However, an answer could be calculated to any required degree of accuracy. A version of this system is used in the final program.

If the answer were around the 50 mark, the program above would have to calculate y about half a million times, a time-consuming exercise. And it could still miss the answer! Between two successive values of x , the graph might touch the x axis and hurry away again without changing sign, or it might cross the axis and cross back again. In the latter case, two answers would be missed.

A further difficulty arises with the scale of y . There can be any calculated value for y , of course, but the computer can only vary the plotted points in unit steps. It must therefore round the calculated values to fit in with the chosen scale. If y approaches zero gradually, many values could be rounded to zero and plotted along the x axis, producing false answers.

All of these difficulties can be overcome, and doubtless have been, by using a sufficiently complex program to produce answers automatically. However, the program which follows is relatively short and simple and is capable of solving equations to any degree of accuracy within the capabilities of the particular computer used. It does require attention from the operator.

The program

It is assumed that the operator, knowing the source of the equation, will be able to estimate the lowest and highest values of x within which the solution lies. This is not essential but it shortens the procedure. These values should be typed in, at lines 10 and 20, during the RUN. Before RUNNING, however, line 110 must be edited and $f(x)$ replaced with the function to be solved.

Lines 30 and 40 draw the x axis on the screen. As mentioned above, the System 80 display is 128 blocks wide, hence $N = 0$ to 127. The display is 48 blocks from top to bottom and the origin of the plot is in the top left hand corner, ie, x values are plotted from left to right and y values from top to bottom. A line across the centre of the screen, the x axis, occurs therefore at $y = 23$.

Lines 50 and 60 divide the x axis into four equal segments, putting five 'pips' under the line.

Lines 65 to 90 assign values to the pips. The lowest value chosen for x is printed under the left hand pip. The values under the remaining pips increase equally, until the highest value of x is printed under the right hand pip. The values are printed at the bottom of the screen, rather than immediately under the axis, to avoid obliteration by the graph points. The semi-colon in line 90 prevents scrolling each time a number is printed.

The x axis is divided into only four segments so that the five numbers do not overlap. The System 80 display is 64 characters wide so that five twelve-digit numbers, including the sign, can be printed with a space between. The number of segments could be increased by printing the numbers alternately on two lines, allowing them to overlap. In practice, the four segments seem to be adequate.

Lines 95 to 140 calculate the y values and plot the points. Line 95 sets the interval between the x values, the smallest interval possible with the System 80 being $1/128$ of the span. Plotting 128 points is time-consuming. Increasing the space between points reduces the time but increases the chance that the y value may cross the x axis and return without being registered. The interval must of course relate to the divisions on the x axis. An interval of $1/26$ of the span has been chosen as a suitable compromise.

If the value of y lies outside the range of -24 to 23 , the graph point will lie outside the display and the RUN will end on an error. Line 120 checks the y value and repeatedly divides by 20 until the value is acceptable.

As described above, when the value of y approaches zero the points tend to be plotted along the x axis itself, making it impossible to detect the correct answer. Line 125 detects

y values close to zero and repeatedly magnifies them by 20, making it easy to identify the crossing point. If y should equal zero, of course, its value is unaffected.

Because of the distortion introduced by lines 120 and 125, the resulting graph bears no resemblance to the graph of the function. This is not significant, as we are concerned only with zero values of y.

Line 130 plots the points in the display. It would normally be SET(X,Y). However, if X were to be used instead of N all the 27 points would be plotted in the left hand quarter of the screen. Using N, and increasing it by four each time, spreads the points so that they occupy the correct positions relative to the scale. The plot has to use 23-Y instead of Y in order to shift zero y from the top left corner of the display down to the x axis.

Lines 150 to 170 hold the display until the operator is ready to continue, which he does by pressing any key and entering new values on either side of the point where the graph crosses the axis. The graph remains on display while he is doing this. The process is continued until a sufficiently accurate value of x can be read off. If the process is carried on long enough, the interval between XL and XH becomes so small that the computer cannot divide it (without going into double precision arithmetic) and identical figures will appear at two or more points along the axis. This does not affect the result.

Pushing the computer to the limits of its accuracy can produce other strange effects. When the difference D in line 65 becomes very small, the increment S in line 100 becomes virtually zero, or is rounded down to zero, so that the loop becomes endless. The plot would go off the screen and the computer would stop on an error. To avoid this, N is tested in line 140 and the program exits from the loop if N exceeds 127.

In entering the lowest and highest values, XL and XH, it should be realised that the computer will calculate and plot Y for 25 values of X between these limits. If XL is negative and XH positive, it is possible that one of the 25 values could be exactly zero. It is vital therefore to inspect the equation for elements which could result in division by zero, or become infinite, such as cotangent x. Where such elements are obvious it is better to enter the positive and negative values as separate exercises, avoiding zero, eg, rather than enter XL = -10, XH = 15, enter XL = -10, XH = -0.00001 and XL = 0.00001, XH = 15.

Even where there are no obvious divisions by zero, this fault can still occur. A trivial example would be $1/(x-1)$ which would trip out at $x = 1$. Also, similar difficulties can be encountered in the ROM programs for calculating trigonometric functions or logs, etc. In these cases the difficulty can usually be overcome quite simply by making slight alterations to the values of XL or XH or both. If this does not work, the interval between XL and XH will have to be subdivided and separate entries made.

Further difficulties can be encountered with negative numbers when the expression contains fractional powers, roots and logs, etc. Nevertheless, it is usually possible to

obtain at least one solution, any missing solutions being complex numbers which cannot in any case be evaluated by this graphical method.

The System 80 will provide answers to six significant figures without recourse to its double precision arithmetic facility, as is illustrated by the following two examples.

A monstrous solution

Before solving the monstrosity invented in the first paragraph, let us try a more homely example:

$$6x^5 - 4x^4 + 3x^2 - 8x - 10 = 0$$

Because the highest power of x is five, there will be five solutions. Complex roots always occur in pairs so that there must be at least one real answer. The possibilities are one real and four complex, three real and two complex, or all real. Two or more real roots may be equal. In practical applications, the operator will have some idea of the range of values within which the solution will lie. This is not so with this theoretical example, so we try (say) -100 and +100 for XL and XH respectively.

The screen shows that the plot crosses the x axis at a point just higher than zero. We therefore re-enter XL and XH with values 0 and 10 and see that the crossing point lies between 0 and 2, which values we enter next. The narrowing down process continues fairly rapidly with the following pairs of values (this is an actual example) (1.25, 1.4), (1.37, 1.38), (1.377, 1.3775), (1.37705, 1.37708), and we read the answer 1.37707.

To solve the original equation we edit Line 110 to read $Y = \text{SIN}(X^5 - 2X^3 + X^2 - 15) - 4X^2 + \text{SQR}(X^2 + 3) + 5$. (Note that X^5 means X raised to the fifth power.) Again, we have no idea where the solution lies, so we try -100 and 100 and note that the plot crosses the axis twice, at a little less than zero and a little more than zero. In order to get a little closer we enter -10 to 10 followed by -2.5 to 2.5. At this point we can see that the crossing points are about -1.25 and +1.25. Dealing with the negative value first we enter (-1.2, -1.2), (-1.285, -1.275), (-1.281, -1.28), (-1.2805, -1.2804), (-1.28046, -1.28044) and find the first solution -1.28045.

To find the positive solution we enter 1.2 to 1.3 and find with this increased magnification that there are in fact two crossing points at approximately 1.25 and 1.29. Continuing as above, we enter another four pairs of numbers, finishing with 1.24708 and 1.24712. We read the second solution as 1.247115, where the final 5 is estimated from the scale.

A further four pairs of numbers ending with 1.29437 and 1.29439 give the third solution as 1.29438.

If on entering the original values of -100 and 100 the plot did not cross the x axis, there are the following three possibilities. The range of values covered was not sufficiently extensive. The range was too great, allowing the Y value to cross and re-cross the axis between the plotted points. All the solutions are complex. A small amount of trial and error is indicated.

```

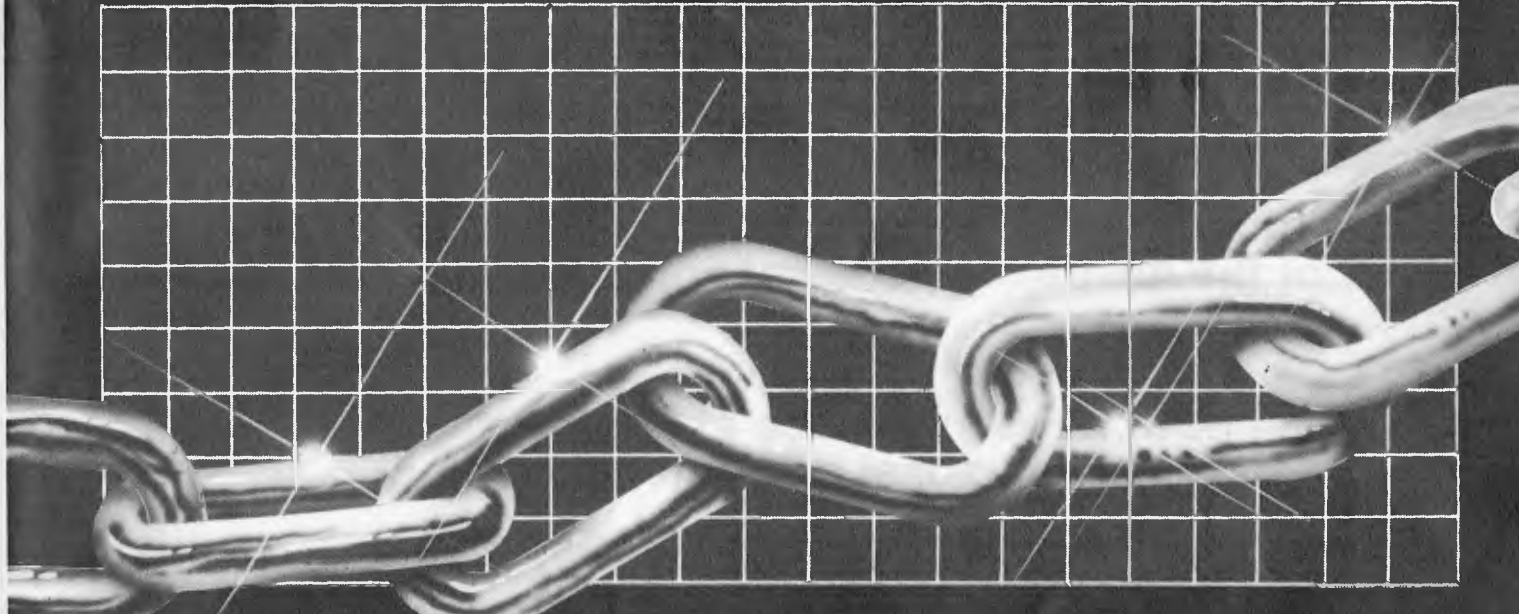
10 INPUT "LOWEST VALUE OF X"; XL
20 INPUT "HIGHEST VALUE OF X"; XH
30 CLS: FOR N = 0 TO 127
40 SET (N,23): NEXT
50 FOR N = 1 TO 105 STEP 26
60 SET(N,24): NEXT
65 D = XH-XL
70 FOR N = 0 TO 4
80 X(N) = XL+N*D/4
90 PRINT @ 960+13*N, X(N);: NEXT
95 S = D/26: N = 1
100 FOR X = XL TO XH STEP S
110 Y = f(X)
120 IF Y>23 OR Y<-24 Y = Y/20: GOTO 120
125 IF Y<1 AND Y>-1 Y = 20*Y: GOTO 125
130 SET(N,23-Y)
140 N = N+4: IF N<128 THEN NEXT
150 PRINT @ 0, "PRESS ANY KEY TO CONTINUE"
160 A$ = INKEY$: IF A$ = "" GOTO 160
170 GOTO 10

```

The program requires about 0.5K of memory.

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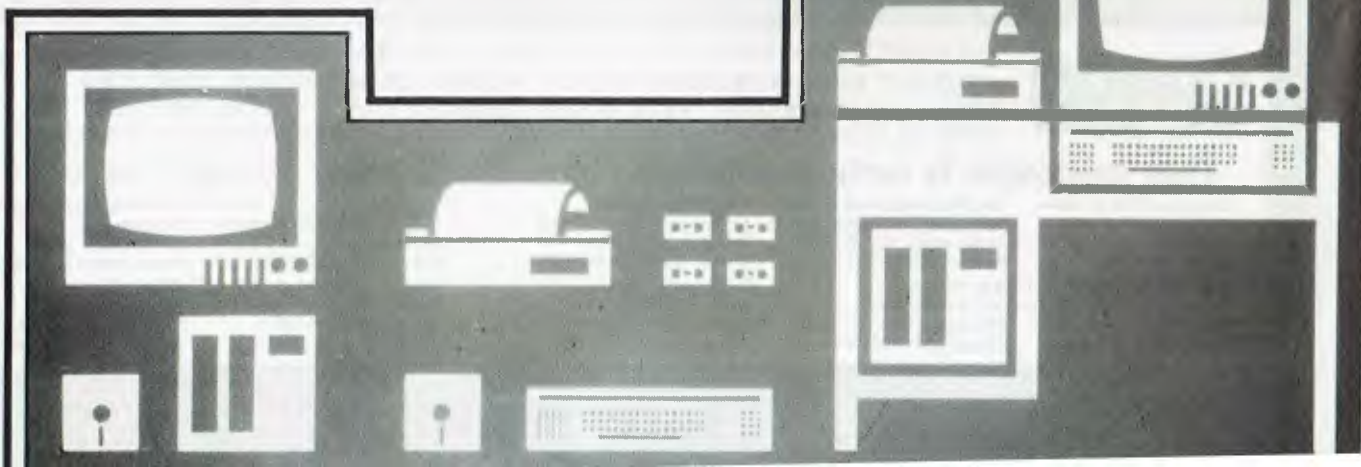
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HIGH DENSITY VDU CARD

Brian Hawkins
continues his article
on building a VDU
with a look at the
software.

Last month I described the principles, hardware design and construction of a high-density VDU card. This month we'll cover the assembler language driver routines to enable the VDU card to be interfaced to an 8080/8085/Z80 processor-based system to give a professional quality, full cursor control display screen.

Functional description

The function of the screen handler or driver routines is to control the placing of ASCII data to the display RAM and to correctly respond to certain screen control ASCII characters. This allows the user's main program to simply pass various parameters to, and call as a subroutine, the driver routines which take care of the detailed functions of the control of the display screen. There are a number of ASCII character codes that are used for control purposes instead of display characters, and the driver routines will respond to these codes and carry out the required function:

- i) Clear screen (0CH) clears the screen and resets the cursor to the top left hand corner;
- ii) Cursor advance code (09H) advances the cursor along a line;
- iii) Backspace cursor (08H) moves the cursor to the left along a line;
- iv) Cursor up (1AH) moves the cursor up one line;
- v) Cursor down (0AH) moves the cursor down one line;
- vi) Carriage return (0DH) fills the rest of the current line with spaces and resets the cursor to the start of the next line.

The cursor's position on the screen is

indicated by the character displayed at that position being video inverted, so that, for example, for new text entry to the screen the cursor appears as a solid rectangular block (ie, the video inverse of a space). For editing existing text, if the cursor was at a position displaying a character it would appear as a black character inside a white or green block. The cursor control codes enable the cursor to be moved about within the confines of the displayed screen area; when a screen boundary is reached the driver routines will ignore further commands that try to move the cursor outside the screen area.

All other ASCII codes from 00H to 7FH cause display characters to be written to the current cursor position and the cursor advanced to the next position. When the cursor reaches the end of a line a carriage return and line feed command will automatically reset the cursor to the start of the next line. In a similar fashion, when the last character of the last line is reached the driver routine automatically scrolls the screen up one line, clears the last line, and resets the cursor to the start of it.

Figure 1 shows how the display memory map is organised. In my prototype system, the base address of the 4k memory block was set at F000H. The diagram shows that the map is not continuous, and so one of the main functions of the driver routine is to turn this into a continuous map (ie, so that the start of line 1, for example, will appear to the host system after the end of line 0). The software does this by keeping the current cursor position stored as two variables, a character position and a line number, and operating on these two variables to keep the cursor within the displayed memory area. The variables required by

the driver routines are in fact stored in a section of the non-displayed memory of the high density VDU card.

Detailed software operation

The screen driver software consists of a number of routines and subroutines written in 8080/8085/Z80 assembler code (400 bytes of code).

The main driver routine is called CHAROP and its function is as a single character output subroutine; this is the main software interface between the host machine's software and the VDU card. CHAROP should be called by the host machine's software with the ASCII character that is to be displayed (or an ASCII command character) in the accumulator. On entry to the subroutine the processor's current status and registers are pushed onto the stack and then the ASCII code in the accumulator is tested to see if it is a display character

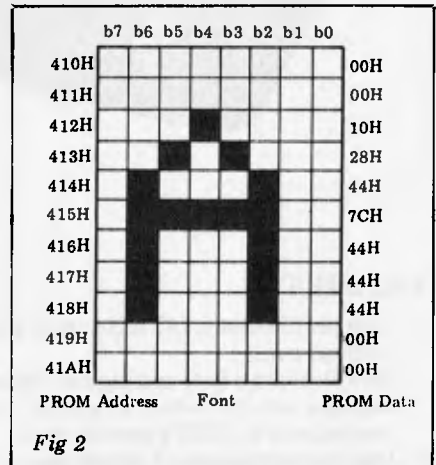


Fig 2

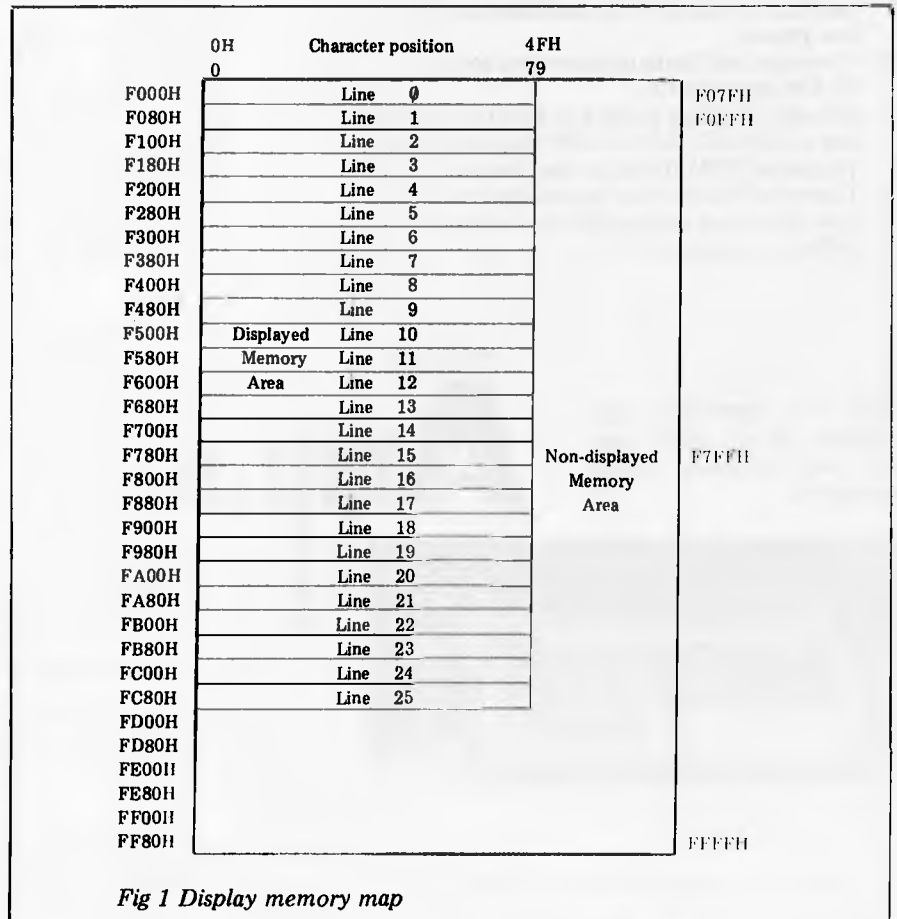


Fig 1 Display memory map

or one of the command characters previously described.

If the ASCII character in the accumulator is a normal display code, the next step is to copy the character to the B register and then to call the subroutine INVCLC. The function of the INVCLC (invert video at current line and character position) subroutine is to find the display memory address that corresponds to the current line number and character and then to invert the video at that position. At this point in the CHAROP routine this subroutine has the effect of removing the cursor from the screen and returning with the memory address of the current cursor position in the H and L index register. The next operation is to write ASCII code in the B register to the memory byte whose address is contained in H and L (MOV M,B). The subroutine CURINC, cursor increment, is then called. This subroutine function is to increment the current cursor position to the next permissible location. The subroutine INVCLC is then called to replace the cursor back onto the screen and finally the processor's status and registers are 'popped' off the stack before returning from the CHAROP subroutine to the user's program. If, on the other hand, a control code is sent to the CHAROP subroutine, a number of other sections of code will be implemented.

1. Carriage return '0DH'. Program flow jumps to the label CARRET; the first step is to remove the cursor from the screen by calling INVCLV. The next step is to calculate the memory address corresponding to the current cursor position by calling FNDLOC. An ASCII 20H (Space) is then written to memory and the position number is then examined to see if it is zero (i.e. we have reached the start of a new line); if this is not the case, program flow jumps to CAR1 and the above steps are repeated. If, however, the condition is satisfied, the cursor is restored to the screen by calling INVCLC and the CHAROP subroutine is left by jumping to RETCH. In this way, when a carriage return code is sent the driver routine fills the rest of the current line with spaces and resets the cursor to the start of the next line.
2. Cursor Advance '09H'. Program flow jumps to the label CURADV and again the first step is to remove the cursor from the screen by calling INVCLC. The character position number CHARNO is then examined to see if it is '4FH'. If it is, the cursor has reached the end of a line and no action is taken, the cursor then being replaced and the subroutine exited from. If, however, we are not at the end of a line the character number is incremented and the cursor replaced, and the subroutine left by jumping to RETCH.
3. Backspace cursor '08H'. Program flow jumps to the label BACKSP and the cursor removed from the screen. As in the last case the character number is examined but this time for the start of a line. If this is the case no further action is taken, the cursor is restored and the routine left via RETCH. If the cursor has not reached the start of the line, however, the character number is

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	NUL	00X																
01	□	01X	FF	81	81	81	81	81	81	81	81	81	FF					
02	◆	02X			10	38	7C	FE	7C	38	10							
03	▲	03X				10	10	38	38	7C	7C	FE	FE					
04	■	04X				7C	7C	7C	7C	7C								
05	×	05X				82	44	28	10	28	44	82						
06	●	06X				38	7C	FE	FE	FE	7C	38						
07	BEL ▲	07X		18	18	3C	3C	3C	3C	3C	3C	7E						
08	←	08X					20	40	FF	40	20							
09	→	09X					04	02	FF	02	04							
0A	↓	0AX	10	10	10	10	10	10	10	92	54	38	10					
0B	↔	0BX					3E	1C	FC	1C	3E							
0C	↖	0CX		F0	C0	A0	90	08	04	02	01							
0D	↗	0DX				7C	38	3F	38	7C								
0E	↕	0EX	10	10	54	7C	7C	7C	44									
0F	↔	0FX				44	7C	7C	7C	54	10	10						
10	↘	10X				F8	20	71	7F	72								
11	↙	11X				1F	04	4E	FE	8E								
12	↔	12X			0C	18	31	FE	31	18	0C							
13	↔	13X				20	18	8C	7F	8C	18	30						
14	▲	14X	10	10	38	38	38	38	38	7C	7C	7C	44					
15	■	15X	CC	CC	33	33	CC	CC	33	33	CC	CC	33					
16	◆	16X	38	38	38	10	38	54	92	38	28	44	44					
17	■	17X	55	FF	55	FF	55	FF	55	FF	55	FF	55					
18	■	18X	24	24	FF	24	24	FF	24	24	FF	24	24					
19	■	19X	FF	99	99	99	99	FF	99	99	99	99	FF					
1A	↑	1AX	10	38	54	92	10	10	10	10	10	10	10					
1B	□	1BX	FF	81	81	81	99	99	99	81	81	81	FF					
1C	←	1CX			08	10	20	10	08	20	10	08						
1D	↔	1DX					40	7C	10	7C	04							
1E	→	1EX			20	10	08	10	20	08	10	20						
1F	⊕	1FX	3C	24	24	E7	81	81	81	E7	24	24	3C					

Fig 3(a) Character font (all unmarked bytes are 00H)

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
20	'Space'	20X																
21	!	21X			10	10	10	10	10		10							
22	"	22X			28	28												
23	#	23X			28	28	7C	28	7C	28	28							
24	\$	24X			10	3C	50	70	1C	14	78	10						
25	%	25X		20	52	24	08	10	24	4A	04							
26	&	26X			30	48	50	20	54	48	34							
27	'	27X			18	18	20											
28	(	28X			08	10	20	20	20	10	08							
29	)	29X			20	10	08	08	08	10	20							
2A	*	2AX			10	54	38	7C	38	54	10							
2B	+	2BX			10	10	10	7C	10	10	10							
2C	,	2CX								18	18	20						
2D	-	2DX							7C									
2E	.	2EX								18	18							
2F	/	2FX			04	04	08	10	20	40	40							
30	0	30X			38	44	4C	54	64	44	38							
31	1	31X			10	30	10	10	10	10	38							
32	2	32X			38	44	04	08	10	20	7C							
33	3	33X			38	44	04	18	04	44	38							
34	4	34X			08	18	28	48	7C	08	08							
35	5	35X			7C	40	78	44	04	44	38							
36	6	36X			18	20	40	78	44	44	38							
37	7	37X			7C	44	08	10	20	20	20							
38	8	38X			38	44	44	38	44	44	38							
39	9	39X			38	44	44	3C	04	08	30							
3A	:	3AX					18	18		18	18							
3B	;	3BX					18	18		18	18	20						
3C	<	3CX					08	10	20	10	08							
3D	=	3DX						7C		7C								
3E	>	3EX					20	10	08	10	20							
3F	?	3FX			30	48	08	30	20		20							

Fig 3(b) Character font

4. Line feed (cursor down) '0AH'. Program flow jumps to LFEEED. This is similar to the last two cases except that this time the line number is decremented (hence moving the cursor back one space), the cursor restored to the screen by calling INVCLC and the routine left via RETCH.
5. Cursor up '1AH'. Program flow jumps to CUP, and the routine is similar to that for cursor down except that the line number is decremented unless the cursor is at the top of the screen already.
6. Clear screen '0CH'. Program flow

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jumps to the label CLRSCN. The subroutine CSCRN is called and this routine clears the screen by filling the screen with ASCII spaces and zeros the line and character number variables CHARNO and LINENO. The cursor is then replaced onto the screen and the routine left by jumping to RETCH.

Other Subroutines are:

Initialise screen (INSCRN) subroutines. This initialises the various screen pointers, clears the screen and set the cursor up in the home position. It should be called by the host systems' software as part of the system initialisation procedure routine.

Find screen memory location (FNDLOC) subroutine. This takes the current line and character number from the variables CHARNO and LINENO and from them calculates the corresponding display memory address (see Figure 1). This address is placed in the index register H and L and control is then returned to the caller.

Invert video at current line and character position (INVCLC) subroutine. This first finds the display memory address corresponding to the current line and character numbers by calling FNDLOC. The routine then fetches the memory byte stored at that address and inverts the top bit; this has the effect of video inverting the character cell from white on black to black on white (or vice versa).

Cursor increment (CURINC) subroutine. This increments the current cursor position held in the two variables CHARNO and LINENO. When called, this routine increments the character position in CHARNO and then checks to see if it needs to start a new line (see Figure 1) by comparing with '50H'. If this is the case, the character number is reset to zero (ie, the start of a line) and the line number LINENO is incremented. The line number is itself then checked to see if the end of the page has been reached; if this is the case the subroutine called SCROLL is called to scroll the whole display screen up one line to allow text entry to continue.

Scroll screen subroutine. This has the effect of moving line 1 to line 0, line 2 to line 1 . . . line 25 to line 24, and clearing the last line, line 25; thus the complete screen is scrolled up one line. To do this a scroll line number and scroll character number SCHARN & SLINEN are used so as to leave the normal character and line numbers unaffected by this routine.

Fill screen (FSCRN) subroutine. This fills the complete screen area with the character whose ASCII code is in the accumulator when the routine is called. Its main function is in the clear screen routine which clears the screen by filling it with ASCII space characters, but it could be used to create the background for a graphics type game, for example.

Clear screen (CSCRN) subroutine. This subroutine clears the screen by loading the accumulator with '20H' (ASCII space) and calling FSCRN.

As described in part one, the character font uses a 2716 EPROM to store 128 characters corresponding to the ASCII codes '00H' to '7FH'. A character cell consists of 11 rows of

eight columns. Figure 2, for example, shows the character font and PROM data pattern for an 'A'; this demonstrates how to code the PROM data for any required font pattern. Figures 3a, b, c, and d give a listing of the data for the standard ASCII character set plus some example graphics characters (Figure 3a).

interface card that may be added to most of the popular systems on the market today. The addition of this unit will help to upgrade a system to that of a much more expensive professional machine at a cost that will allow more computing power to more people — which after all is what personal computing is all about.

Conclusion

These two articles have described a flexible low-cost high-density VDU

A full software listing plus circuit diagrams will be published next month.

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
40	@	40X			1C	22	4E	54	4C	20	1C							
41	A	41X			10	28	44	7C	44	44	44							
42	B	42X			78	24	24	38	24	24	78							
43	C	43X			38	44	40	40	40	44	38							
44	D	44X			78	24	24	24	24	24	78							
45	E	45X			7C	40	40	78	40	40	7C							
46	F	46X			7C	40	40	78	40	40	7C							
47	G	47X			38	44	40	5C	44	44	38							
48	H	48X			44	44	44	7C	44	44	44							
49	I	49X			38	10	10	10	10	10	38							
4A	J	4AX			1C	08	08	08	08	48	30							
4B	K	4BX			44	48	50	60	50	48	44							
4C	L	4CX			40	40	40	40	40	40	7C							
4D	M	4DX			44	6C	54	54	44	44	44							
4E	N	4EX			44	44	64	54	4C	44	44							
4F	O	4FX			10	28	44	44	44	28	10							
50	P	50X			78	44	44	78	40	40	40							
51	Q	51X			38	44	44	44	44	4C	3C							
52	R	52X			78	44	44	78	50	48	44							
53	S	53X			38	44	40	38	04	44	38							
54	T	54X			7C	10	10	10	10	10	10							
55	U	55X			44	44	44	44	44	44	38							
56	V	56X			44	44	44	28	28	10	10							
57	W	57X			44	44	44	54	54	6C	44							
58	X	58X			44	44	28	10	28	44	44							
59	Y	59X			44	44	28	10	10	10	10							
5A	Z	5AX			7C	04	08	10	20	40	7C							
5B	[	5BX			38	20	20	20	20	20	38							
5C	\	5CX				40	20	10	08	04								
5D	]	5DX			1C	04	04	04	04	04	1C							
5E	^	5EX			10	38	54	10	10	10	10							
5F	_	5FX									FF							

Fig 3(c) Character font

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
60	'	60X			18	18	08											
61	a	61X					30	08	38	48	34							
62	b	62X			40	40	58	64	44	64	58							
63	c	63X					38	44	40	44	38							
64	d	64X			04	04	34	4C	44	4C	34							
65	e	65X					38	44	7C	40	38							
66	f	66X			08	14	10	38	10	10	10							
67	g	67X					34	4C	4C	34	04	44	38					
68	h	68X			40	40	58	64	44	44	44							
69	i	69X			10		30	10	10	10	38							
6A	j	6AX			08		18	08	08	08	08	48	30					
6B	k	6BX			40	40	48	50	60	50	48							
6C	l	6CX			18	08	08	08	08	08	1C							
6D	m	6DX					6C	54	54	54	44							
6E	n	6EX					58	64	44	44	44							
6F	o	6FX					38	44	44	44	38							
70	p	70X					58	64	44	64	58	40	40					
71	q	71X					34	4C	44	4C	34	04	06					
72	r	72X					58	64	40	40	40							
73	s	73X					38	40	38	04	78							
74	t	74X			10		38	10	10	14	08							
75	u	75X					44	44	44	4C	34							
76	v	76X					44	44	44	28	10							
77	w	77X					44	54	54	54	28							
78	x	78X					44	28	10	28	44							
79	y	79X					44	44	44	4C	34	04	38					
7A	z	7AX					7C	08	10	20	7C							
7B	{	7BX					08	10	10	10	10	08						
7C	}	7CX			10	10	10	10	10	10	10	10	10					
7D	~	7DX					20	10	10	08	10	10	20					
7E	~	7EX					20	54	80									
7F	BjH	7FX	C0	A0	C0	A0	BC	CC	0D	2F	15	05	05					

Fig 3(d) Character font

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CALCULATOR CORNER

Compiled by Dick Pountain

Casio FP-10 printer

Some months have passed since Casio launched the mini-printer to go with their 602p/702p calculators, but a backlog of material has prevented me from reviewing it until now.

The FP-10 is a compact mains/battery electrostatic printer which is probably the cheapest such unit in the world, squeezing in as it does below the Sinclair ZX81 printer at \$164.50.

Interfacing to the calculator is via a cable and the cassette port or via a socket on the FA-2 Cassette Adaptor; it is a stand-alone unit, unlike Sharp's integrated printer/adaptor. At 16x8 x4.5mm it is barely pocketable but the whole system will fit easily into a small briefcase. A box of five rolls of 35mm aluminised paper is supplied — each roll

holding 30 feet (about 2,500 lines) and costing \$6.35 for 5. Inserting the paper is remarkably simple since no spindle is used; the roll merely sits in a close fitting recess under the removeable top cover. Threading is equally straightforward — this is done by inserting the loose end into a slot and pressing FEED (FEED and ON/OFF are the only controls on the unit). Four AA batteries sit in a compartment underneath, and a socket is provided for 6v DC from an optional mains adaptor which can drive the printer directly or charge a rechargeable battery pack. Four AAs will give roughly four rolls worth of operation. The standard of construction is very pleasing, from the matt/shiny finish ABS case to the diminutive print mechanism itself. The latter is a subunit which can be lifted out when the case is opened up; it occupies less than a third

of the case volume and is surprisingly simple in design. A small motor drives a slotted cam through reduction gears; this engages a pin on the carriage and drives it back and forth along a rail — a far more robust-looking arrangement than Sinclair's daring belt design. The actual head consists of seven brass wires and it forms a whole new row of 7x5 characters at a pass. The characters are well-formed and legible but with only 20 to a line it is inevitable that when listing programs many lines will run over giving a rather untidy listing. Speed at around 40 cps is creditable but hardly relevant in this application as few print-outs will exceed 20 or so lines. Print speed is affected by what is printed as printing is unidirectional and not logic seeking. A fine show of sparks occurs as the head traverses the paper.

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Selective printing can be achieved in a program or manually by setting the appropriate mode.

The FP-10 can print all the characters which the 702p can display, and graph-plotting of a crude sort may be performed by using the CSR formatting instruction with an asterisk or point.

Using the printer with the 501/502p and 601/602p calculations is also possible. Operation is somewhat different as these machines do not have a print mode, the command INV SAVE

INV EXE being used instead. The sequence could be stored in a program register and that key used as a 'print' button. Selective printing of results from within a program is possible by inserting INV SAVE INV EXE at appropriate points.

Listing programs is done by assigning a file name or number to the block and listing all 10 registers together in PCL mode. Similarly, data blocks must be printed as a named file.

It is possible to print data or program blocks from magnetic tape; by setting

the selector switch on the F-2 to PRT/MT data will be printed out as it is loaded.

Now that the 702 is being offered at better discounts, a portable hard-copy calculating system which has quite sophisticated statistical processing capabilities can be put together for around \$420; the next logical step would be some memory expansion and a fast digital micro-cassette recorder, a la HP-41C - though there is no indication that either is planned in the near future.



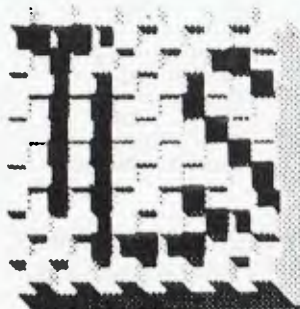
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DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc. Organisers are requested to notify APC of forthcoming events well in advance to allow time for inclusion in 'Diary Data'.

Sydney	HP (Aust) Productivity Course, North Ryde, Enquiries: Ms Nankervis (02) 887 1611	June 14-18, 1982
Sydney	Data 82, Centrepoint, Contact: Graphic Directions	August 10-12, 1982
Canberra	National Microcomputer Conference, Contact: MICSIG, ACS	August 18-20, 1982
Melbourne	Data 82, Melbourne Showgrounds	November 9-11, 1982
Sydney	The 1st Australian Personal Computer Show, Centrepoint, Contact: Australian Exhibition Services	March 10-12, 1983

USER GROUPS INDEX

Below is a list of alterations and additions to the list of user groups published in the March issue.

National Sinclair ZX Users Group. The group send out a twelve page newsletter every month. Interested parties can obtain our introductory newsletter by sending a 27c stamp to P.O. Box 148, Glen Waverley, 3150.

The Microcomputer Club of Melbourne (MICOM) has moved to a new meeting place: Burwood State College on Burwood Highway. The Club meets on the third (3rd) Saturday of each month from about 2pm to 5pm. MICOM caters to a wide variety of home, personal and professional microcomputer users. Most meetings, one or two beginners show up and are

introduced to the library of books and magazines. It's up to them to introduce themselves to other members, some of whom may also have only one or two months experience, while others have been in computing a decade or more. Other new faces, belonging to people with more computer experience tend to find a kindred group without needing any help.

MICOM currently has one user group - the CP/M group which has a separate monthly meeting. Not surprisingly, more MICOM members run the S100 bus than any other. However, let anyone impune any microcomputer you like to mention, and you'll likely find an owner rising to

defend it. There are also CPU experts, some of whom help design the operating systems as well.

Last November there was a mighty avalanche of protest and vehement defence of status quo when the premier place of Basic in microcomputing was challenged by a supporter of Pascal and ADA. When the hubris ceased the discussion continued at high level till the chairman closed the hall! The Pascalite was an APC contributor who was invited along as guest speaker, for what was probably the most interesting meeting of the year. Readers can obtain further information by writing to MICOM, P.O. Box 60,

Canterbury, Vic. 3126.

Steve Buttery.
(MICOM Treasurer
& Press Officer.)

The Sorcer User's Group of South Australia has a new meeting place on the first floor of the Commodities Exchange Building, 123 Pirrie Street, Adelaide. Meetings are held on the second Wednesday of every month.

Interested people can write to Jeremy Webber, Secretary, SUGSA, 22 Delange Avenue, Banksia Park, SA, 5091.

The Apple Users' Society of Melbourne has a new contact phone number and address: AUSOM, P.O. Box 43, Forest Hill, 3131. Phone (03) 8780219

NETWORK NEWS

Here is a list of all Australian personal computer networks. As more networks appear - and as more facilities are added to existing ones - we'll report them in this section, which appears monthly.

The Australian Beginning. Operator: The Australian Beginning Pty. Ltd. 364 La Trobe Street, Melbourne. Tel: (03) 329 7998. Facilities: Information service, electronic mail, software storage, and software downloading. Hours: 24 hours/day, 7 days/week.

INFONET. Operator: Network Services Division of Computer Sciences of Australia Pty. Ltd., 460 Pacific Highway, St Leonards, NSW. Tel: (02) 439 0033. Facilities: Access to

databases produced by the Australian Bureau of Statistics and the Institute of Economic and Social Research. Hours (E.S.T.): Monday to Friday (7am to 9pm), Saturday (8am to 5pm) and Sunday (8am to 11.30am).

AUSINET. Operator: ACI Computer Services, P.O. Box 42, Clayton, Victoria. Tel: (03) 544 8433. Facilities: Medium to databases whose subject coverage includes agriculture, education, energy,

industry, public affairs, science and technology and an online Australian database directory. Hours: 8.30am to 9.00pm E.S.T. Monday to Friday.

CSIRONET. Operator: CSIRO Division of Computing Research, P.O. Box 89, East Melbourne. Tel: (03) 419 1333. Facilities: Carries a broad range of scientific and technological databases compiled in Australia and overseas, including general scientific research, renewable energy resources, agriculture,

water resources, mining and geology, and thermodynamics.

IP Sharp Associates Network. Operator: IP Sharp Associates Pty. Ltd., 13th Floor, 175 Pitt Street, Sydney. Tel: (02) 232 6366. Facilities: The network is an international time sharing data processing network, the host computers being located in Toronto, Canada. Hours: 24 hours/day, 7 days/week.



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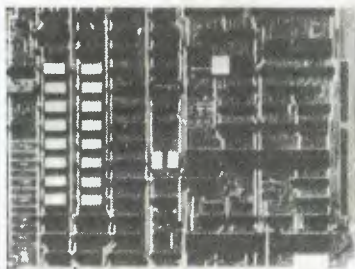


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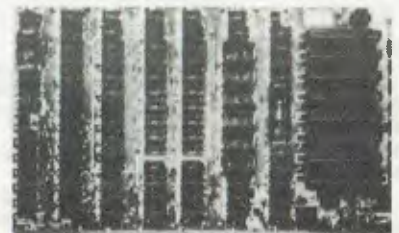
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LOGO LEARNING

Originally designed as a teaching language, Logo appears set to star in other areas too. Harvey Mellor reports.

Logo is a philosophy of education and a group of computer languages designed to assist learning; it arose from psychology, ~~and other disciplines~~ Lisp, and arose from mathematics, engineering and Fortran.

Logo began in the late '60s with the work of Seymour Papert in the Artificial Intelligence Laboratory at MIT. Originally a mathematician, he was inspired by Piaget's view of children as active builders of their own intellectual structures. He also looked at the way AI workers were trying to construct intelligent programs and tried to apply the same techniques to children. He sums up his own philosophy of education in *Mindstorms* — an important book for anyone concerned with computers and education.

The conventional first computer language is Basic, but it suffers from two great problems: firstly, it is not as easy to learn as is claimed (teachers have such low expectations of many of their pupils' capabilities at programming that this is never noticed); and secondly, anything but simple programs in Basic become tortuous and hard to follow.

In the Logo environment children 'teach' computers and, by becoming aware of the structure of procedures and the ideas of planning and debugging, teachers and students develop a vocabulary in which they can talk about what they know and how they solve problems, ie, they become epistemologists.

Turtles

A Turtle is a robot 'animal' consisting of a glass dome on wheels with a retractable pen at the centre of the base; it can also have touch sensors, a horn and a light. The Turtle is connected to the computer via a cable, and signals are sent as characters in ASCII which are then decoded by a special interface (this arrangement simplifies connection to a variety of computers).

The Turtle obeys Logo commands typed at the keyboard, eg, FORWARD 40, RIGHT 90 (ie, turn 90 degrees clockwise), PENUP, PENDOWN. The delimiter is usually a single space. As Logo is an interpreted language, each command is obeyed as it is entered. Children as young as four can learn to program the computer to tell the Turtle to produce simple line drawings. Error messages are made as simple as possible ('TELL ME HOW TO FRWRD'), and to overcome typing problems most commands can be abbreviated to two letters, such as FD for FORWARD. To do the same set of instructions a fixed number of times, the command is REPEAT, as in REPEAT 4 or FD 30 RT 90.

If a drawing does not turn out as expected then there is a bug in the procedure and the process of debugging begins. The concepts of procedures, bugs and debugging replace the debilitating concepts of 'ability' and 'failure'; 'How can I do this better?' replaces 'I can't do this'.

A fundamental technique of debugging is the dry run or code walkthrough. With the Turtle this is exactly what we do, we walk through the program, so many steps forward, turn so many degrees and so on! We 'play Turtle'.

The Turtle is also often represented as a triangle on a VDU screen; lines can now be drawn much more quickly and can be erased (to correct mistakes or to produce animation).

There are two great advantages to beginning with the 'real' Turtle; it moves in the child's real three-dimensional world, rather than a two dimensional screen on which up is mysteriously called *forward*, and it better demonstrates the capabilities of the computer — for besides drawing pictures it can chase your friends and carry your books!

Teaching the computer

The computer can be taught new words (ie, define procedures, if you must have it in Latin). This definition also uses a variable.

```
TO TRIANGLE SIDE
```

```
  REPEAT 3 [FORWARD :SIDE RIGHT 120]
```

```
END
```

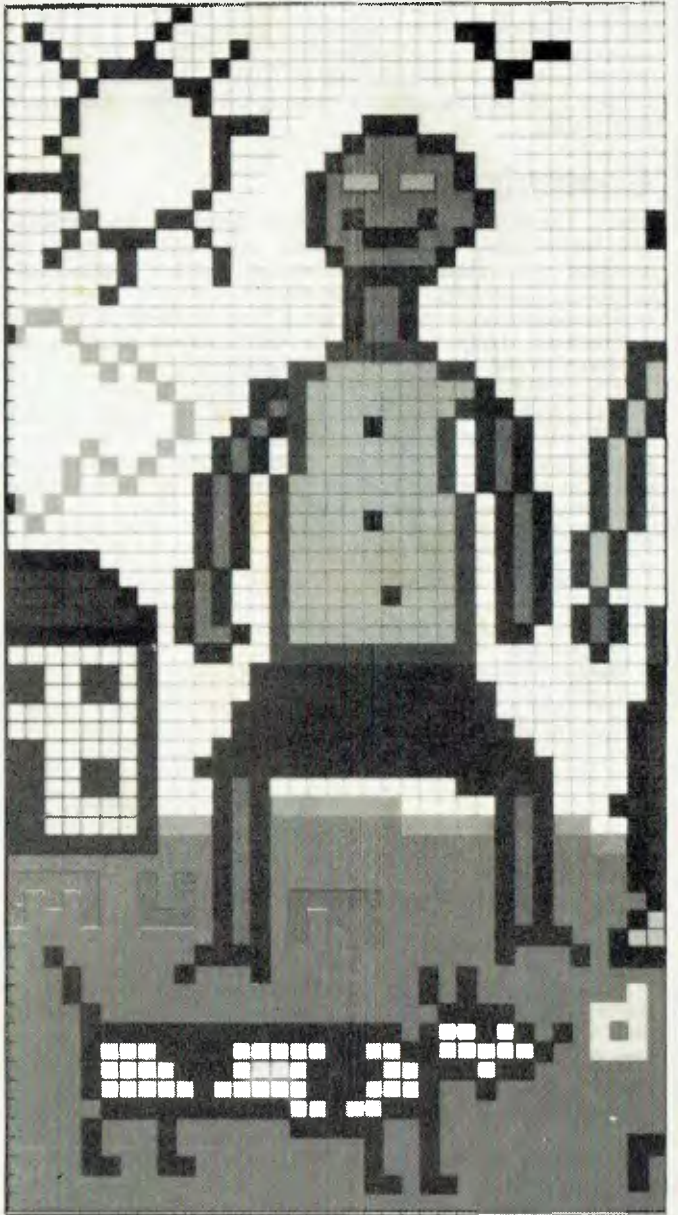
TO indicates that a definition follows, :SIDE means the contents to the variable SIDE, while "SIDE is used for the name of the variable.

TRIANGLE can now be used like any Logo command, so that typing TRIANGLE 20 will cause the Turtle to draw an equilateral triangle of side 20 units. The turn used is 120 degrees, as can be determined from the Total Turtle Trip Theorem: 'If a Turtle takes a trip around the boundary of any area and ends up in the state in which it started, the sum of all turns will be 360 degrees.'

Procedures can be saved on tape or disk for later use.

One very important aspect of this way of defining procedure is that it makes Logo an extensible language (like Forth and *natalk*). This means that a teacher who knew no other language than Logo would still be able to define the commands that he wanted his pupils to use in their work. If pupils wanted to draw circles in their diagrams, a command CIRCLE could be defined for them:

```
TO CIRCLE SIZE
```



```
REPEAT 360 [FORWARD :SIZE RIGHT 1]
```

```
END
```

This draws a 360-sized polygon, but can you tell the difference? And if you can't tell the difference, then what is the difference?

Planning

When more complex drawings are required we need to resort to planning (top-down programming, the breaking up of a procedure into sub-procedures).

A simple procedure to draw a house (Figure 1) might be:

```
TO HOUSE SIZE
  SQUARE :SIZE
  TRIANGLE :SIZE
```

```
END
```

We can now write the two sub-procedures SQUARE and TRIANGLE. TRIANGLE we have already seen and SQUARE can be defined in a very similar way. Because Logo is interpreted, the main procedure can be typed in before the sub-procedures are defined. Once the sub-procedures are defined we can run HOUSE and we get Figure 2. We have a bug; playing Turtle helps us find the bug and correct our procedure:

```
TO HOUSE SIZE
  SQUARE :SIZE
  FORWARD :SIZE
  RT 30
  TRIANGLE :SIZE
END
```



Figure 1



Figure 2

TRIANGLE and SQUARE both leave the Turtle in the state they found it; HOUSE can be made similarly 'state-transparent' by inserting LEFT 30 BACK :SIZE before the end. Procedures are best made state-transparent if they are to be used as sub-procedures in other procedures. We can now define a super-procedure called STREET which draws a sequence of houses, and by varying :SIZE can even suggest perspective.

Geometry

One of the aims of Logo is that there should be 'no threshold and no ceiling'. In other words, any child can begin to program immediately and *everyone* can be intellectually stretched in the Logo environment.

To look at more complex procedures we need more Logo commands. Logo can handle arithmetical expressions, assignments (eg MAKE "A 31), decisions (eg, IF:SIZE < 30 THEN FORWARD :SIZE ELSE FORWARD :SIZE - 30), and conditional loops (WHILE :TALLY > 0 THEN MAKE "SUM :SUM+ :TALLY). Logo procedures can call themselves as sub-procedures — they are recursive. Recursion is a very powerful programming control structure. Here is a procedure to draw a binary tree such as Figure 3.

```
TO BRANCH LENGTH LEVEL
  IF LEVEL = 0 THEN STOP
  FORWARD :LENGTH
  LEFT 45
  BRANCH :LENGTH/2 :LEVEL - 1
  RIGHT 90
  BRANCH :LENGTH/2 :LEVEL - 1
  LEFT 45
  BACK :LENGTH
END
```

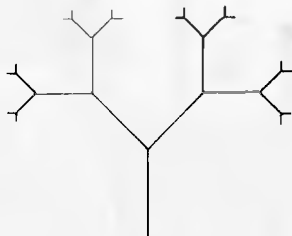
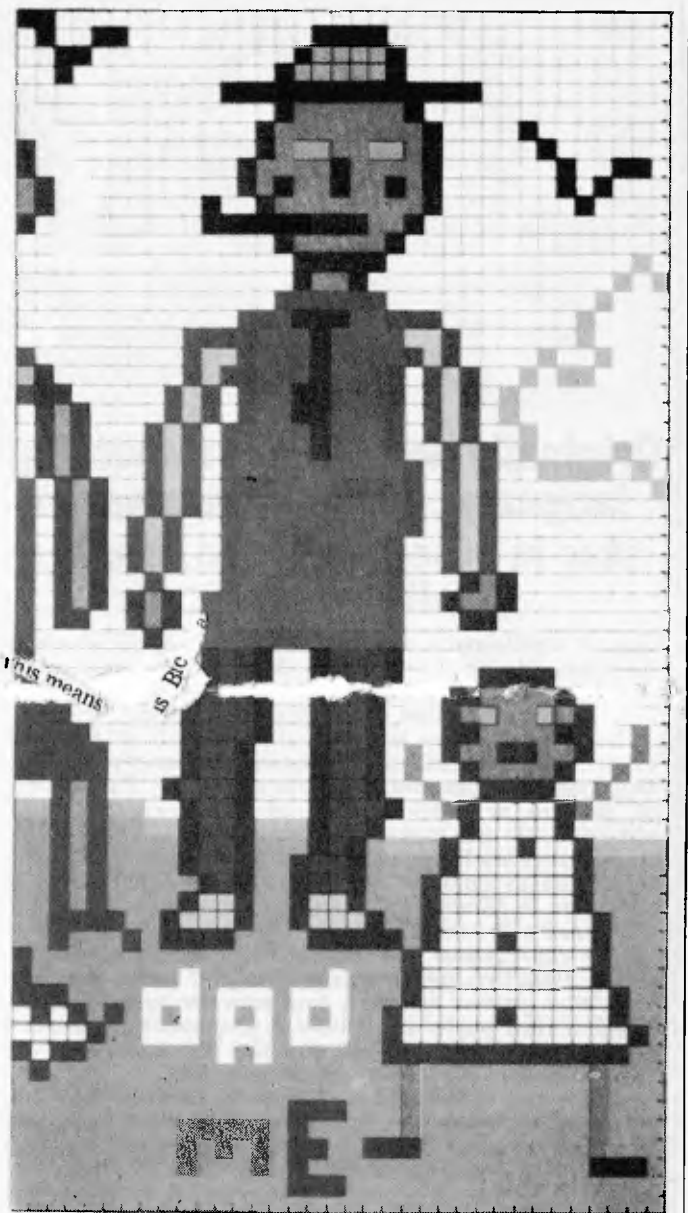


Figure 3

This program is taken from the book *Turtle Geometry* by Harold Abelson and Andrea diSessa. This book is based on their work with high school students and undergraduates and uses Logo to teach geometry through a genuine process of exploration; the students *do* mathematics rather than just learn about it. It should dispel anyone's illusions that Turtle geometry is for children. It begins with simple polygon programs and a discussion of the mathematical implications, goes on to discuss models of animal behaviour, escaping from mazes, spacefilling curves, curves on curved surfaces,



topology, and finishes with a simulator for General Relativity.

Turtle geometry has been generally recognised as important and has been incorporated into certain versions of Pascal and into Smalltalk.

Sprites

Turtle geometry is the best known example of the application of Logo but there are many more. Turtles can be programmed to use the information from their touch sensors to find their way around objects, and turtle-like robots can be programmed to balance a stick. Logo has been used in the composition of music, and in writing CAL programs.

An interesting application of Logo in physics is the DynaTurtle, which is a point which moves with constant velocity (unless a force is applied), modelling Newtonian mechanics. In TI Logo this idea has been extended and gives rise to entities called Sprites. There are 32 Sprites, each of which can be told to carry a predefined or user defined shape in one of 16 colours in any direction at any speed. To the usual Logo commands is added the instruction WAIT (number) which causes the computer to wait for (number)/60 seconds before processing the next command. The result is an environment which is not as much for investigating Newtonian mechanics as for creating startling visual effects and animation and in which children should be able to program their own arcade type games.

List processing

Logo can operate on lists, on lists of lists and so on, reflecting its origins in Lisp. Logo procedures themselves are represented as lists of lists, so Logo procedures can construct, modify and run other Logo procedures.

LOGO LEARNING

Square brackets are used to delimit lists. Some of the basic list processing commands are FIRST (which gives the first item of a list), BUTFIRST (which gives all but the first item of a list), and SENTENCE (joins two inputs to make a list).

The OUTPUT command causes a procedure to quit and return to the level that called it, carrying a single value (this value could be a list, however). If we use this to implement a procedure, CALLUSER, that causes a procedure to halt, take input from the keyboard and use this as its output to the next higher level, we have a useful aid for top-down programming, for we can test the main procedure before the sub-procedures have been written.

Here is a simple procedure that omits the first occurrence of a word from a list:

TO WITHOUT1 ITEM LIST

```
IF :LIST = [] THEN PRINT [ITEM NOT FOUND] STOP
IF :ITEM = FIRST: LIST THEN OUTPUT BUTFIRST
:LIST OUTPUT SENTENCE FIRST:LIST WITHOUT1
:ITEM BUTFIRST: LIST
```

END

So typing PRINT WITHOUT 1 BASIC [LOGO FORTH BASIC PASCAL] would produce the output [LOGO FORTH PASCAL].

The future

Earlier versions of Logo were implemented on mainframes

and minis. Versions of Logo for microcomputers are now beginning to appear. Logo will shortly be available in this country from Texas Instruments on the TI 99/4A — the short programs in this article have been run in TI Logo. A rather different version of Logo has been written for Apple, but has only just been issued as this article is being written.

Logo has tremendous implications for education. It has been used with average children from four to 18, with highly-gifted high school students, with undergraduates, with autistic children and with children suffering from cerebral palsy. It 'works'. Once children have become able to think about their thinking in this way, the same problem-solving techniques can be applied in different areas, including physical skills. The Logo group at MIT have used this approach to teach juggling and stilt walking.

In this country Logo will probably find an increasing use in pioneering computing in junior schools and on the fringes of the secondary sector (e.g. the gifted, or those with severe 'learning problems'). It is unlikely to be used very much within the main body of secondary education because it will not fit into the framework of subjects, exams and grades.

This framework, with its stress on 'ability' (and therefore its converse, 'failure'), tends to reinforce those class divisions which comprehensive education set out to ameliorate; the Logo philosophy, which instead emphasises procedures, bugs and debugging, has a distinctly egalitarian tendency.

As Logo is implemented on personal computers, a powerful educational tool will become available to families, alternative education groups, and any group in which informal learning takes place. If there were more software of this kind we could begin to think about freeing education from schooling, a process that would have great social consequences.

Further reading

Turtle Geometry, Harold Abelson and Andrea diSessa, MIT Press, 1981.



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BLUDNERS

```

1000 IF(M-32850)/40=INT((M-32850)/40)OR(M-32885)/40=INT((M-32885)/40)THEN1020
1010 D=R(D):POKE59464,0:RETURN
1020 D=R(D):POKE59464,0:RETURN
1030 REM *** GAME OVER ***
1040 POKE59467,0:REM # DEACTIVATE SOUNDBOX #
1050 SVS849:REM # DISABLE CAT #
1060 FORDL=IT02500:NEXT
1070 PRINT"TAB(12)**** GAME OVER ***
1080 PRINT"TAB(5)"ALL THE CHEESE HAS BEEN EATEN!"
1090 PRINT"TAB(12)"YOUR SCORE:"SC
1100 IFSC>HSTHENHS=SC
1110 HS=MID$(STR$(HS),2)
1120 ILEN(HS)<5THENHS=LEFT$(HS,5-LEN(HS))+HS#
1130 PRINT"TAB(12)"HIGH SCORE:"HS
1140 PRINT"TAB(6)"PRESS ANY KEY TO PLAY AGAIN.
1150 POKE158,0
1160 GETH$=IFH$=""THEN1160
1170 GOTO889
1180 REM *** INSTRUCTIONS ROUTINE ***
1190 PRINT"TAB(17)"CHEESE" PRINTTAB(17)
1200 PRINT"THE OBJECT OF THE GAME IS TO PREVENT
1210 PRINT"THE MICE (.) REACHING THE CHEESE.
1220 PRINT"YOU CONTROL A CAT (O) AND MAY MOVE IT
1230 PRINT"WITH THE KEYS 8 (UP), 2 (DOWN), 4 (LEFT)
1240 PRINT"AND 6 (RIGHT). TO CATCH A MOUSE YOU MUST
1250 PRINT"INTERCEPT IT, IN WHICH CASE IT WILL RUN
1260 PRINT"INTO YOUR JAWS.
1270 PRINT"PRESS SPACE TO CONTINUE...
1280 GETH$=IFH$<" "THEN1280
1290 PRINT"THE GAME ENDS WHEN ALL THE CHEESE HAS
1300 PRINT"BEEN EATEN. YOU SCORE POINTS FOR EACH
1310 PRINT"MOUSE YOU EAT THE QUICKER YOU EAT A
1320 PRINT"MOUSE, THE MORE YOU SCORE FOR IT.
1330 PRINT"PLUG IN A SOUNDBOX IF YOU HAVE ONE!
1340 PRINT"PRESS 'R' TO READ THE INSTRUCTIONS AGAIN!
1350 PRINT"OR SPACE TO RESTART THE GAME..."
1360 GETH$=IFH$<" "ANDH$<"R"THEN1360
1370 IFH$="R"THEN1180
1380 RETURN
1390 REM *** INSTAL MACHINE CODE ***
1400 REM (USED FOR CAT MOVEMENT)
1410 S=0:FORJ=826TO1002
1420 READX:POKEJ,X:S=S+X:NEXT
1430 IFSC>20252THENPRINT"TYPIING ERROR RECHECK LAST 25 LINES." END
1440 RETURN
1450 REM *** MACHINE CODE ***
1460 DATA165,177,133,0,120,165,144,133
1470 DATA192,165,145,133,193,169,226,133
1480 DATA144,169,3,133,145,80,96,120
1490 DATA165,192,133,144,165,193,133,145
1500 DATA98,96,173,18,232,201,239,208
1510 DATA16,169,0,141,75,232,169,192
1520 DATA133,144,165,133,133,145,108,132
1530 DATA0,198,0,208,249,165,177,133
1540 DATA0,165,15,133,1,166,16,133
1550 DATA2,165,151,201,18,240,15,201
1560 DATA2,240,25,201,41,240,34,201
1570 DATA50,240,39,108,192,0,165,1
1580 DATA24,105,40,133,1,144,2,230
1590 DATA2,76,199,3,198,1,165,1
1600 DATA201,255,208,2,198,2,76,199
1610 DATA3,230,1,208,2,230,2,76
1620 DATA199,3,165,1,56,233,40,133
1630 DATA1,176,2,198,2,160,0,177
1640 DATA1,201,32,208,16,169,32,145
1650 DATA15,165,1,133,15,165,2,133
1660 DATA16,169,81,145,15,109,192,0
1670 DATA160,0,169,81,145,15,76,92
1680 DATA3
READY.

```

Above is the missing section of the program "PET Cheeze" from the April issue. Thanks to the readers who rang (screaming) or wrote in to notify us of our omission.

And our biggest confession yet: after hauling companies over hot coals on various occasions for nondelivery of advertised goods, we have

perpetrated this crime. The advertisements featured recently for the "Microcomputer Benchtest Special" did unwittingly precede its targeted publication date. The magazine is due to be published in late June and mail ordered copies will be despatched promptly. Our apologies.

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LAZING AROUND

by J J Clessa

Earlier than usual deadlines mean I haven't received enough entries from the March issue to conduct a "fair" draw, so I'll announce winners and the correct answer in the next issue.

Incidentally, if any previous winners still haven't received their prizes, would they let us know and we'll try to rectify the matter. Please include the date of the competition. We've now changed the system for prize distribution and we hope there won't be any problems in future.

Quickie

No answers, no prizes. A man drives to work at 60 kph. How fast would he need to drive back to average 120 kph for the total journey? The answer is *not* 180 kph.

Prize puzzle

Six ladies are eligible for the offices of captain, vice-captain and treasurer (in

descending order of seniority) in the local ladies' golf club.
Audrey won't serve if Elaine is captain or if Freda is treasurer.
Betty won't be treasurer if Cynthia is one of the officials.
Audrey won't serve with both Betty and Elaine.
Freda won't serve if Elaine is also an official.
Betty won't be vice-captain.
Freda won't serve if she outranks Audrey.
Cynthia won't serve with Audrey or Betty unless she is captain.
Doris won't serve unless Betty is captain.
Betty won't serve with Doris unless Elaine is an official.
Elaine won't serve unless she or Audrey is captain.
How can the three offices be filled?
Answers on postcards, please, to May Prize Puzzle, APC, 462 Burwood Road, Hawthorn, 3122 to arrive by the last day of June.

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XEROX 820

Xerox is the other giant corporation which entered the micro market in 1981. Steve Withers investigates its offering.

Dubbed 'The Worm' (an allusion to the success of the Apple II), the 820 is the Xerox entry to the personal computer market. Built around well-tried components like the Z80 CPU, there is nothing radical about this system; instead, it is a solid, no-frills computer with virtually no software included in the price.

Hardware

Virtually all the electronic components of the 820 are housed within the moulded plastic monitor cabinet which is finished in the same off-white paint as the rest of the system. A single printed circuit board carries the processor, memory, and all the input/output devices. The full 64k of 4116 dynamic RAM is available, as the monitor EPROMs and video memory are switched out when they are not being accessed.

The video display was generally sharp and clear, but it regularly developed a severe wobble about half an hour after switching on. Fortunately, this would only last a few minutes and I suspect that the rough handling the machine received on its way to me might have been responsible. The monitor also produced the high-pitched whistle so often generated by these devices, but there were no problems with TV or radio interference.

The display provides the usual 24 rows of 80 characters on a 12in black and white screen. Provision is made for two character sets (each of 128 symbols) with software selection, but both sets were the same on the review machine. The only way of highlighting characters is by setting the high-order bit of the code which causes the symbol to flash. A block cursor is used, except when it is over a character — in which case its position is indicated by making the character flash. This can be confusing when flashing characters are being used for emphasis, and so the absence of inverse video and reduced intensity is particularly noticeable. A small selection of extra symbols, including several types of arrowhead and the copyright sign, may be obtained by prefixing the control codes with code 1F (ASCII 'VS'). The existence of true descenders — however small — adds to the overall quality of the display, but it is unfortunate that nothing has been done to minimise reflection from the plain glass screen.

The controls are scattered about the lower edges of the cabinet. The brightness control is a slider conveniently mounted under the front left corner of the case and the on/off switch is on the right hand side, about halfway back. Tucked well away on the back panel is the reset button, easy to find if your arms are long enough.

The keyboard is mounted in a separate case and connected to the main unit by a rather inflexible multicore lead. While the action of the keyboard is not the best I have experienced, it is

certainly not the worst, but I would have expected an office products manufacturer like Xerox to pay more attention to this aspect of the design. To give you some idea, it's about the same as the SuperBrain keyboard. One problem I experienced was that some keys needed a greater pressure than others, leading to several lost characters. Another snag was that, contrary to the description in the manual, the 'LOCK' key is actually a shift lock rather than a capitals lock, so the punctuation marks and numbers are reversed as well. I hope that the manual corresponds with production machines, as capitals lock is far more useful. A separate number and function keypad is fitted, but this useful feature has a strange quirk: typing control-1 (or any other digit) on the number pad does not generate the same code as control-1 on the main keyboard. The significance of this will become apparent when I discuss the software.

In addition to all the usual keys, there is a 'HELP' button at the top left of the keyboard which generates control-shift-6; this is, of course, only useful when the software recognises this code as a request for help, and could cause confusion when running programs which use a different key for this purpose. A very sensible departure from common practice is the provision of two control keys, one each side of the space bar, beneath the shift keys. Another thing I liked was that the delete, back-space and cursor control keys all repeat when held down, as does the space bar.

Overall, the keyboard is adequate for most purposes and is very stable due to its soft rubber feet.

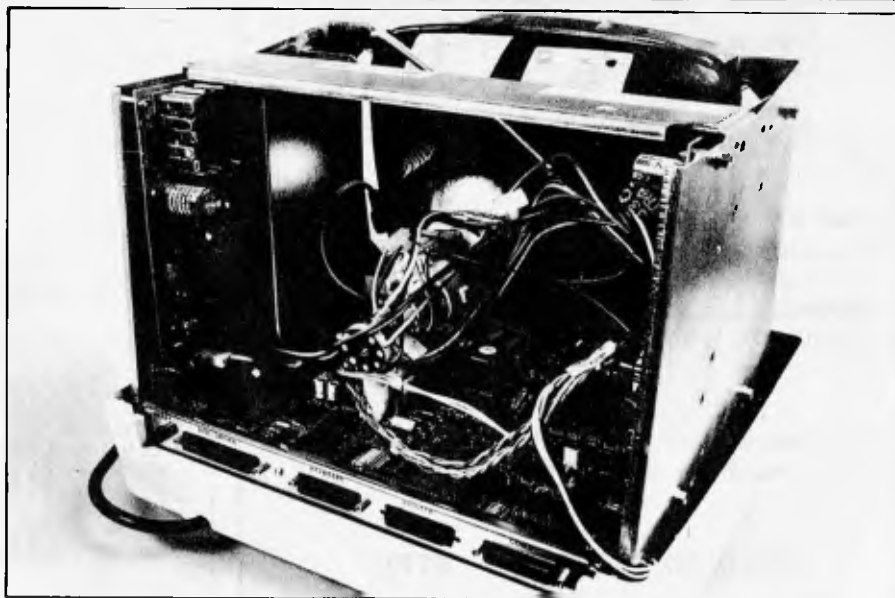
Either 5¼in or 8in disk drives may be used with the 820, although they cannot be mixed. Both types are Shugart products and are supplied in cabinets containing two drives, although it is possible to daisy-chain a third and fourth drive onto these. The mini-floppies are compact enough to fit on a desktop with the rest of the system, but the larger drives are fitted with their own power supply, so they might be better placed on a separate shelf.

The compactness and lower price of the 5¼in drives are probably their only advantages. Being single-sided, single-density units, they only offer 81k of storage per disk, despite using 40 tracks. They are significantly slower than the 8in drives, taking 15 seconds to load a certain program, compared with 10 seconds on the larger system (NB, the disk test timings are for the 5¼in drives).

A major advantage of the 8in disk system is that it uses the IBM 3740 format, easing the acquisition of software and the interchange of data with other systems. This format gives a net capacity of 241k per disk, a far more practical proposition than the smaller size.

A disadvantage shared by both types of disk unit is that, due to their hard plastic feet, they tend to slide about when one closes the drive doors. Both are reasonably quiet in operation, helped by the fact that the 5¼in drive motors switch off 15 seconds after they are used.

The Diablo 630 daisywheel printer supplied with the test system is an optional extra. It has all the usual features associated with this type of



Monitor case also houses CPU.

printer, including provision for tractor and sheet feeders. While I cannot provide any objective evidence, this printer seems to be quieter in operation than some other daisywheels I have used.

Printer, keyboard and disk drives all plug into clearly labelled D-type connectors mounted on the back panel of the main cabinet. A second RS-232 port is also provided which may be configured for connection to a terminal or modem by altering the positions of a number of clips on the pins of a connector fitted to the circuit board. A number of other options may be exercised in this way. The printer and communications channels are controlled by a single Z80 SIO, plus a dual programmable baud rate generator, although the communications port is also capable of accepting clock signals from the external device.

A completely uncommitted PIO is fitted, providing 16 bits of I/O with four handshaking lines. These lines are not brought out to the case; instead, they are terminated by a connector on the circuit board. As with the communications port, certain options must be selected by fitting clips within the cabinet.

Reference is made to a circuit diagram in the documentation, but it was not present in the binder. In any case, unless the user was familiar with the chips used, additional manuals or datasheets would be needed to make use of the options presented.

Software

The only software included in the price of the 820 is the EPROM-resident monitor and a diagnostics package. The monitor contains all the input/output routines (including the disk drivers), but I was unable to extensively investigate the commands it provides as the manual seemed to describe a different version to that fitted to the computer. For example, the command to boot up the system is given as 'A', but the power-on display indicated that 'L' was the key to press. The manual also describes a real-time clock and calendar maintained by the monitor from the one-second interrupts produced by a timer chip, but when I examined the specified memory locations they never changed. The timer was obviously



Diablo printer is very quiet.



8in disk drive by Shugart.

working, as the disk time-out feature was functioning, so presumably some sort of initialisation is needed — or has the memory map changed?

On the subject of interrupts, the whole I/O subsystem is interrupt driven, so characters zip in and out smoothly (except during disk operations, as the processor is halted at these times). As an example, the monitor responds to keyboard interrupts by collecting the

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character and placing it in a 16-byte buffer. The keyboard input routine then collects the character from the buffer as required, thus providing a type-ahead feature.

The diagnostics disk exercises the display, printer and disk drives, and tests the computer's memory in two blocks. The whole cycle takes only a few minutes to complete, and would be of value when trying to determine whether the hardware or software is the cause of some obscure problem. It would then probably be worth running the suite regularly to bring to light any faults before they cause difficulties.

CP/M is the only operating system offered by Xerox, so why isn't it included in the price? It is a sensible choice, but offering customers a disk-based system without including an operating system is rather like selling a car without wheels. However, I was pleased to see that the source code for the complete BIOS module is supplied on the system disk, along with the usual CP/M utilities and programs to initialise and copy disks. This permits user modifications, ie, to accommodate new devices.

A small selection of software is already available, with other items still under evaluation by Xerox. Of course, there is nothing to stop you going along to your friendly local dealer and picking up whatever CP/M-compatible product you like, although there could be problems with availability if you choose the 5¼in disks.

Xerox currently offers Microsoft Basic version 5 (all I shall say is that the Benchmark times are perfectly respectable), SuperCalc, and Xerox Word Processing.

SuperCalc is the spreadsheet program described in April 1982s Benchtest of the Osborne-1. Something I particularly liked about the program is the way it allows conditional expressions, making it easier to deal with things like the higher rates of our tax system (no, APC doesn't pay that well!). These statements have the form:

IF (conditional expression, arithmetic expression 1, arithmetic expression 2). The conditional expression is evaluated first and, if it is true, arithmetic expression 1 is evaluated to give the result, otherwise expression 2 is used.

Xerox Word Processing (XWS) is a heavily customised version of Wordstar. The menus, error messages, and control keys have all been changed — the error messages are friendlier, but the mnemonic nature of some of the commands has been lost. An example is the prefix key for on-screen formatting commands: control-o with Wordstar, but control-4 under XWS. Numbers are used extensively as command keys, so the fact that the number pad generates different codes to the digit keys on the main board can cause some confusion.

Unlike SuperCalc, XWS appears to directly access the memory mapped display, resulting in high-speed screen updating.

Xerox 820 and CD 2000

A Melbourne based company, Novex Data Systems, is doing some very interesting things with the Xerox 820
— Ian Davies reports.

Their most exciting product is the CD2000 operating system, a multi-tasking system which divides memory up into four partitions and uses interrupt techniques to allow up to four programs to execute in the one machine concurrently.

A set of functions accessible from the keyboard is used to effectively correct the screen and keys up to any one of the four partitions. What this means is that you can have your stock control system, invoices register and word processor all in the machine at the same time, and can switch from one to another very quickly. Not only this, but since the tasks execute concurrently, your word processor can continue with a time consuming resequence operation while you are using a program in another partition. It is even possible to have multiple copies of the same program running in different partitions at the same time. The system is not really multi-user, as only one person can use the 820 at the one time, but it is multi-tasking in that the one machine can do more than one thing for that one person at effectively the same time. It is even possible to run CP/M in one of the partitions while the other three are running CD2000 based programs.

The operating system is only available for Xerox 820s with a hard disk configuration — the justification being that a floppy based system would involve too many disk changes when switching applications. Novex offers hard disks in the range of eight megabytes up to 330 Mbs and said that all of their hard disks are actually intelligent data management systems with on-board RAM, PROM and processor. The 820 communicates with the disk drive via high level commands such as "SORT FILE" or "MOVE FILE". The drives are equipped with an

8085 processor running at 9.5 Mhz and the next step is to expand up to a sixteen bit processor. A number of 820s can be linked to the one storage device, thereby providing distributed systems.

Twelve "types" are supported on the system, including print files, text, variable record length files and indeed sequential files with up to four secondary indexes. When used in conjunction with indexed files, the data management system can be sent high level "find" commands. Individual records can be locked to sort out concurrent update contention problems and password driven file or record security is also provided.

The data management system forms the heart of an 820 network which allows distributed office data processing and communication via an electronic mail system, and can also be patched into other networks. Devices can also be shared between the 820s, mediated by the data management system. For example, a printer can be connected to the data management system and the 820s simply send their print requests down the line. If the printer is currently busy doing work for someone else, the data management system will spool the output until the printer is available. The 820 concerned never sees any of this and thinks that the printer is available for its own private use.

Novex has also made a local hardware enhancement to the 820 to provide inverse video capability and will soon be launching a very impressive high resolution colour graphics option. This option provides up to six logical screens, four with four colours and low resolution graphics and the other two with 1024 x 512 resolution and 64 colours. Sixteen different character sets, zoom, rotate and pixel scrolling are also provided.

Documentation

The main documentation is supplied in three-ring binders with thumb-index dividers for easy reference. Clear, illustrated instructions are provided covering the unpacking and connection of the system. Novice users are catered for on the 'this is how to put a disk into the drive' level (important if there is no one around to demonstrate the essentials) as well as a description of the process of formatting and copying disks. These points are covered in both the Word Processing and CP/M manuals.

More advanced users are catered for by a section in the CP/M manual which gives details of the monitor commands and the entry points and parameters of its major routines. This also gives an overview of the hardware's operation, including port utilisation, user-strappable options, and pin assignments. I believe the inclusion of this portion in the CP/M manual underlines my point about Xerox's failure to include

the operating system as part of the basic package.

The manuals for SuperCalc and Microsoft Basic are those provided by the software companies, although I got the impression that they will normally be supplied in the same format as Xerox's own documentation. The SuperCalc documentation includes a handy reference card.

The Word Processing manual has been extensively rewritten by Xerox to cover their customisation of the software and to provide a 'tutorial' approach. I must admit that I didn't bother with the Wordstar manual when I bought that program (except for the installation instructions) as the menus showed all I needed to get started, so I really can't compare the two except to say that the typeface used by Xerox is much more attractive!

A useful extra is the small introduction and reference manual. I found it very helpful while getting used to the system.

BENCHTEST

BUSINESS SYSTEM

Users

The Xerox 820 is another of those computers designed for use with software intended to make boring tasks quicker and easier. I can't really see anyone buying it for other than business or professional use, but such people are likely to require the extra storage capacity of the 8in disk drives. However, they should be attracted by the fact that maintenance is available from the manufacturer (at approximately one percent of hardware price per month). Xerox claims its field engineers have an average response time of four hours, which is far better than my experience with two well-known maintenance companies. It is also reasonable to expect Xerox engineers to know enough about their own equipment to correct any faults efficiently.

Prices

The pricing of the 820 is reasonably competitive, but not especially impressive when it is remembered that all software is charged separately.

820 with 5¼in drives \$3780
820 with 8in drives \$4665

Diablo 630 printer \$3195
CP/M \$195
Word Processing Software \$495
Other software prices have not been fixed, but the preliminary price list suggests that they will be broadly in line with those charged by other suppliers.

The 820 will be sold in three ways: through dealers, through Xerox shops, and by the company's sales force.

Future plans

Apart from enlarging their range of software, the only expansion mentioned by Xerox staff was a Winchester disk unit. A 6-megabyte drive is already being used within the company, so it should be available very soon.

Conclusions

The Xerox 820 is a vanilla-flavoured computer: not very exciting, but fine if that's what you want. I can't see it eating into Apple's user base, but some potential customers will be attracted by

the idea of buying a computer from a company they already know and trust. Assuming that the documentation and firmware are brought into line with each other, my main reservations are the unusually low capacity of the 5¼in disk drives and the quality of the keyboard fitted to the review machine.

Benchmark Timings

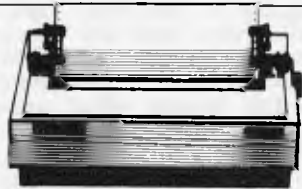
BM1	1.7
BM2	5.5
BM3	15.5
BM4	15.1
BM5	16.2
BM6	28.9
BM7	46.1
BM8	8.0

DT1	1.6
DT2	33.6
DT3	35.8
DT4	32.7
DT5	34.7

Technical specifications

CPU	Z80, 2.5MHz
Memory	64k dynamic RAM, plus monitor EPROM and video RAM
Disks	2-4 drives, either 5¼in (81k net per disk) or 8in (241k)
Cassette	n/a
Ports	2 RS-232, 16-bit parallel I/O
Screen	12in black and white, 24 x 80 characters
Keyboard	75 key, auto-repeat on some non-printing keys, number pad includes cursor control keys

PRINTER SURVEY



Over the next few pages are the results of a printer survey we ran earlier this year to bring you the most up-to-date table of available machines. While more than forty machines are detailed in the table, the list is by no means totally comprehensive. However, the printers listed are a representative sample of the range available in Australia and would suit the vast majority of applications. Below we offer guidance on how to get the most from these tables.

If a feature or function is available on a printer we have put an asterisk in the appropriate column although this doesn't necessarily mean that it is included in the price.

The company listed at the top of the column as the supplier is usually a major importer, manufacturer or distributor. In certain instances, however, a number of companies import the printer or printer range and we have listed the company to first reply to our survey. Your local computer store will certainly carry stocks of some of the machines described and even if it doesn't have the particular machine you want, it will probably be able to obtain it for you.

We've identified four types of print mechanism. Dot matrix printing is formed by an array of needles fired at the printer ribbon which then impacts

on the paper, giving a 'dotty' appearance to the characters. Daisywheel and golf ball printers work by using ready-formed characters cast in metal or plastic. This gives a typewriter or typeset appearance which is obviously much neater. This neatness comes at a price, as you will see. Line printers are able to print an entire line at a time, either by using a chain, a drum or a 'comb' to form the letters. The chain and drum carry preformed letters which give a neater appearance than the comb, which gives the 'dotty' appearance mentioned earlier.

Where applicable, we have shown the dot matrix format because this will give you an idea of the final print quality. The deeper the matrix, the better the character shape. Some of the smaller matrices can only form y, g and p by perching the descender 'on the line', so to speak. Graphics come in two varieties - high and low resolution. The low resolution are often referred to as 'block' graphics, being small blocks a quarter to a sixth the size of a character. The high resolution graphics are those capable of producing accurate graphs and drawings, for example. Dot matrix printers quite often allow the user to define his own characters, as well as using those included in the printer itself.

Moving on to the layout of the

printed page, justification relates to the printer's ability to line up the right hand edge of print whether under its own or the computer's control. Proportional spacing separates the words and, sometimes, individual letters evenly to give a neat appearance to each line. Proportional letter spacing gives the best possible appearance to the print.

You'll find that you may have to pay extra for a tractor feed mechanism, although this is by no means always the case, and price isn't a good guide. Some of the cheapest printers include a tractor mechanism in the basic price. Friction feed is like a typewriter and pin feed is similar, except that the platen has sprockets built in to feed continuous stationery. Horizontal tabbing relates to the printer's ability to move the print head to predefined tab positions, like a typewriter, whereas vertical tabbing allows the machine to pull paper through to predefined vertical positions. A typical example would be of an invoice where, having printed the last detail line, you want to move to the total box to print the invoice value. Bidirectional feed enables the printer to move the paper either forward or backwards and is often found on friction feed printers or those with dual tractors.

Interfaces quite often cost extra and they come in many shapes and sizes. We've covered the main ones here and if you find that every interface type is indicated, then you can be pretty sure that your machine is catered for. The serial interface most commonly relates to the RS232 standard while the parallel often describes the IEEE-488.

Supplier/tel	Alfatron			AMPEC ELEC.			Archives Computers (Aust) (03) 699 8377		CASE Communication Systems Ltd (02) 438 2400	
	(03) 758 9551			(02) 818 1166						
Model	Alfaprint	Betaprint	Star 80	M8510A	M1550	FIO-40	F10-55	Qume Sprint 9	Data South DS-180	CX80 Colour 1990
Price in \$ ex S. Tax	\$381.60	\$404.60	\$495.00	\$950	\$1550	\$2300	\$3200	\$2950	-	\$1990
Print Mechanism	/									
Dot matrix	*	*	*	*	*	-	-	-	*	*
Daisywheel	-	-	-	-	-	*	*	*	-	-
Golf ball	-	-	-	-	-	-	-	-	-	-
Line										
Matrix	5x7	5x7	7x7	7x9	7x9	-	-	-	9x7	7x5
Graphics	-	-	-	*	-	-	-	-	-	-
No of ch/symbols	96	96	224	96	96	96	96	96+	96+	143
True descenders	-	-	-	*	*	-	-	*	-	-
Underlining	-	-	-	*	*	*	*	*	*	-
Features	/									
Bold	*	*	*	*	*	*	*	*	-	-
Double width	*	*	*	*	*	-	-	-	-	*
Condensed	-	-	-	*	-	-	-	-	-	-
Super/subscript	-	-	-	*	*	-	-	*	-	-
Other	-	-	-	-	-	-	-	-	-	7 colour
Justified	-	-	-	*	*	*	*	*	-	-
Prop spacing	-	-	-	*	*	-	-	*	-	-
Max speed (cps)	52.5	52.5	100	112	120	40	55	45	180	125
Max Ch/line	42	80	132	136	231	136	163	198	-	80
Max Ch/in	20	16	18	17	17	-	-	15	-	10
Max Line/in	6	6	12	8	8	-	-	8	8	8
Paper width (ins)	/									
Min	58mm	115mm	10in	4.5	4.5	-	-	00	3in	4
Max	-	-	-	10	15.5	15.5	15.5	15	15	10
Form length (ins)	/									
Min	-	-	-	-	-	-	-	3	-	1
Max	-	-	-	-	-	-	-	14	-	42
Paper feed	/									
Tractor	-	-	*	-	-	Opt.	Opt.	*	*	*
Pin	-	-	-	*	*	-	-	*	-	-
Friction	*	*	*	*	*	*	*	*	-	-
Tab	/									
Horiz	-	-	-	*	*	-	-	*	*	-
Vert	-	-	-	*	*	-	-	*	*	-
Bidirectional feed	-	-	-	*	*	*	*	*	*	*
Paper out sensor	-	-	-	*	*	*	*	*	*	*
Interface	/									
Serial	-	-	-	*	*	*	*	*	*	*
Parallel	-	-	-	*	*	*	*	Optional	*	*
Centronics	*	*	*	*	*	*	*	-	*	*
20 mA	-	-	-	*	*	-	-	-	*	*
Other	Options	Options	-	*	*	-	-	-	-	IEEE
Keyboard	/									
Size (cms)	/									
Width	18.5	18.5	37	39.8	-	57.4	57.4	61.72	40.64	41
Depth	12.5	17	30	28.5	-	40.5	40.5	42.5	60.96	32
Height	8	8	18.8	12.0	-	15.35	15.35	17.15	17.78	19
Weight (kgs)	Approx. 2	Approx 3	8.5	8.5	11	14	14	20	15.55	10

Supplier/tel	Dick Smith Electronics		T.C.G		Warburton Franki				
	(02) 888 3200		(02) 439 6477		(02) 648 1711 (03) 699 4999				
Model	Seikosha Gr.Printer GP80	Seikosha Gr.Printer GP100A	C. Itoh D.Matrix 8300P	C. Itoh D.Matrix 8510P	Tec D.Wheel FP1500	Novell Image 800	Epson MX-100 III	Epson MX-80 III F/T	Epson MX-80 III
Price in \$ ex S. Tax	\$461.82	\$461.82	\$849.45	\$849.45	\$1846.90	\$1599	\$1199	\$999	\$910
Print mechanism	//								
Dot matrix	Single	Hammer	*	*	-	*	*	*	*
Daisywheel	-	-	-	-	-	-	-	-	-
Golfball	-	-	-	-	-	-	-	-	-
Line	-	-	-	-	-	-	-	-	-
Matrix	*	*	*	*	-	9x9	9x9	9x9	9x9
Graphics	*	*	-	-	-	-	*	*	*
No of ch/symbols	96	96	96	96	64	96+96 Opt.	96+	96+	96+
True descenders	-	-	-	*	*	*	*	*	*
Underlining	-	-	-	*	*	*	*	*	-
Features	//								
Bold	-	-	-	*	*	* Prog.	*	*	*
Double width	*	*	*	*	-	* Prog.	*	*	*
Condensed	*	*	*	*	-	* Prog.	*	*	*
Super/subscript	-	-	-	-	-	* Prog.	*	*	-
Other	-	-	-	-	-	* Prog.	*	*	*
Justified	-	-	-	-	-	* Prog.	*	*	*
Prop spacing	-	-	-	*	*	Prog.	-	-	-
Max speed (cps)	30	30	100	100	40	150	100	80	80
Max Ch/line	80	80	132	132	132	224	233	132	132
Max Ch/in	10	10	16	16	16	16.5 Prog.	-	-	-
Max Line/in	6	6	8	8	8	8 Prog.	8+	8+	8+
Paper width (ins)	//								
Min	2	2	2	2	2	1½	4	4	4
Max	8½	8½	9½	9½	15	15	15.5	10	10
Form length (ins)	//								
Min	1	1	1	1	1/48	Fully	-	-	-
Max	11½	11½	11½	11½	11½	Prog.	127	127	127
Paper feed	//								
Tractor	-	-	-	-	-	*	*	*	*
Pin	*	*	*	*	*	-	*	*	*
Friction	-	-	-	*	*	-	*	*	-
Tab	//								
Horiz	*	*	*	*	*	Prog.	*	*	*
Vert	-	-	*	*	-	Prog.	*	*	*
Bidirectional feed	-	-	*	*	*	*	*	*	*
Paper out sensor	*	*	*	*	*	*	*	*	*
Interface	//								
Serial	-	-	-	-	-	*	*	*	*
Parallel	-	-	-	-	-	*	* Standard	*	* Stan.
Centronics	*	*	*	*	*	*	* Standard	*	* Stan.
20 mA	-	-	-	-	-	*	-	-	-
Other	-	-	-	-	-	-	IEEE	IEEE	IEEE
Keyboard	//								
Size (cms)	//								
Width	320	410	430	385	570	24"	39.2	39.9	39.9
Depth	160	210	360	285	410	17"	39.3	37.5	37.3
Height	130	140	175	120	220	7"	13.3	13.3	10.7
Weight (kgs)	2.3	3	8	3	12	37lbs	-	-	-

PRINTER SURVEY

PROGRAMS

```

1636 X=X1*YT
1638 CLS:PRINT@64,"THE CUBE ROOT OF":PRINT XX:PRINT"EQUALS":X
1640 GOSUB 24000:GOTO 5
2000 GOSUB 20000:X=1-XC*XC:YR=3:GOSUB 23000
2002 YC=15:GOSUB 30000
2004 IF ABS(XC) < 1 AND XX > PI THEN X= -X
2006 IF XX <=1 THEN R$="RADIAN" ELSE R$="RADIAN"
2008 IF ZR=4 THEN 2014
2010 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS SINE IS":PRINT X
2012 GOSUB 24000:GOTO5
2014 IF X=0 THEN 2020
2016 X=1/X:YC=15:GOSUB 30000
2018 PRINT@64,TR$:PRINTXX;R$:PRINT:PRINT"ITS COSECANT IS":PRINTX
:GOSUB 24000:GOTO5
2020 PRINT@64,TR$:PRINTXX;R$:PRINT:PRINT"ITS COSECANT IS":PRINT
"INFINITY":GOSUB 24000:GOTO5
2050 GOSUB 20000:X=XC:YC=16:GOSUB 30000
2052 IF XX<=1 THEN R$="RADIAN"ELSE R$="RADIAN"
2054 IF ZR=5 THEN 2058
2056 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS COSINE IS":PRINTX
:GOSUB 24000:GOTO5
2058 IF X=0 THEN 2062
2060 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS SECANT IS":PRINT
1/X:GOSUB 24000:GOTO5
2062 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS SECANT IS":
PRINT"INFINITY":GOSUB 24000:GOTO5
2100 GOSUB 20000:X=1-XC*XC:YR=3:GOSUB 23000
2102 IF XX<=1 THEN R$="RADIAN" ELSE R$="RADIAN"
2104 IF ZR=6 THEN 2116
2106 IF XC=0 THENPRINT@64,TR$:PRINTXX;R$:PRINT
:PRINT"ITS TANGENT IS":PRINT"INFINITY":GOSUB 24000:GOTO5
2108 IF ABS(XC)>=1 THEN X=0:T=0:GOTO2114
2110 IF XX >PI THEN X= -X
2112 T=X/XC:IF ABS(T) >.9999999999999999 AND ABS(T) <1
THEN T=SGN(T)*1
2114 X=T:YC=15:GOSUB 30000:PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT
"ITS TANGENT IS":PRINT X:GOSUB 24000:GOTO5
2116 IF XC=0 THEN X=0:GOTO2124
2118 IF ABS(XC)>=1 THENPRINT@64,TR$:PRINT XX;R$:PRINT
:PRINT"ITS COTANGENT IS":PRINT"INFINITY":GOSUB 24000:GOTO5
2120 IF XX >PI THEN X= -X
2121 X=XC/X:IF ABS(X) >.9999999999999999 AND ABS(X) <1
THEN X=SGN(X)*1
2122 YC=15:GOSUB 30000
2124 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS COTANGENT IS":
PRINTX:GOSUB 24000:GOTO5
3000 CLS:GOSUB 3600:XX=X:Y=1-X*X:YR=3:GOSUB 23000
3002 IF X=1 THEN T=0:GOSUB 17000:GOTO3010
3005 IF X<.8 THENGOSUB 15000 ELSEGOSUB 16000
3010 CLS:PRINT@64,RE$:PRINT"SINE IS ":GOSUB 4000
3015 GOSUB 24000:GOTO5
3100 CLS:GOSUB 3600:XX=X
3105 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3110 CLS:PRINT@64,RE$:PRINT"COSINE IS ":GOSUB 4000
3115 GOSUB 24000:GOTO5
3200 CLS:GOSUB 3650:XX=X:X=XX+1:YR=3:GOSUB 23000:X=1/X
3202 IF X=1 THEN T=0:GOSUB 17000:GOTO3210
3205 IF X<.8 THENGOSUB 15000 ELSEGOSUB 16000
3210 CLS:PRINT@64,RE$:PRINT"TANGENT IS ":GOSUB 4000
3215 GOSUB 24000:GOTO5
3300 CLS:GOSUB 3700:XX=X:X=XX-1:YR=3:GOSUB 23000:X=X/XX
3305 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3310 CLS:PRINT@64,RE$:PRINT"COSECANT IS ":GOSUB 4000
3315 GOSUB 24000:GOTO5
3400 CLS:GOSUB 3700:XX=X:Y=1/X
3405 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3410 CLS:PRINT@64,RE$:PRINT"SECANT IS ":GOSUB 4000
3415 GOSUB 24000:GOTO5
3500 CLS:GOSUB 3650:XX=X:X=XX+1:YR=3:GOSUB 23000:Y=Y/X
3505 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3510 CLS:PRINT@64,RE$:PRINT"COTANGENT IS ":GOSUB 4000
3515 GOSUB 24000:GOTO5
3600 PRINT@64,"X MUST BE IN THE RANGE FROM
-1 TO +1, INCLUSIVE.
ENTER X":INPUTX
3605 IFABS(X)>1THENPRINT@512," NOT VALID,TRY AGAIN":GOTO3600
3610 PRINT@512,CHR*(31):RETURN
3650 PRINT@64,"X MUST BE IN THE RANGE FROM
-1015 TO +1015, INCLUSIVE.
ENTER X":INPUTX
3655 IFABS(X)>1015THENPRINT@512,"NOT VALID,TRY AGAIN":GOTO3650
3660 PRINT@512,CHR*(31):RETURN
3700 PRINT@64,"X MUST ONLY BE BETWEEN -1015
AND -1, OR BETWEEN +1 AND +1015.
ENTER X":INPUTX
3705 IFABS(X) <1 OR ABS(X) >1015 THENPRINT@512," NOT VALID, TRY AGAIN":
GOTO3700
3710 PRINT@512,CHR*(31):RETURN
4000 PRINT XX:PRINT:PRINT"=":PRINT"RADIAN":PRINT"OR":PRINT"
" DEGREES":RETURN
15000 IFABS(X) <=.55 THEN YC=17 ELSEIF ABS(X) <=.65 THEN YC=15
ELSEIF ABS(X) <=.7 THEN YC=14 ELSE YC=13
15020 DIMA(53),B(53),C(53),X(53)
15025 A(1)=-1:FORY=3TO53STEP2:B(Y)=A(Y-2)*Y-2:NEXT
15030 B(1)=1:FORY=3TO53STEP2:B(Y)=B(Y-2)*Y-1:NEXT
15035 FORY=1TO53STEP2:C(Y)=B(Y)*Y:NEXT
15040 FORY=1TO53STEP2:C(Y)=A(Y)*B(Y):NEXT
15045 X(1)=X:FORY=3TO53STEP2:X(Y)=X(Y-2)*XX:NEXT
15050 T=0:FORZ=1TO53STEP2:T=T+C(Z)*X(Z):NEXT:T=T+PI/2
15060 IF XX <0 AND ZR=1 THEN T=PI+T:GOSUB 17000:RETURN
15070 IF XX <0 AND ZR=3 THEN T=(PI/2-T)+PI/2:GOSUB 17000:RETURN

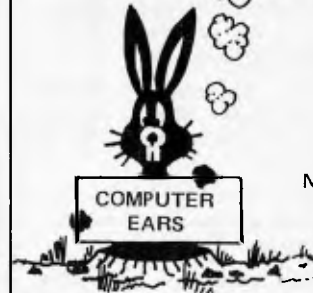
```

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MICRO VISIONS 

PROGRAMS

```
280 A$=INKEY$: IFA$="" THEN280
290 IFA$="G" OR A$="H" THEN CLS:END
300 IF ASC(A$) <65 OR ASC(A$) >70 THEN PRINT@960,
"TYPE LETTERS 'A' TO 'G' ONLY !!": GOTO280
310 ZR=ASC(A$)-64
320 ON ZR GOTO 3000,3100,3200,3300,3400,3500
500 CLS
505 PRINT@64,"FOR FACTORIALS, THE VALUE OF X
MUST BE A POSITIVE WHOLE NUMBER,
NOT MORE THAN 33.
```

```
ENTER YOUR VALUE FOR X " : INPUT X
510 IF X<0 OR X>33 OR X <> INT(X) THEN PRINT@512,
"NOT VALID, TRY AGAIN.": GOTO505
515 PRINT@512,CHR$(30);
520 XX=X: X=1: X1=0
530 X1=X1+1: X=X * X1 : CLS
540 IF X1<XX THEN530
545 IF XX=0 THENA$="" ( BY CONVENTION ) " ELSEA$=""
550 PRINT:PRINT:PRINT"FACTORIAL OF":XX:PRINT"EQUALS":X:A$
560 GOSUB 24000:GOTO5
600 CLS
605 PRINT@64,"X MUST BE IN THE RANGE FROM
-85 TO +85, INCLUSIVE.
```

```
ENTER THE VALUE OF X.": IF Z1=1 THEN Z1=0
607 INPUT X
610 IF ABS(X) >85 THEN PRINT@576,"NOT IN RANGE, TRY AGAIN.":
GOTO605 ELSE PRINT@576,CHR$(30);
615 Y=0: XX=X: IF X=0 THEN X=1: GOTO675
620 IF X<0 THEN X=-X: Z1=1
625 IF X<.005 THEN640
630 IF X>=.005 AND X<.01 THEN640
635 X=X/2: Y=Y+1: IF X>=.005 AND X<.01 THEN640 ELSE635
640 A1=X: A2=A1: A3=A1/2: A4=A1*/6: A5=A2/24: A6=A2*X/120
A7=A2*A1/720: A8=A2*A1*X/5040: A9=A2*A2/40320: A10=A2*A2*X/362880
645 X=1+X+A3+A4+A5+A6+A7+A8+A9+AA+AB
650 IF Y=0 THEN670
655 FOR Z=1 TO Y: X=X*Z: NEXT Z
670 IF Z1=1 THEN X=1/X
675 YC=15: GOSUB 30000
680 CLS:PRINT:PRINT:PRINT"1/E TO THE POWER":PRINTXX
:PRINT"EQUALS":PRINTX
685 GOSUB 24000:GOTO5
1000 CLS
1005 PRINT@64,"NOTE THAT THE VALUE OF X
MUST BE BETWEEN 10-34 AND 10+34,
INCLUSIVE.
```

```
ENTER YOUR VALUE FOR X.": INPUT X
1010 IF X<10-34 OR X>10+34 THEN PRINT@576,"NOT VALID, TRY AGAIN"
: GOTO1005 ELSE PRINT@576,CHR$(30);
1020 XX=X: LE=X: T=1: Z=0
1025 IF LE<1 THEN T=-1: LE=1/LE
1030 IF LE<1.0055 THEN1060
1035 IF LE>=1.0055 AND LE<=1.011 THEN1060
1040 YR=2: GOSUB 23000: Z=Z+1
1045 CLS: IF Z/2=INT(Z/2) THEN PRINT@448,"THINKING * * * *":
ELSE PRINT@448,"THINKING * * * "
1055 IF LE>=1.0055 AND LE<=1.011 THEN1060 ELSE1040
1060 CLS: PRINT@448," NEARLY THERE NOW
-----" FOR Y=1 TO 750: NEXT Y
1065 LE=LE-1
1070 A=LE*X: A0=AA: A1=A0*A0: A2=A/2: A3=A*X/3: A4=A0/4: A5=A0*X/5
A6=A0*A/6: A7=A0*A*X/7: A8=A1/8: A9=A1*X/9: AA=A1*A/10
LE=LE-A2+A3-A4+A5-A6+A7-A8+A9-AA
1075 IF Z=0 THEN1085
1080 FOR Y=1 TO Z: LE=LE*Z: NEXT Y
1083 IF ZV=4 AND (XX <=10-15 OR XX >=10+15) THEN LE=LE+10-10
1085 LE=LE*T
1090 IF ZV=4 THEN LE=LE/2.30258509299519
A$="LOG. TO THE BASE 10 OF" ELSE A$="THE NATURAL LOGARITHM OF"
1095 YC=14: X=LE: GOSUB 30000
1100 CLS: PRINT:PRINT A$:PRINT XX:PRINT"EQUALS":PRINT X
1110 GOSUB 24000:GOTO5
1500 CLS
1505 PRINT@64," NOTE THAT THE VALUE OF X MUST
BE A POSITIVE NUMBER, OR ZERO,
NOT GREATER THAN 10+34.
```

```
ENTER YOUR VALUE FOR X.":PRINT:INPUT X
1510 IF X<0 OR X>10+34 THEN PRINT@640,"NOT VALID, TRY AGAIN.":
GOTO1505 ELSE PRINT@640,CHR$(30);
1520 YR=1: SQ=X: XX=X: GOSUB 23000
1525 X=SQ: YC=17: GOSUB 30000
1530 CLS:PRINT@192,"THE SQUARE ROOT OF":PRINTXX:PRINT"EQUALS":
PRINTX
1535 GOSUB 24000:GOTO5
1600 CLS
1605 PRINT@64,"THE VALUE OF X CAN BE POSITIVE
OR NEGATIVE, BUT WITH AN ABSOLUTE
VALUE NOT GREATER THAN 1036.
```

```
ENTER THE VALUE FOR X.":PRINT:INPUT X
1610 IF ABS(X)>1036 THEN PRINT@704,"NOT VALID, TRY AGAIN.":
GOTO1605 ELSE PRINT@704,CHR$(30);
1620 IF X<0 THEN Y1=-1 ELSE Y1=1
1625 XX=X: X=ABS(X)
1630 IF X=0 THEN X1=0: GOTO 1636
1632 X1=X/(1/3)
1634 FOR ZC=1 TO 2: X2=((X/X1/X1)+2*X1)/3: X1=X2: NEXT ZC
```

PROGRAMS

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TRS-80 Double Precision Maths and Trig

by B. Snell

Although the TRS-80/System 80 keyboards offer a range of numerical and trigonometric functions, these are somewhat restricted and tend to output 'garbage' numbers after the first six figures when used in double precision mode — which can be inconvenient, to say the least, for those whose work with their computer demands high numerical accuracy.

This suite of subroutines will give a high standard of accuracy and an extended range of functions to the TRS-80/System 80 user. It requires a 16k machine to run. It will not print meaningless numbers at the end of a result, which means that if a result contains twelve digits then all twelve digits are meant to be there. Accuracy is +1,

—½ in the last digit.

Using this package, the user can convert his computer into a reliable desktop calculator and single subroutines could be used as part of other programs. System 80 users should type the program in as listed and press 'video cut' before running. TRS-80 users will need to incorporate CHR\$(23) after every CLS command. This simply tidies up the readout. The program presents a menu of all the functions available which is easy to follow and can be read from lines 1-300. Finally, the BREAK key is left disabled at the end of the program. This can be overcome by omitting the two POKE statements in line 5.

```
1 / MATH & TRIG PRECISION SUBROUTINES. BARRIE SNELL. 1981.
5 CLS: CLEAR: CLEAR: 100: DEFDBL A-X: DEFINT Y,Z
   POKE 16396,151 : POKE 16397,201
10 PI=3.1415926535897932:P2=2*PI
50 CLS: PRINT@64," WHICH TYPE OF PROBLEM DO
   YOU WISH TO SOLVE :-----

(A) ARITHMETIC
(B) TRIGONOMETRIC
(C) NONE OF THE ABOVE"
55 A$=INKEY$: IFA$="" THEN 55
60 IFA$="A" THEN 100 ELSE IFA$="B" THEN 200 ELSE IFA$="C" THEN CLS: END
   ELSE PRINT@960," TRY AGAIN !": GOTO 55
100 CLS: PRINT@64," DO YOU WANT TO FIND VALUES FOR

(A) FACTORIAL OF X
(B) 'E' TO THE POWER X
(C) NATURAL LOG. OF X
(D) LOG. TO BASE 10 OF X
(E) SQUARE ROOT OF X
(F) CUBE ROOT OF X
(G) NONE OF THE ABOVE"
110 A$=INKEY$: IFA$="" THEN 110
120 IFA$="G" THEN CLS: END
130 IFA$(A$) < 65 OR ASC(A$) > 71 THEN PRINT@960,"
   TYPE LETTERS 'A' TO 'G' ONLY !": GOTO 110
140 ZV=ASC(A$)-64
150 ON ZV GOTO 500,600,1000,1000,1500,1600
200 CLS: PRINT@64," DO YOU WANT TO FIND VALUES FOR

(A) SINE
(B) COSINE
(C) TANGENT
(D) COSECANT
(E) SECANT
(F) COTANGENT
(G) ANY OF THEIR INVERSE
   FUNCTIONS. E.G. ARCSINE
(H) NONE OF THE ABOVE"
210 A$=INKEY$: IFA$="" THEN 210 ELSE IFA$="G" THEN 270 ELSE IFA$="H"
   THEN 290
230 IFA$(A$) < 65 OR ASC(A$) > 71 THEN PRINT@960,"
   TYPE LETTERS 'A' TO 'H' ONLY !": GOTO 210
240 ZR=ASC(A$)-64: TR$="YOUR ANGLE WAS EQUIVALENT TO"
250 GOSUB 250000
260 ON ZR GOTO 2000,2050,2100,2000,2050,2100
270 CLS: PRINT@64," DO YOU WANT TO EVALUATE

(A) ARC SINE
(B) ARC COSINE
(C) ARC TANGENT
(D) ARC COSECANT
(E) ARC SECANT
(F) ARC COTANGENT
(G) NONE OF THESE"
```

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PROGRAMS

```

15000 IF X<=0 AND ZR=4 THEN T=P2-T:GOSUB 17000:RETURN
15000 GOSUB 17000 : RETURN
16000 YC=13:Y=0:ZY=0
16010 IF X<=0 THEN16040
16020 IF(ZR-1)*(ZR-2)*(ZR-3)*(ZR-4)=0 THENZY=1 ELSE ZY=2
16030 IF(ZR-2)*(ZR-4)*(ZR-5)*(ZR-6)=0 THEN X=-X
16040 IFX)=.99995 THEN16070
16050 X=(X+1)/2:YR=3:GOSUB 23000 Y=Y+1
16060 IFX<.99985 THEN16050 ELSE16070
16070 X=(2*X+1)/3:YR=3:GOSUB 23000:X=6-6*X:GOSUB 23000
16080 IF Y=0 THEN16100
16090 FORZ=1TOY:X=X*2:NEXT
16100 IF ZY=0 THEN T=X:GOSUB 17000:RETURN
16110 IF ZY=1 AND (ZR=1 OR ZR=4)THEN T=PI*X:GOSUB 17000:RETURN
16120 IF ZY=1 AND (ZR=2 OR ZR=3)THEN T=PI-X:GOSUB 17000:RETURN
16130 IF ZY=2 THEN T=PI-X:GOSUB 17000:RETURN
17000 RE$="THE SMALLEST ANGLE WHOSE SINE IS T:GOSUB 30000
      T=X*X:TD:GOSUB 30000:TD=X: RETURN
20000 Y=0:IFX<=.084 THEN20030
20010 IF X>=.084 AND X<=.168 THEN20030
20020 X=X/2:Y=Y+1:IF X>=.084 AND X<=.168 THEN20030 ELSE20020
20030 P1=X*X:A2=A1*A1:A3=A2*A2:A4=A1/2:A5=A2/24:A6=A1*A2/720:
      A7=A3/40320:A8=A1*A3/3628800:A9=A2*A3/479001600
20040 XC=1-A4+A5-A6+A7-A8+A9:IFY=0THEN20060
20050 FORZ=1TOY:XC=2*XC*XC-1:NEXT Z
20060 IF ABS(XC)<.5D-14 THEN XC=0
20070 RETURN
23000 X1=0:X2=0:X3=0
23002 IF YR=1 THEN X1=50
23004 IF YR=2 THEN X1=LE
23006 IF YR=3 THEN X1=X
23008 X1=ABS(X1)
23010 IF X1=0 THEN X2=0 : GOTO 23014
23012 X2=SQR(X1):FOR ZS=1 TO 2:X3=(X1/X2+X2)/2:X2=X3:NEXT ZS
23014 ON YR GOTO 23016,23018,23020
23016 SQ=X2:RETURN
23018 LE=X2:RETURN
23020 X=X2:RETURN
24000 PRINT@B32," ANY MORE FUNCTIONS ?
      (YES OR NO)"
24005 A$=INKEY$:IFA$=""THEN24005
24010 IFA$="Y"THEN RETURN
24015 IFA$="N"THENCLS:PRINT@B32,"G O O D B Y E !" :PRINT:PRINT:
      PRINT:PRINT:END
24020 PRINT@B60," TYPE 'YES' OR 'NO' ONLY !":GOTO24005
25000 CLS
25010 PRINT@B4,"DO YOU WANT TO ENTER
      THE ANGLE X IN -----
      (A) RADIANS
      (B) DEGREES
25020 A$=INKEY$:IFA$=""THEN25020
25030 IFA$="A"THEN 25050 ELSEIFA$="B"THEN 25090
25040 PRINT@B40," TYPE 'A' OR 'B' ONLY !":GOTO25010
25050 CLS
25060 PRINT@B4,"ENTER X IN RADIANS.
      POSITIVE OR NEGATIVE, DECIMAL OR
      OTHERWISE, BUT NOT GREATER THAN
      ONE THOUSAND."
25070 INPUT X:IFA$="A">1000THENPRINT@B46,"NOT VALID. TRY AGAIN."
      :GOTO25060
25075 ZF=SGN(X):X=ABS(X):X=(X/P2-INT(X/P2))*P2
25077 IF ZF<0 THEN X=-X
25085 X=X:CLS:RETURN
25090 CLS
25100 PRINT@B4,"ENTER X IN DECIMAL DEGREES.
      POSITIVE OR NEGATIVE, BUT NOT
      GREATER THAN TEN THOUSAND."
25110 INPUTX:IFA$="B">10000 THENPRINT@B46,"NOT VALID. TRY AGAIN."
      :GOTO 25100
25120 ZF=SGN(X):X=ABS(X):X=(X/360-INT(X/360))*360
25125 IFZF<0 THEN X=-X
25130 X=X*PI/180:XX=X:CLS:RETURN
30000 ! ACCURACY OF RESULTS ROUTINE
30010 X$=STR$(X):Y$="0"
30020 FOR Z=1 TO LEN(X$)
30030 IF Y$=MID$(X$,Z,1) THEN 30050 ELSE NEXT Z
30040 X$=LEFT$(X$,YC) : X=VAL(X$) : RETURN
30050 D$=MID$(X$,Z+1) : X$=LEFT$(X$,Z+1) : X*=LEFT$(X$,YC)
30060 X=VAL(X$+D$) : RETURN

```

Apple 3D Maze.

by Malcolm Banthorpe

Over the past month or so I have become almost addicted to this game. The object is to navigate your way from entrance to exit of a maze which the computer draws (as a plan view) when the game starts. This is done using the commands Forward (one to nine steps), Left or Right. As soon as it has finished drawing the maze the computer puts you theoretically at the entrance to it, giving you a 3D perspective view of the tunnel ahead. You are told which direc-

tion you are facing each time you move and if you leave too much time between moves the computer will ask you to hurry up and remind you of the commands.

It is perfectly possible to get completely lost in the maze and provision has been made for this. You are allowed three 'Help calls' which show your position on the plan view for as long as you need to work out where you are, and three 'Jumps' which transport you

PROGRAMS

to a random location so you can get even more lost. As the maze is drawn at

random it is different every time so the variations are endless.

```

1
JLIST
10 H1 = 278
12 V1 = H1 / 2
15 HGR
20 TEXT : HOME
21 PRINT TAB( 16)"*****"
22 PRINT TAB( 15)" 3D MAZE $"
23 PRINT TAB( 16)"*****"
24 PRINT
25 PRINT "THE COMPUTER WILL DRAW
  A MAZE WITH A"
26 PRINT "SINGLE EXIT AT THE UPP
  ER EDGE"
27 PRINT
28 PRINT "AS SDON AS THE MAZE IS
  COMPLETE, THE"
29 PRINT "PLAN VIEW WILL BE REPL
  ACED BY A 3D"
30 PRINT "PERSPECTIVE VIEW AS SE
  EN FROM YOUR"
31 PRINT "CURRENT POSITION"
32 PRINT
33 PRINT "YOU START AT THE LOWER
  EDGE"
34 PRINT
35 PRINT "YOUR OBJECT IS TO GET
  WITHIN SIGHT OF"
36 PRINT "THE EXIT"
37 PRINT : PRINT
38 PRINT "PRESS ANY KEY TO CONTI
  NUE"
39 GET A$
40 HOME
41 PRINT "THESE ARE THE COMMANDS
  YOU CAN USE TO"
42 PRINT "NAVIGATE THE MAZE"
43 PRINT
44 PRINT TAB( 10)"F = MOVE FOM
  ARD (1 -9) STEPS"
45 PRINT
46 PRINT TAB( 10)"L = TURN 90 D
  EGREES LEFT"
47 PRINT
48 PRINT TAB( 10)"R = TURN 90 D
  EGREES RIGHT"
49 PRINT
50 PRINT "IF YOU GET LDST YOU CA
  N GET HELP BY"
51 PRINT "PRESSING 'H'"
52 PRINT
53 PRINT "THIS WILL RETURN TO TH
  E PLAN VIEW"
54 PRINT "WITH YOUR POSITION IND
  ICATED"
57 PRINT : PRINT "OR YOU CAN TAK
  E A CHANCE AND PRESS 'J'"
58 PRINT : PRINT "THIS WILL TRAN
  SPORT YOU TO A RANDOM": PRINT
  "LOCATION"
59 PRINT : PRINT "YOU WILL BE LI
  MITED TO 3 JUMPS AND 3 HE
  LP CALLS"
60 PRINT : PRINT "PRESS ANY KEY
  TO START ": GET A$
70 FOR I = 1 TO 17: READ D: NEXT
80 FOR L = 768 TO 793: READ D: POKE
  L,D: NEXT
90 FOR L = 800 TO 821: READ D: POKE
  L,D: NEXT
100 DEF FN A(X) = INT ( RND ( 1
  ) * X + 1)
105 HP = 0:JU = 0
110 GR : COLOR= 15
115 FOR V = 0 TO 39: HLIN 0,39 AT
  V: NEXT
120 HOME
125 X = FN A(19) * 2:Y = 38
130 HTAB X + 1: FLASH : PRINT " ^
  ": NORMAL
135 P = X - 12: IF P < 1 THEN P =
  1
140 HTAB P: PRINT "YOU START HER
  E"
145 SX = X
150 COLOR= 0: PLOT X,39
155 D = FN A(2)
160 L = 2 * FN A(24) - 24
165 POKE 815,100
170 CALL 800
175 IF D = 1 THEN Y = Y + L:XT =
  X
180 IF D = 2 THEN XT = X + L:YT =
  Y
185 IF XT < 1 OR XT > 38 OR YT <
  0 OR YT > 37 THEN 155
190 : IF D = 1 THEN 200
195 IF D = 2 THEN FOR H = X TO
  X + L STEP SGN (L): COLOR=
  15: PLOT H,Y: GOSUB 6000: COLOR=
  0: PLOT H,Y: NEXT
200 IF D = 1 THEN FOR V = Y TO
  Y + L STEP SGN (L): COLOR=
  15: PLOT X,V: GOSUB 6000: COLOR=
  0: PLOT X,V: NEXT
205 X = XT:Y = YT
210 IF Y < > 0 THEN 155
215 EX = X
220 X = SX:Y = 38:D = 1

```

```

225 COLOR= 15: PLOT 8X,39
230 HOME
235 GOTO 470
240 F = 0
245 VTAB 24: PRINT CHR$ (7): HTAB
  1
250 PRINT "COMMAND ? ": FLASH :
  PRINT " ":T = 0: NORMAL
255 P = PEEK ( - 16384): IF P >
  127 THEN A$ = CHR$ ( P - 128
  ): POKE - 16368,0: GOTO 280
260 T = T + 1: IF T < 800 THEN 25
  5
265 VTAB 24: HTAB 1: FLASH : PRINT
  "HURRY UP": NORMAL : SPEED=
  10: PRINT " - THE COMMANDS A
  RE F,L,R,H,J ": HTAB 1
270 SPEED= 100: PRINT "
  ": SPEED= 255
275 GOTO 245
280 IF A$ = "R" THEN F = 1:D = D
  + 1: IF D = 5 THEN D = 1
285 IF A$ = "L" THEN F = 1:D = D
  - 1: IF D = 0 THEN D = 4
290 IF A$ = "F" THEN F = 1
295 IF A$ = "H" THEN F = 1
300 IF A$ < > "J" THEN 320
305 JU = JU + 1: IF JU > 3 THEN HOME
  : FLASH : PRINT "YOU'VE ALRE
  ADY HAD 3 JUMPS": NORMAL : GOTO
  245
310 F = 1:P = 0: GOSUB 6500
315 X = FN A(19) * 2:Y = FN A(1
  6) * 2: IF SCRN( X,Y) = 15 THEN
  315
320 IF F = 0 THEN 240
325 IF D = 1 THEN B$ = "NORTH"
330 IF D = 4 THEN B$ = "WEST"
335 IF D = 3 THEN B$ = "SOUTH"
340 IF D = 2 THEN B$ = "EAST"
345 HOME : PRINT "YOU ARE FACING
  'B$"
350 IF A$ < > "H" THEN 385
355 HP = HP + 1: IF HP > 3 THEN HOME
  : FLASH : PRINT CHR$ (7): CHR$
  (7): "YOU'VE ALREADY HAD THRE
  E HELP CALLS": NORMAL : GOTO
  245
360 PRINT
365 PRINT "PRESS SPACE-BAR TO RE
  TURN TO 3D VIEW"
370 COLOR= 3: PLOT X,Y: GOSUB 50
  00: COLOR= 0: PLOT X,Y: GOSUB
  5000
375 POKE 49238,0: IF PEEK ( - 1
  6384) = 72 THEN 370
380 GET A$: HOME : POKE 49239,0:
  GOTO 245
385 IF A$ < > "F" THEN 470
390 PRINT "HOW MANY STEPS (1-9)
  ?": GET A$: PRINT A$
395 IF A$ < "1" OR A$ > "9" THEN
  390
400 S = VAL (A$)
405 C = 1
410 ON D GOTO 415,430,445,460
415 Y = Y - 1: IF SCRN( X,Y) = 1
  5 THEN Y = Y + 1: GOSUB 8000
  : GOTO 470
420 C = C + 1: IF C < = 8 THEN 4
  15
425 GOTO 470
430 X = X + 1: IF SCRN( X,Y) = 1
  5 THEN X = X - 1: GOSUB 8000
  : GOTO 470
435 C = C + 1: IF C < = 8 THEN 4
  30
440 GOTO 470
445 Y = Y + 1: IF SCRN( X,Y) = 1
  5 THEN Y = Y - 1: GOSUB 8000
  : GOTO 470
450 C = C + 1: IF C < = 8 THEN 4
  45
455 GOTO 470
460 X = X - 1: IF SCRN( X,Y) = 1
  5 THEN X = X + 1: GOSUB 8000
  : GOTO 470
465 C = C + 1: IF C < = 8 THEN 4
  60
470 ON D GOSUB 480,570,650,730
475 GOTO 240
480 GOSUB 1000
485 RESTORE
490 READ B
495 Y = Y
500 A = B: READ B: IF B > V1 THEN
  530
505 GOSUB 9000
510 C = A / 2:D1 = B / 2:E = B
515 IF SCRN( X - 1,Y) = 0 THEN
  GOSUB 1100
520 Y = Y - 1: IF Y = 0 AND SCRN(
  X,Y) = 0 THEN 805
525 IF SCRN( X,Y) = 0 THEN 500
530 Y = Y: RESTORE
535 READ B
540 A = B: READ B: IF B > V1 THEN 565
545 C = A / 2:D1 = B / 2
550 IF SCRN( X + 1,Y) = 0 THEN

```



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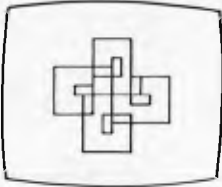
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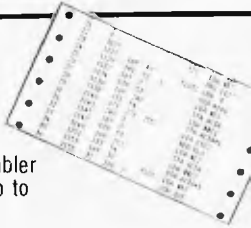
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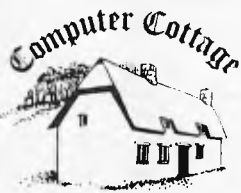
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PROGRAMS

```

GOSUB 1200
555 Y = Y - 1: IF SCRN( X, Y) = 0
    THEN 540
560 GOSUB 1300
565 Y = YT: RETURN
570 GOSUB 1000
575 RESTORE : XT = X
580 READ B
585 A = B: READ B: IF B > V1 THEN
610
590 GOSUB 9000
595 C = A / 2: D1 = B / 2: E = B
600 IF SCRN( X, Y - 1) = 0 THEN
    GOSUB 1100
605 X = X + 1: IF SCRN( X, Y) = 0
    THEN 585
610 X = XT: RESTORE
615 READ B
620 A = B: READ B: IF B > V1 THEN
645
625 C = A / 2: D1 = B / 2
630 IF SCRN( X, Y + 1) = 0 THEN
    GOSUB 1200
635 X = X + 1: IF SCRN( X, Y) = 0
    THEN 620
640 GOSUB 1300
645 X = XT: RETURN
650 GOSUB 1000: RESTORE : YT = Y
655 READ B
660 A = B: READ B: IF B > V1 THEN
685
665 GOSUB 9000
670 C = A / 2: D1 = B / 2: E = B
675 IF SCRN( X + 1, Y) = 0 THEN
    GOSUB 1100
680 Y = Y + 1: IF SCRN( X, Y) = 0
    THEN 660
685 Y = YT: RESTORE
690 READ B
695 A = B: READ B: IF B > V1 THEN
720
700 C = A / 2: D1 = B / 2
705 IF SCRN( X - 1, Y) = 0 THEN
    GOSUB 1200
710 Y = Y + 1: IF SCRN( X, Y) = 0
    THEN 695
715 GOSUB 1300
720 C = A / 2: D1 = B / 2
725 Y = YT: RETURN
730 GOSUB 1000: RESTORE : XT = X
735 READ B
740 A = B: READ B: IF B > V1 THEN
765
745 GOSUB 9000
750 C = A / 2: D1 = B / 2: E = B
755 IF SCRN( X, Y + 1) = 0 THEN
    GOSUB 1100
760 X = X - 1: IF SCRN( X, Y) = 0
    THEN 740
765 X = XT: RESTORE
770 READ B
775 A = B: READ B: IF B > V1 THEN
800
780 C = A / 2: D1 = B / 2
785 IF SCRN( X, Y - 1) = 0 THEN
    GOSUB 1200
790 X = X - 1: IF SCRN( X, Y) = 0
    THEN 775
795 GOSUB 1300
800 X = XT: RETURN
805 TEXT : HOME
    
```

```

810 PRINT "CONGRATULATIONS YOU A
RE WITHIN SIGHT"
815 PRINT "OF THE EXIT"
820 PRINT : PRINT
825 PRINT "PLAY AGAIN (Y/N) ?";
830 GET A$
835 IF A$ = 'Y' THEN 100
840 END
1000 CALL 768: POKE 49239,0: HCOLOR=
3: HPLLOT 0,0 TO H1,V1: HPLLOT
0,V1 TO H1,0
1010 HPLLOT 0,0 TO H1,0: HPLLOT TO
H1,V1: HPLLOT TO 0,V1: HPLLOT
TO 0,0
1020 RETURN
1100 HCOLOR= 0: HPLLOT A,C TO B,D
1
1110 HPLLOT A,V1 = C TO B,V1 - D1
1120 HCOLOR= 3: HPLLOT A,C TO A,V
1 = C
1130 HPLLOT B,D1 TO B,V1 - D1
1140 HPLLOT B,D1 TO A,D1
1150 HPLLOT B,V1 - D1 TO A,V1 - D
1
1160 RETURN
1200 A = H1 - A: B = H1 - B
1205 HCOLOR= 0: HPLLOT B,01 TO A,
C
1210 HPLLOT B,V1 - D1 TO A,V1 - C
1220 HCOLOR= 3: HPLLOT A,C TO A,V
1 = C
1230 HPLLOT B,D1 TO B,V1 - D1
1240 HPLLOT B,D1 TO A,D1
1250 HPLLOT B,V1 - D1 TO A,V1 - D
1
1260 RETURN
1300 HCOLOR= 0: HPLLOT E,E / 2 TO
H1 = E, V1 = E / 2: HPLLOT E,V
1 = E / 2 TO H1 = E, E / 2
1310 HCOLOR= 3: HPLLOT E,E / 2 TO
H1 = E, E / 2: HPLLOT TO H1 =
E, V1 = E / 2: HPLLOT TO E, V1
= E / 2: HPLLOT TO E, E / 2
1320 RETURN
5000 FOR T = 0 TO 100: NEXT : GOSUB
6000: RETURN
6000 FOR S0 = 1 TO 3: Z = PEEK (
= 16336): NEXT : RETURN
6500 FOR N = 255 TO 5 STEP - 10
: POKE 815,N: POKE 4923B + P
,0: CALL 800:P = ABS (P - 1
): NEXT : RETURN
8000 FLASH : PRINT "ONLY "C = 1"
STEPS WERE POSSIBLE": NORMAL
: RETURN
8010 PRINT "DIRECTION"
8020 NORMAL : RETURN
9000 HCOLOR= 3: HPLLOT V1,V1 = B /
2: RETURN
10000 DATA 0,32,62,84,102,112,1
22,130,136,140,144,148,152,1
54,156,158,160
10010 DATA 162,0,138,141,94,192,
160,32,140,13,3,157,0,63,232
,208,250,200,192,64,208,242,
141,95,192,96
10020 DATA 160,1,162,0,138,24,23
3,1,208,252,141,48,192,232,2
24,5,208,242,136,208,237,96
    
```

Atari Sums For Kids.

by Derek Lees

At last I have managed to procure a program for the Atari 400/800! This one goes a little further than a lot of maths programs for infants in that it teaches addition as well as subtraction — albeit on a simple level — and should keep any child amused at the same time.

Two random numbers are generated which, when added or subtracted, give an answer between zero and nine. A correct answer will move two spaceships towards each other until they collide and explode. A wrong answer will yield different noises and colours, drive the symbols apart and cause the answer to be displayed prior to the next try. Five correct answers will give a noisy response of 'great stuff!'

An effective amendment to this program is to replace the appropriate

lines with the ones given below. This makes use of the audio track of the Atari 410 recorder. Immediately after CLOADing the program, take the tape out of the recorder *without rewinding* and put it into an ordinary recorder. Prepare a list of such comments as 'well done!' — these must be five seconds long. Then put the recorder into record mode with the pause control engaged and, when you are ready, use a stopwatch to time yourself recording the remarks. Finally, rewind the tape and reload the program. It is a good idea to use the child's name, thus adding a personal touch to the congratulations given by the computer. Synchronisation may need practice and line 3001 may need adjustment. Sums for kids needs 5k to run.

Amendment:

```

3000 POKE 54018, 52: REM SWITCH ON RECORDER
3001 FOR WAIT=0 TO 1200: NEXT WAIT
3002 POKE 54018, 60: REM SWITCH OFF RECORDER
3003 RETURN
    
```

PROGRAMS

```

1 REM +++ADDING & SUBTRACTION GAME"
2 REM +++FOR INFANTS. TRY TO MAKE"
3 REM +++THE SPACESHIPS MAKE CONTACT"
4 REM +++& EXPLODE.WRONG ANSWERS
5 REM +++DRIVE THEM APART.
6 REM
7 REM +++D.J.Lees,January 1982
8 REM
10 GRAPHICS 2:SETCOLOR 4,10,2
11 REM TYPE TITLE IN INVERSE VIDED
12 POSITION 5,1:?" #6;"*****"
13 POSITION 5,2:?" #6;"*sums for*"
14 POSITION 5,3:?" #6;"* kids *"
15 POSITION 5,4:?" #6;"*****"
16 POKE 752,1:REM SUPPRESS CURSOR
17 ? "this program belongs to NAME OF CH
ILD"
20 FOR W=0 TO 3000:NEXT W
49 REM REMOVE GRAPHICS WINDOW
50 GRAPHICS 2+16
51 REM TWO POKES TO DISABLE BREAK KEY
52 POKE 53774,64:POKE 16,64
53 S1=3:S2=16
54 POSITION S1,4:?" #6;CHR$(190):POSITION
S2,4:?" #6;CHR$(188)
55 SETCOLOR 4,2,3
58 X=0:Y=0
59 B1=INT(RND(0)*2)
60 A=INT(9*RND(1)+1)
65 B=INT(9*RND(1)+1)
67 TRAP 65:IF B1=0 THEN B=INT(-B):IF A+B
<0 THEN 60
68 TRAP 65:IF B1=1 THEN IF B>9-A THEN 60
85 FOR Z=0 TO 10:SOUND 0,200,10,10:NEXT
Z:SOUND 0,0,0,0
90 IF B1=1 THEN POSITION 7,7:?" #6;A;"+:
B;"=?"
92 IF B1=0 THEN POSITION 7,7:?" #6;A;B;"=
";"?
100 C=A+B
120 CLOSE #1:OPEN #1,4,0,"K:":GET #1,E
121 IF E<ASC("0") THEN 120
122 IF E>ASC("9") THEN 120
125 POSITION 11,7:?" #6:VAL(CHR$(E))
128 IF C-VAL(CHR$(E))=0 THEN 136
129 REM CHR$(45) IS FULL STOP IN COLOR 1
130 REM CHR$(188) IS < AND (190) IS > IN
COLOR 3
131 S1=S1-1:S2=S2+1:IF S1<0 THEN S1=0:IF
S2>19 THEN S2=19
132 POSITION S1+1,4:?" #6;CHR$(46):POSITI
ON S2-1,4:?" #6;CHR$(46)
133 POSITION S1,4:?" #6;CHR$(188):POSITIO
N S2,4:?" #6;CHR$(190)
134 POSITION 5,0:?" #6;" "":POS
ITION 5,0:?" #6;S2-S1:" miles":REM TYPE M
ILES IN INVERSE ALSO
135 GOSUB 500:GOTO 150
136 POSITION S1,4:?" #6;CHR$(46):POSITION
S2,4:?" #6;CHR$(46):S1=S1+1:S2=S2-1
137 POSITION S1,4:?" #6;CHR$(190):POSITIO
N S2,4:?" #6;CHR$(188):IF S2-S1=5 THEN GO
SUB 3000
138 IF S2-S1<=0 THEN GOSUB 2000:FOR W=0
TO 1000:NEXT W:GOTO 50
139 POSITION 5,0:?" #6;"

```

```

140 POSITION 5,0:?" #6;S2-S1:" miles"
145 GOSUB 600
150 X=X+N:Y=Y+P
153 REM WAIT BEFORE SETTING NEXT QUESTIO
N
155 FOR W=0 TO 600:NEXT W
170 POSITION 4,10:?" #6;"
:GOTO 59
480 REM
490 REM +++WRONG ANSWER!+++
495 REM
500 LO=65:HI=35:PU=35
501 FOR J=1 TO 20:SETCOLOR 4,J,5
502 SOUND 0,PU,10,14
503 FOR W=1 TO 50:NEXT W
504 PU=LO:LO=HI:HI=PU:NEXT J:SOUND 0,0,0
.0:SETCOLOR 4,2,3
505 P=1:N=0
510 FOR W=0 TO 250:NEXT W
515 FOR J=0 TO 250 STEP 10:SOUND 0,J,10,
10:NEXT J:SOUND 0,0,0,0
520 IF B1=1 THEN POSITION 5,9:?" #6;"no!
";A;"+:B;"=";C
521 IF B1=0 THEN POSITION 5,9:?" #6;"NO!
";A;B;"=";C
525 FOR W=0 TO 1000:NEXT W:POSITION 7,7:
?" #6;" "":FOR W=0 TO 500:NEXT W:POSI
TION 5,9:?" #6;" "
550 RETURN
585 REM
590 REM +++CORRECT ANSWER!+++
595 REM
600 FOR J=0 TO 5:FOR I=0 TO 15:SETCOLOR
4,I,5:SOUND 0,10*1,10,10:NEXT J
601 SOUND 0,0,0,0:P=1:N=1
602 POSITION 11,7:?" #6;C
604 RETURN
1850 REM
1900 REM +++EXPLOSION+++
1905 REM
2000 POSITION 5,0:?" #6;" "":POSI
TION 7,7:?" #6;" "
2001 FOR C=1 TO 100:POKE 710,INT(15*RND(
1)*17):POKE 712,PEEK(710)
2002 L=INT(150*RND(1)):V=INT(10*RND(1)+1
)
2004 SOUND 0,L,8,10:SOUND 1,75,8,V:SOUND
2,50,8,10:SOUND 3,25,8,V:NEXT C
2006 FOR J=0 TO 256:SOUND 0,J,10,10:NEXT
J:SOUND 0,0,0,0:SOUND 1,0,0,0:SOUND 2,0
,0,0:SOUND 3,0,0,0
2007 GRAPHICS 2+16:SETCOLOR 4,0,0:RETURN
2050 REM
2900 REM +++FIVE CORRECT ANSWERS!+++
2905 REM
2906 REM TYPE GREAT STUFF INVERSE VIDED
2907 REM TO GET COLOUR
3000 FOR L=0 TO 5:SOUND 0,200-L*30,10,10
3001 POSITION 4,10:?" #6;"GREAT STUFF!":
FOR W=0 TO 60:NEXT W:POSITION 4,10:?" #6;
" "":FOR W=0 TO 60
3002 NEXT W:NEXT L
3003 SOUND 0,0,0,0:RETURN

```

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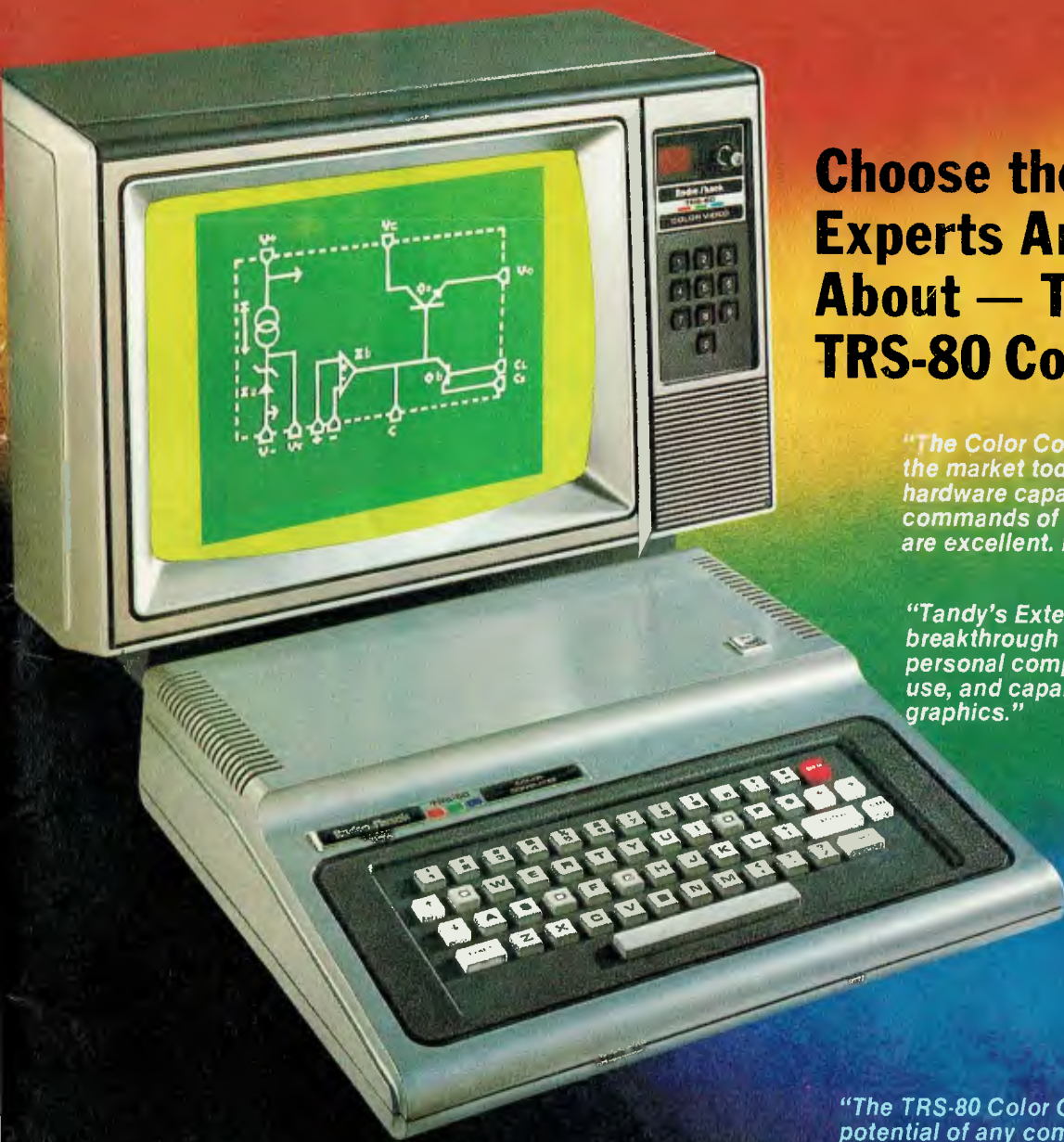
by G. Parleuliet

Full instructions are included in the listing.

```

10 TEXT : HOME
15 GOSUB 9000
20 CE = BGG:CS = - 958
30 DEF FN C(X) = INT (X * 1E1 + 0.5) / 1E1
40 DEF FN A(X) = V * COS (A / P) * T
50 DEF FN B(Y) = V * SIN (A / P) * T - 16 * (T * T)
60 G = 32:P = 180 / 3.14159
65 GOSUB 3000
68 ONERR GOTO 8000
70 VTAB (21): CALL CE: INPUT "INPUT ELEVATION -> ":A$:A = VAL (A$): IF A$ = "" THEN 70
80 IF A$ = "Q" THEN 280
90 IF A > 90 OR A < 0 THEN VTAB (22): CALL CS: PRINT "ANGLE BEYOND LIMITS": GOTO 160
120 VTAB (21): CALL CS: PRINT "ELEVATION= "A
130 VTAB (22): CALL CE: INPUT "POWDER CHARGE-> ":V$:V = VAL (V$)
140 V = V * 100
150 T1 = (V * SIN (A / P)) / G
160 T = T1:T = T * 2
170 IF FN A(D) > 27899 THEN VTAB (22): HTAB (22): PRINT "SHELL WILL FALL": VTAB (23): HTAB (22): PRINT "BEYOND LIMITS": GOTO
65
180 T = T / 2
190 IF FN B(H) > 15899 THEN 300
200 VTAB (22): CALL CS: PRINT "POWDER = "V / 100
210 T1 = INT (T1 * 2)
230 HPLLOT 0.159 TO 279.159
240 FOR T = 1 TO T1 STEP 2
250 X = FN A(D) / 100:Y = 159 - (FN B(H) / 100)
260 HPLLOT X,Y
265 GOSUB 2000
270 NEXT
280 PRINT "TYPE SPACE FOR ANOTHER PLOT": PRINT "TYPE 'Q' TO QUIT - "": GET Z$: PRINT Z$
290 IF Z$ < > "Q" THEN HOME : GOTO 65
300 TEXT : HOME : VTAB (12): PRINT ".....DONE": END
1000 REM
1005 YT = INT (RND (1) * 100)
1006 TY = INT (RND (1) * 200)
1007 IF TY > 139 OR YT > 268 THEN GOTO 1009
1008 IF TY < 10 OR YT < 10 THEN 1009
1010 HPLLOT TY,YT TO TY - 5,YT + 10 TO TY,YT + 10 TO TY + 5,YT TO TY,YT: HPLLOT TY = 10,YT + 5 TO TY + 20,YT + 5
1015 HPLLOT TY + 20,YT + 3 TO TY + 17,YT + 3 TO TY + 14,YT + 7 TO TY + 17,YT + 7 TO TY + 20,YT + 3
1020 RETURN
2000 REM
2001 IF Y > YT - 5 AND Y < YT + 5 THEN 2020
2010 RETURN
2020 IF X > TY - 15 AND X < TY + 15 THEN CALL CE: PRINT "BOOOOM YOU HIT": GOSUB 5000: RETURN
2022 GOSUB 7000
2024 RETURN
2025 GOSUB 5000
2030 RETURN
3000 HGR : HCOLOR= 3: HPLLOT 0.159 TO 279.159: GOSUB 1000: RETURN
4000 REM ESCAPE
4002 FOR XX = 100 TO 250 STEP 5
4003 HCOLOR= 7
4005 AA = 1
4010 HPLLOT XX,155 TO XX,148 TO XX - 2,148 TO XX - 2,146 TO XX + 2,146 TO XX + 2,148 TO XX,148
4020 HPLLOT XX,152 TO XX = 4,149
4030 HPLLOT XX,152 TO XX + 4,149
4040 HPLLOT XX - 3,159 TO XX,155 TO XX + 3,159
4050 IF AA = 1 THEN HCOLOR= 0:AA = 0: GOTO 4010
4060 AA = 0
4070 NEXT XX
4999 RETURN
5000 REM CRASH
5050 HCOLOR= 0: GOSUB 1010
5060 HCOLOR= 7
5100 YT = YT + 10
5200 GOSUB 1010
5300 IF YT > 145 THEN HCOLOR= 0: GOSUB 6000: RETURN
5400 GOTO 5000
6000 REM EXPLOSION 2
6010 GOSUB 1010: HCOLOR= 7
6020 HPLLOT TY,YT TO TY - 10,YT + 10: HPLLOT TY,YT TO TY - 5,YT + 10 TO TY - 3,YT TO TY,YT + 10 TO TY,YT TO TY + 5,YT + 10 TO
TY + 1,YT TO TY + 10,YT + 10: HCOLOR= 0: GOSUB 4000: HCOLOR= 0: RETURN
7000 REM
7010 HCOLOR= 3
7020 FOR B = 1 TO 10
7022 C = 1
7030 HPLLOT TY,YT TO 0,159
7035 IF C = 1 THEN C = 0: HCOLOR= 0: GOTO 7030
7040 NEXT B
7045 HCOLOR= 7
7050 RETURN
8000 A = 90:V = 0: GOTO 70
8100 V = 0
8200 RETURN
9000 VTAB 15: HTAB 15: FLASH : PRINT "ATTACK": NORMAL
9010 FOR TT = 1 TO 1500: NEXT TT
9020 HOME
9030 PRINT "DO YOU WANT INSTRUCTIONS YES OR NO ": GET TT$
9040 IF TT$ = "N" THEN RETURN
9050 HOME
9060 PRINT "YOU ARE REQUIRED TO FIRE ON AND HIT THE APPROACHING PLANE IF YOU MISS YOU MAY GET HIT"
9070 PRINT : PRINT "YOU ARE IN CONTROL OF A ANTI-AIRCRAFT GUN AND YOU MUST FEED INTO THE COMPUTER THE ELEVATION OF THE GUN
(THAT IS THE ANGLE 0 TO 90"
9080 PRINT : PRINT "YOU MUST ALSO ENTER THE POWDER CHARGE THIS DETERMINES THE DISTANCE THE SHELL TRAVELS"
9090 PRINT : PRINT "THE RANGE OF CHARGES AVAILABLE IS 0 TO 10"
9100 VTAB 23: PRINT "TO CONTINUE PRESS ANY KEY... ": GET TT$
9120 HOME
9150 VTAB 15: HTAB 10: FLASH : PRINT "GOODLUCK": NORMAL : FOR TT = 1 TO 1200: NEXT TT
9200 RETURN

```

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