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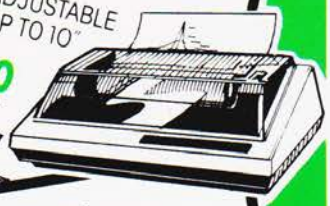

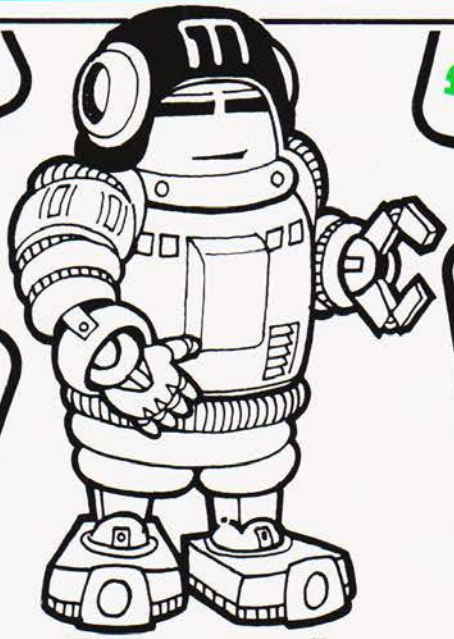

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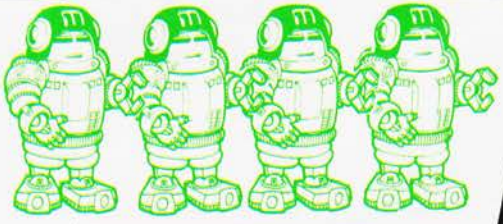

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CONTENTS

VOL 4 NO 6 AUGUST 1982

EDITORIAL & ADVERTISEMENT OFFICE
145 Charing Cross Road, London WC2H 0EE.
Telephone 01-437 1002-7. Telex 8811896.

Advertisement Copy Control :
Sue Couchman, Sonia Hunt
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Ron Harris BSc
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Origination and design by MM Design & Print.

ABC **Member of the Audit Bureau of Circulation**

Computing Today is normally published on the second Friday in the month preceding cover date. Distributed by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233. Printed by: Alabaster Passmore & Sons Ltd, Maidstone, Kent.

Subscription Rates : UK £12.10 including postage. Airmail and other rates upon application to Computing Today Subscriptions Department, 513 London Rd, Thornton Heath, Surrey CR4 6AR.

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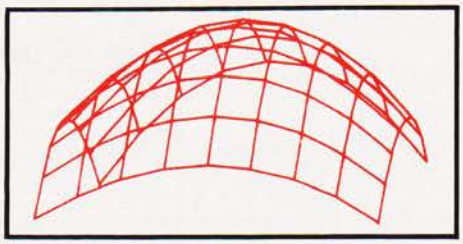
All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.



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4. Printers There is a range of Xerox

printers available for the 820, such as the 630 which has: High quality 40 CPS Daisy Wheel Printer. Bi-directional printing, choice of 10, 12, 15 pitch and P.S. Two matrix printers are also available.

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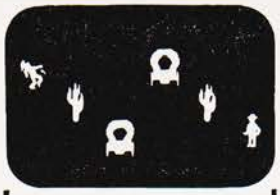

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The Centronics two colour unit comes as a field installable kit which can be added to existing 739 printers or purchased as an additional option on a new machine.

What can you do with it? Well, Centronics suggest using the kit to create more interesting graphical presentation and the highlighting of business and financial information. Typical application areas include legal, accounting and financial institutions, schools and other educational establishments.

Priced at £40, further information on the colour option kit is available from Centronics Data Computer (UK) Ltd, Victoria Way, Burgess HIll, Sussex. Telephone enquires can be made on 04446-45011.

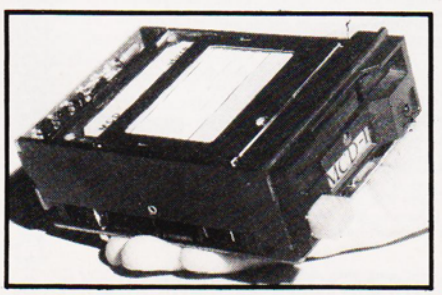
A FLOPPY CASSETTE?▼

Based on a small 3" single sided floppy disc enclosed within a rigid plastic cassette case, the MCD-1 Micro Cassette Disc system provides storage with compact size, low power consumption, ease of use and high reliabilty.

The capacity of the present version is up to 150K (formatted) and the transfer rate is up to 250K per second. The hardware design is functionally compatible with standard minifloppy controllers.

You can find out more about the MCD-1 from BATS-NCI Ltd, 375b Regents Park Road, London N3 1DG or you can 'phone them on 01-349 4511.

Hang on a minute, if you've read this far you may be interested in a dual disc system, incorporating an exparision memory and disc controller. Priced at just under £400, the system uses two MCD-1 mechanisms and has

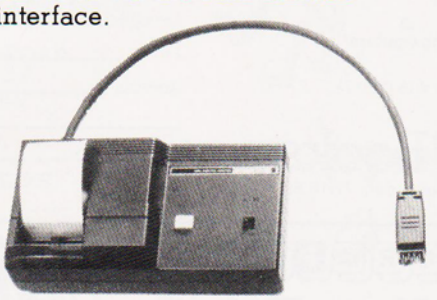


been specifically designed for the Genie range of computers. For further information contact Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE or 'phone 0629-2430.

POCKET PRINTER▼

Compatible with the BASIC-language FX702P hand-held computer and the earlier FX601P and FX602P alpha-numeric programmable calculators comes the FP10 mini electronic printer.

The FP10 prints at a rate of two lines a second on 35mm wide metallised recording paper and can be used to give hard copy print-out of results, listings of program steps and memory contents. Connection is either direct or via the FA2 cassette interface.



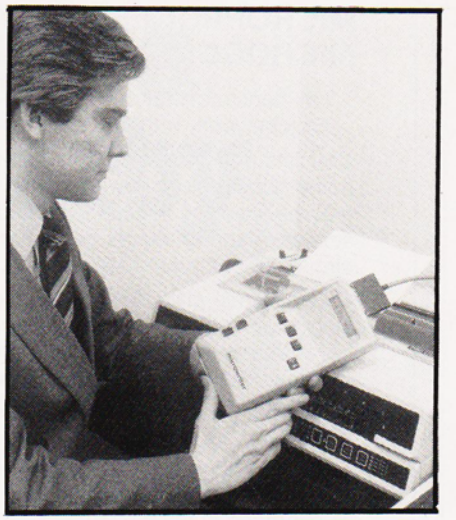
Complete with a set of manganese batteries, a supply of paper and a comprehensive instruction manual, the FP10 is priced at £49.95. Enquiries should be made to Casio Electronics Company Ltd, 1000 North Circular Road, London NW2 7SD or by telephone on 01-450 9131.

SINGLE-HANDED

A personal hand-held word processor called the Microwriter Mark IV incorporates the innovation of the five finger keyboard permitting users to write the whole ASCII set entirely by touch alone.

The memory capacity of the machine is 8K although text can be stored on a mini-cassette or floppy disc using a microcomputer or word processing system. Text can be reviewed and edited through either the built-in LCD or by connection to an ordinary domestic TV. Once corrected, printed copy can be obtained via a daisy wheel printer or an electronic typewriter.

A wide range of functions such as inserting, deleting, correcting, formatting, tabulation and backwards and forwards read can



be obtained using a control key. Measuring just 230mm by 117mm by 50mm, the unit is very portable and uniquely suitable for application by disabled people.

Priced at £485 + VAT, you can find out more about the Microwriter Mark IV by ringing 01-831 6801 or by writing to Microwriter Ltd, 31 Southampton Row, London WC1.

PERSONAL PROBLEMS

One of the criticisms often levelled at magazines which print listings of computer programs is that these often contain errors. Equally often the suggestion is made that the Editor uses printout as produced by the computer to ensure that no errors are inserted by the various typesetting processes. Computing Today uses special symbols in its programs so these have to be reset but in our new quarterly magazine, Personal Software, we decided that, as all the programs were for one particular computer, we'd list them directly from the system.

If you own a BBC Micro you may well have bought the magazine and tried out some of the programs; judging by the state of the postbag and our red-hot telephone switchboard, a lot of you have. It appears that the use of computer generated listings may also be prone to error! All the programs in the magazine were run and tested — that's how we took all the pictures — but somehow when they were dumped onto the printer, an exceedingly odd gremlin got in the works and made a veritable pig's ear of a number of the programs.

These are all the mistakes that we currently know about:

CONSUMER NEWS

SURROUND p14
Line 60 should read MODE 4:CLS:VDU 19,1,0,0,0,0: VDU 19,0,3,0,0,0

WORDSQUARE p27
Line 1210 has a spurious colon ':' at the end which may be deleted.
Line 1230 should read NEXT A:RETURN

FOX & HOUNDS p36
The SOUND commands in Lines 870 and 880 are missing their final parameter. This is 15 and must be separated from the previous value by a comma.
There also appears to be a quirk in the algorithm which shows up as the machine refusing to admit that it has been beaten. This can be cured by adding a counter to the number of times this loop is called.

THE WHITE BARROWS p40
Line 30 should read N=42:@%=&00000303

LEAPFROG p61
The contents of lines 1020 and 1030 should be exchanged.
Line 1850 should read PRINT TAB(5,23);"PRESS ANY KEY";

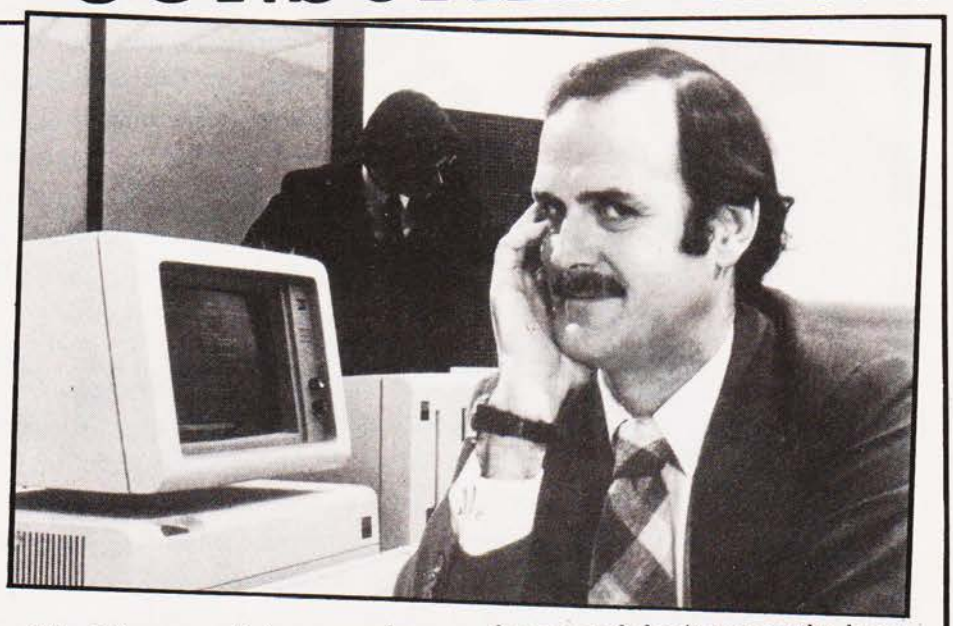
HOME FINANCE p70,71
Two of the arrays DIMensioned in Line 50, M1 and S1, should be M% and S%. They also appear in Lines 360, 1310, 1320 1670, 2500, 2510, 2770 and 2790 and the appropriate M% or S% should be substituted.
Due to a layout error Lines 2200 to 2360 appear in the wrong place. No lines are missing and the BASIC will accept them if typed in as printed.
On some copies it appears that Line 3070 is somewhat faint. It should read IF R$="Y" THEN 2930

PYTHON PICTURE SHOW▲

Following the success of their first two films 'What is a Computer?' and 'How does a Computer Work?', Video Arts have released two new films called 'What is a Computer Program?' and 'What is a Word Processor?'.

'What is a Computer Program?' has been produced to provide the necessary explanations to managers and staff as to just how work done in the office can be translated into instructions for a computer. The other film, 'What is a Word Processor?' is a comedy aimed at both the secretarial and managerial level which attempts to dispel some of the concern and mystique surrounding the subject.

If you want to find out more about these excellent basic training films, contact Video Arts Ltd, Dumbarton House, 68 Oxford Street, Lodnon W1N 9LA or telephone 01-637 7288. Oh yes . . . how could I have forgotten to mention that the incomparable John Cleese features in both movies.



SINCLAIR'S SPECTRUM SLIPS

Remember that Uncle Clive promised to bring you your Spectrum within two weeks? Well, if you ordered it you should have heard by now that there is a delay... of up to six weeks. Sadly, with orders standing at some 15,000 units and production exceeding that volume it means that those who ordered first will have to wait longest.

The actual problem is not being discussed but we understand that it was caught by Timex's quality control staff and resulted in the whole of the first production batch being sent back to the factory. Still, you do have the safisfaction of knowing that Timex has finally got its quality control system into action and we won't (hopefully) have a repeat of the ZX81 saga.

So if you ordered a system directly it was announced, you're likely to be getting it around the second week of July; the later you ordered the sooner after that date you'll get it. So, do everyone a favour and don't swamp the boys and girls at Cambridge or Camberley with your calls, it only adds to the problem.
Henry Budgett

THAT'S HANDY

At last, a mere two years after its first announcement, the new NewBrain microcomputer is available for business, scientific and educational applications as well as home computing purposes.

Measuring just 11" by 6" by 2", the NewBrain comes in two packages, the basic model A and the AD model. The A model incorporates 32K RAM, 29K ROM, a dual cassette port, TV and monitor ports, V24 bi-directional and printer ports, a 40 or 80 character by 32 line video display and an expansion port. The AD model also includes a built-in single line, flourescent, 16 character, 14 segment display.

Memory expansion modules are available with either 64K, 128K, 256K or 512K RAM and these may be linked together giving a total memory capacity of over 2M. The New Brain may also be configured to a comprehensive range of peripherals including monitors, matrix and daisywheel printers, 5¼" 100K and 1M floppy discs and 4½ to 18M Winchester discs.

The model A and model AD are priced at £199 + VAT and £229 + VAT respectively. For more details get in touch with Grundy Business Systems Ltd, Cambridge Science Park, Milton Road, Cambridge. Telephone enquiries can be made on 0223-350355.

IF YOU BUY ONLY ONE COMPUTER PROGRAM THIS YEAR MAKE IT

DECISION?MASTER

If you've ever struggled with a personal or business decision – and who hasn't? – you can appreciate the power of DecisionMaster, the new decision-making computer software from Syntonic Software Corporation.

Decision-making is an important part of our lives. We're faced with decisions on how to run our businesses, how to spend our money, how to do our jobs, how to care for our families. In the final analysis, it is our ability to make *good* decisions that will determine our happiness and success.

Yet most of us make the majority of our decisions with little or no thought! Few of us have a system for analyzing the factors that affect our decisions – even when those decisions may change the course of our lives.

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THE MILLIONAIRE ▲

Within the first six weeks of the Osborne 1 portable personal computer being shipped to our shores at the beginning of February, sales of over one million pounds have been achieved in the UK alone.

Exceeding the original sales targets, it has been reported that the company's new headquarters are presently distributing 500 machines a month to a nationwide network of dealers. Micheal Healy, head of Osborne Corporation (UK), wants to get the sales targets 'in line with our aim to become market leaders in the UK'.

Uniquely packaged, (well almost), the Osborne 1 provides the professional and business user with five software packages, Wordstar/Mailmerge, Supercalc, CBASIC, MBASIC and CP/M, worth over £800 of the total system price tag, £1,250.

For further details of the Osborne 1 contact Osborne Computer Corporation UK, 38 Tanners Drive, Blakelands North, Milton Keynes or telephone 0908-615274. Of course, if you want to read an in-depth review of the Osborne 1, look no further than the June copy of CT!

EXPANSION EXPANSION

Remember the Alphatronic system for Adler? Well, they have now expanded the machine to operate as a 64K CP/M system rather than the original 48K. Three operating systems are now available as well as a number of languages. One important point to note is that software compatibility has been maintained from the earlier version.

The new 64K machine will be priced at £2,295 and owners of the existing model can upgrade for around £300.

Further details are available from Triumph Adler UK Ltd at 27 Goswell Road, London EX1M 7AJ or you can ring them on 01-250 1717.

And while you're speaking to them you might ask about the separate dual floppy disc drive unit developed by Quality Business Machines to provide Alphatronic users with a further 250K of storage per disc. This plug-in disc option is available from Triumph Adler UK for £1,300.

THE VIP

Designed for the person without computer experience, the VIP is a compact desktop colour graphics system the size of a briefcase.

Incorporating a 6809 microprocessor and over 320K of memory, the VIP provides a 512 by 512 resolution, fast vector and character generation, 15 colours and the ability to store two pictures in memory. The VIP is suitable for applications required by graphic designers, control engineers and design engineers.

Priced at £2,900, you can get more information from Micro Design Ltd, 25 Gurnards Avenue, Fishermead, Milton Keynes MK6 2BW or by telephone on 0908-663655.

EVERYTHING YOU WANTED TO KNOW...

Having problems deciding which computer system to invest in? Your worries could be over if you get hold of a copy of this publication.

Titled 'Computer Benefits? Guidelines for local information and advice centres', this 104-page book could also prove invaluable to schools, colleges and small businesses considering buying a computer.

Complete with chapters on how computers work, which applications best suit which computers and a detailed section on various information systems, the book also contains a glossary of all your favourite bits of computer jargon.

Copies of this National Consumer Council Report can be obtained from Community Information Project, c/o Library Association, 7 Ridgemount Street, London WC1 7AE priced at £3.

BRAIN WAVES ▼

A couple of new product ideas have been released for use with the SuperBrain microcomputer.

First up is a 5.75M disc storage facility and data error recovery version utilising Winchester discs. This version of the SuperBrain will include SuperBios which significantly increases the power, speed and application of the computer whilst remaining a standard CP/M system.

Priced at £3,950, further information on the 5.75M SuperBrain can be obtained from Icarus Computer Systems Ltd, 27 Greenwood Place, London NW5 1NN or by 'phoning 01-485 5574.

BUSINESS NEWS

All existing SuperBrains can be upgraded to 5.75M for around £1,700-1,800.

Also available for the SuperBrain is an S-100 interface allowing the machine to communicate with the outside world via analogue/digital input and output devices as well as support the connection of extra memory and peripherals which operate on an interupt basis. The price of the unit is £250.

For more details on the S-100 interface contact Cambridge Micro Computers Ltd, Cambridge Science Park, Milton Road, Cambridge CB4 4BN or 'phone them on 0223-314666.

A CONVERSATION PIECE?▲

Designed and manufacturered in the UK, the MC Combo is a CP/M-based business system capable of conversing with mainframes; the system is IBM compatible.

The basic machine comes complete with two double sided, double density 5¼ " discs providing storage of up to 400K. As well as 64K of RAM and 12K EPROM, the MC Combo also offers four serial RS232 ports, a Centronics bi-directional port and eight timers. The price of the system starts at around £1,088; an optional 6.9M hard disc system is available for £2,950.

A national dealer network is in the process of being set up but in the meantime, further information can be obtained from MegaBrain Computers Ltd, 2 Ganton Street, London W1. Telephone enquiries can be made on 01-734 9462.

ALL SYSTEMS GO!

System One is a desktop microcomputer designed for both multi-user and single user applications.

The basic system consists of a Z80A CPU, 64K of user RAM and 4K ROM and can be expanded further using twin, quad capacity 5¼ " floppy disc drives providing 790K for the CS1 model. The CS1-H version is able to support an integral 5" 5M mini Winchester hard disc drive. CRT and printer interfaces are provided as standard.

Ideally suited for applications in business, engineering, medicine and education, the System One's series also includes system diagnostics which enable quick tests to be made ensuring the device is functioning correctly.

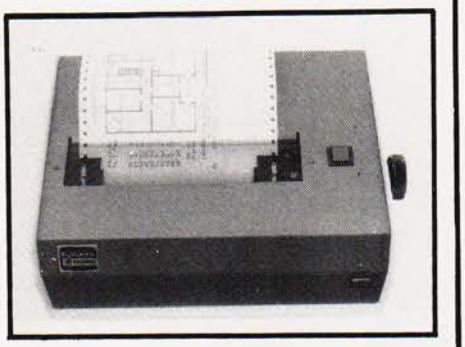
Prices for the basic System One system start at £2,795. More information can be obtained from Comart Ltd, Little End Road, Eaton Socon, St Neots, Cambs or by 'phoning 0480-215005.

ACTING SCHOOL▼

There certainly has been a lot of interest shown in ACT's Sirius 1 microcomputer, indeed, the distributors, ACT, have now opened a special school located at their Birmingham headquarters offering a wide range of training courses.

Available to both customers and dealer staff, the courses include a Sirius Overview, Pulsar Accounting, Wordstar, MicroModeller, SuperCalc, Operating Systems and Communications. Bookings can be made through any of the 150 ACT Sirius dealer or from ACT, ACT House, 111 Hagley Road, Edgbaston, Birmingham B16 8LB; telephone enquiries can be made on 021-454 8585. The price of each course is around £75 and that includes food and refreshment as well as hands-on experience with the Sirius 1 computer.

And while you're talking to them, you might like to bring up the subject of Winchester disc drives. The word is that there are two new systems being offered with the Sirius 1 with a 10M and a 23M capacity. Worth checking out!



SCREEN PRINTER▲

Eurofax Ltd and Whymark Instruments have got together to produce the Model 857 A4 plain paper videographic printer.

The device uses plain paper rather than electrosensitive or thermal paper and will hold 60 metres of paper — enough for about 250 A4 printouts. Printing an A4 page in about a minute, the Model 875 also includes a 'small' option that enables two screen image printouts to be displayed on one A4 sheet.

Suitable for printing Viewdata (Prestel/private), Videotext and Teletext, with a remote control facility operated from the terminal, the machine also accepts Viewdata/Videotext signals from the normal British Telecom/BREMA recommended interface.

Apart from the Epson print head, the Model 875 is entirely British made and priced at £549. For further data get in touch with Eurofax Ltd, 194 Burntwood Lane, Caterham, Surrey CR3 6TB or 'phone 0883-45709.

LEADERS IN COMPUTER GAMES

FIRST CHOICE FOR ZX: SUPPORT:

ZX-81

ZX-80

QS DEFENDER.
UP – DOWN – THRUST – FIRE
First and only full screen display. Software to drive QS SOUND BD. Moving Planetary surface. Up to 84 fast moving characters on screen at once. On screen scoring. Ten missiles at once. Increasing attack patterns. Requires 8K ROM, and 4K min of RAM. **£5.50.**

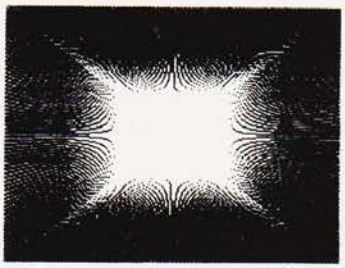
QS SOUND BD.
A programmable sound effects board using the AY-3-8910. 3 TONES; 1 NOISE; ENVELOPE SHAPER: + TWO 8 BIT I/O PORTS. Easily programmable from BASIC, the AY chip does most of the work leaving your computer free for other things. Signal O/P via 3.5 mm Jack socket Ports O/P via a 16 pin I.C. Socket. **£26.00.**

QS CHRS BD./
A programmable character generator giving – 128 SEPARATELY PROGRAMMABLE CHARACTERS. ON/OFF SWITCH. 1K ON BOARD RAM. Enables creation and display of your own characters to screen or printer. Demo cassette of fast machine code operation routines and lower case alphabet included. See below for ZX PRINTER listing. **£26.00.**

QS - LOWER CASE

a b c d e f g h i j k l m n o p q r s t u v w x y z

QS INVADERS.
LEFT – RIGHT – FIRE
13×7 INVADERS; High score; 3 levels of play; RND saucers; Bonus base; Drives Sound bd. & CHRS bd. Requires 7K RAM, 8K ROM + Slow. **£5.50.**



QS HI-RES BD.
A Hi-res graphics board giving – 256×192 PIXELS. 6K ON BD. RAM. SOFTWARE SELECT/DESELECT. MIXED TEXT AND GRAPHICS. 2K ON BOARD ROM. Resident fast machine code graphics software (in ROM) provides the following HI-RES Commands. – MOVE x, y; PLOT x, y; DRAW x, y; BOX x, y; UP; DOWN; LEFT; RIGHT; PRINT A$; SCROLL; BLACK; WHITE CLEAR COPY. See above for ZX PRINTER listings using COPY. **£85.00.**

QS ASTEROIDS
LEFT – RIGHT – THRUST – FIRE
Software to drive QS SOUND BD. Multiple missiles firing in 8 directions. On screen scoring. Increasing number of asteroids. Full mobility of ship to all areas of the screen. Two asteroid sizes. Bonus ship at 10,000 points. Requires 8K ROM, 4K min of RAM + SLOW function. **£5.50.**

QS 3K RAM Bd.
An extremely reliable static RAM Bd. which combines with the computer's memory to give 4K total. Plugs direct in to the rear port on your ZX Computer. **£15.00.**

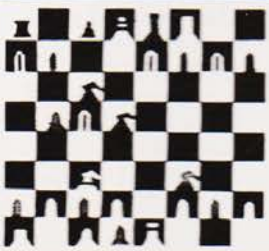
QS MOTHER BOARD BD. & QS CONNECTOR.
A reliable expansion system allowing a total of any RAM pack plus two other plug in boards to be in use at once. On board 5V regulator drives all external boards. Fitted with two 23 way double sided edge connectors. Connector is 2×23 way edge conns soldered back to back. Expansion can operate in two ways – (1) COMPUTER ↔ CONNECTOR ↔ Any QS add on bd. (but no extra RAM pack). (2) COMPUTER ↔ CONNECTOR ↔ MOTHER BD ↔ ANY RAM PACK. (2 bds to fit in mother bd.) Mother board **£12.00** Connector **£4.00.**

Special offers & news

(1) QS PRINTERFACE Connects a ZX Printer to an Acorn Atom. Simple, easy to use, gives listings, commands and Hi-Res screen dump. On board 2K ROM. **£25.00**

(2) QS HARMONY A machine code programme for the QS sound board, gives you easy control of phasing, chorus, tempo, volume, pitch. Complete with sample programme to play the serenade from Mozart's Don Giovanni. ZX81, 4K RAM. **£4.50**

(3) QS Mother bd. + connector + CHRS bd. + The special Graphics version of **ARCTIC COMPUTING'S ZX CHESS II. £45.00.**
The strongest chess program with 7 levels of play.



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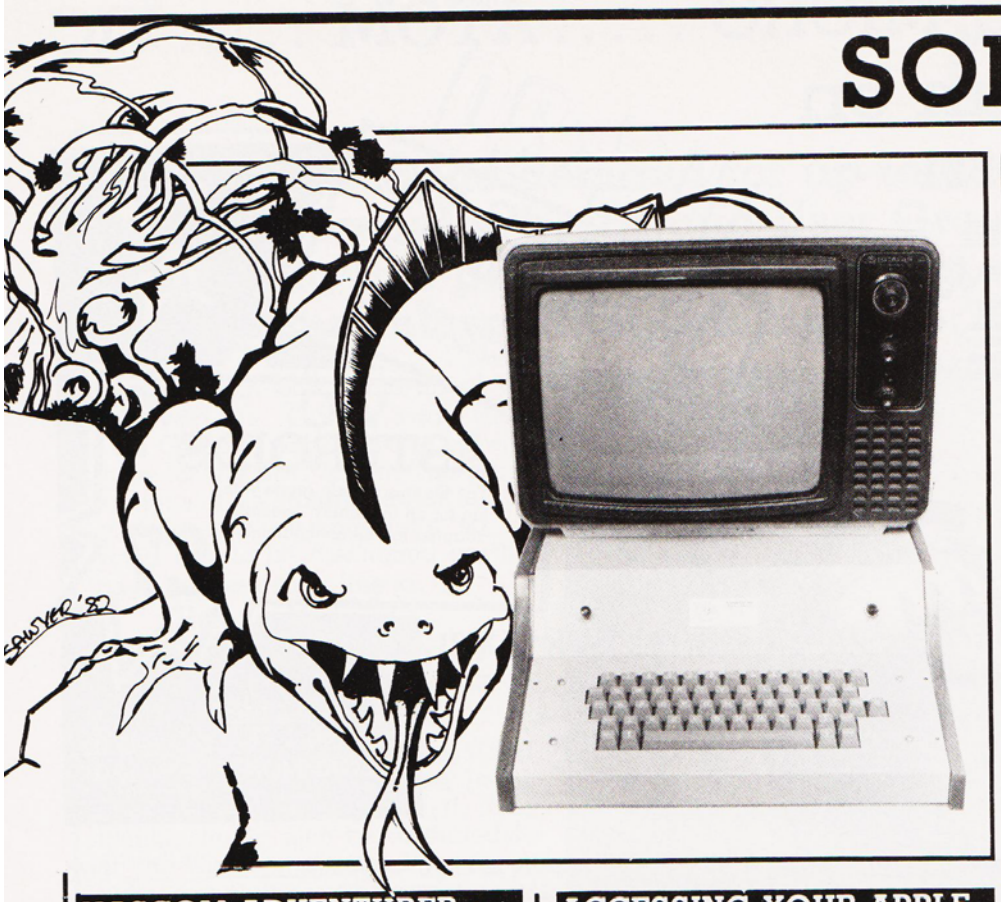
Please state Type of machine, Which ROM, Memory size, when ordering.

SOFT WARES



NASCOM ADVENTURER ▲

A 32K game is available for the NASCOM which is a scaled-down version of the original classic, Adventure, written for mainframes.

Written in Z80 machine code, the program takes you through a vast labyrinth of underground caves wherein you will find an assortment of treasurers, strange creatures and many other hazards and surprises. There are over 140 locations to visit and the program has over 400 messages it can relay to you during the game.

Although it will probably take you weeks (**months! Ed.**) to become a Grand Master, don't panic, you don't have to take up your whole Summer holiday exploring as there is the facility to save your character on tape at any time.

Complete with a full instruction manual on how to make the most of Adventure, the program comes on a C60 cassette for £20. For further information get in contact with Syrtis Software, 23 Quantock Road, Bridgewater, Somerset TA6 7EG.

And for all those of you who are merrily playing the 16K version of this game and want to upgrade it to the 32K version, simply send in your old tape with £10 and you'll get the extra 16K on the other side. Alternatively, you could send £11 to receive the second instalment on a new tape; remember to quote your original serial number though!

ACCESSING YOUR APPLE

No, this has nothing to do with buying your Apple computer with a well-known credit card — it's a database management package for the Apple.

The package, called ACCESS, offers a multitude of facilities including an Active Command Stack that allows you to input a list of commands which will be executed one after another; a word processor-type screen editor enabling you to insert and delete characters with full cursor control over fields and pages of a record; and hidden fields are supported as are computed on-screen fields.

A version of ACCESS will shortly be available for the SyMBfile 5M hard drive and the SyMBstore 8M floppy disc system.

Priced at £199.95, ACCESS is available through the Apple dealer network or directly from Spider Software at 98 Avondale Road, South Croydon, Surrey. Telephone enquiries can be made on 01-680 0267.

AND SO, FORTH!

A new software package, FORTH-79 Version 2, offers the user both a cleaner language and the options of floating point arithmetic and Hi-Res graphics.

The package meets all the provisions of the FORTH-79 standard and will run unaltered on the Apple II and CP/M and NorthStar systems. The high-speed compiled code used in the software makes it especially suitable for use in real-time applications.

The basic system includes a screen editor, macro-assembler, screen package, 32-bit integer arithmetic and a comprehensive tutorial and reference manual.

The retail price of the system is $99.95 and with enhancements is $139.95. For further information get in touch with MicroMotion, 12077 Wilshire Boulevard, Suite 506, Los Angeles, CA 90025, USA. If you want to 'phone them please don't forget to use the American code (010) and dial 213-821 4340.

TRADER JACK

Following on from the introduction of the excellent ZX81-Monopoly game comes a new trading/adventure game called Trader Jack. You'll need the full 16K of your machine to run this one though.

The game starts with you receiving £40,000 (not a bad start to any game), and with that tidy sum you have to purchase supplies, cargoes, fittings, crew wages and a ship.

Set in the Polynesian Islands of the South Pacific, the program takes you via storms, volcano eruptions and various other disasters. You'll also get a chance to practice your Pidgin English since all the instructions are relayed in this colourful language.

Trader Jack is available priced at £7 from Work Force, 140 Wilsden Avenue, Luton, Beds. You could find out more about their range of software by 'phoning 0582-454456.

BOLDLY ONGOING

The classic Star Trek adventure game has been released for the ZX81 by Aquarius Software.

Complete with a hostile Klingon fleet of starships, phasers, photon torpedoes, warp and sub-light drives, shields, star-bases and lots more, you too can find out what it's like to be the captain of the Starship Enterprise. Available on cassette, the game is priced at £3.95.

For further details contact Aquarius Software, 53 Towncourt Crescent, Petts Wood, Kent BR5 1PH. They also have a number of other programs available for the ZX81 so it might be a wise move to ask for a catalogue.

ZX81 ..... B.B.C. MICRO ..... ATOM VIC

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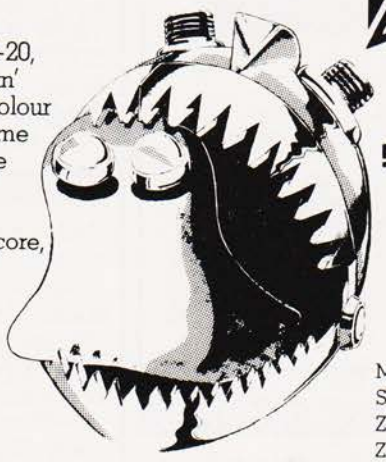
VICMEN

Undoubtedly the best game currently available for the VIC-20, based on the popular 'Puckman' arcade game. High resolution colour graphics are used, and the game may be played using either the keyboard or a joystick. All the features of the real game, including sound effects, high score, bonus man etc. Written entirely in machine code so as to fit in the unexpanded VIC-20. Described by Your Computer (June 1982) as "brilliant".

£7 inclusive



VIC PANIC

Based on the popular and addictive arcade game 'Space Panic', this is yet another full feature machine code game for the unexpanded VIC-20. Climb the ladders and dig holes to trap the monsters. Full use is made of high resolution graphics and sound effects.

£7 inclusive

VIC COSMIADS

A superb fast-moving and very addictive version of the popular Galaxians game, for the unexpanded VIC-20. You are continuously under attack from the swooping aliens. Shoot them all down and a new wave of even more ferocious aliens appear. Great sound effects.

£7 inclusive

VIC-20

ANOTHER VIC IN THE WALL

A slick, machine code version of 'Breakout' for the unexpanded VIC.

£7

VIC ASTEROIDS

The famous arcade game with fun for all the family, specially adapted for the unexpanded VIC.

£7

Also for the VIC:

VIC MEN	£7.00
VIC GAMMON	£7.00

sinclair ZX81

MAZOGS	£10.00	INVADERS	£4.00
STARTREK	£5.00	DICTATOR	£9.00
ZXAS ASSEMBLER	£5.00	DAMSEL & THE BEAST	£6.50
ZXDB DEBUGGER	£6.50	CONSTELLATION	£8.00
ZXTK TOOLKIT	£6.00	PROGRAM PACKS 1-8 (each)	£4.00
MULTIFILE	£17.50		

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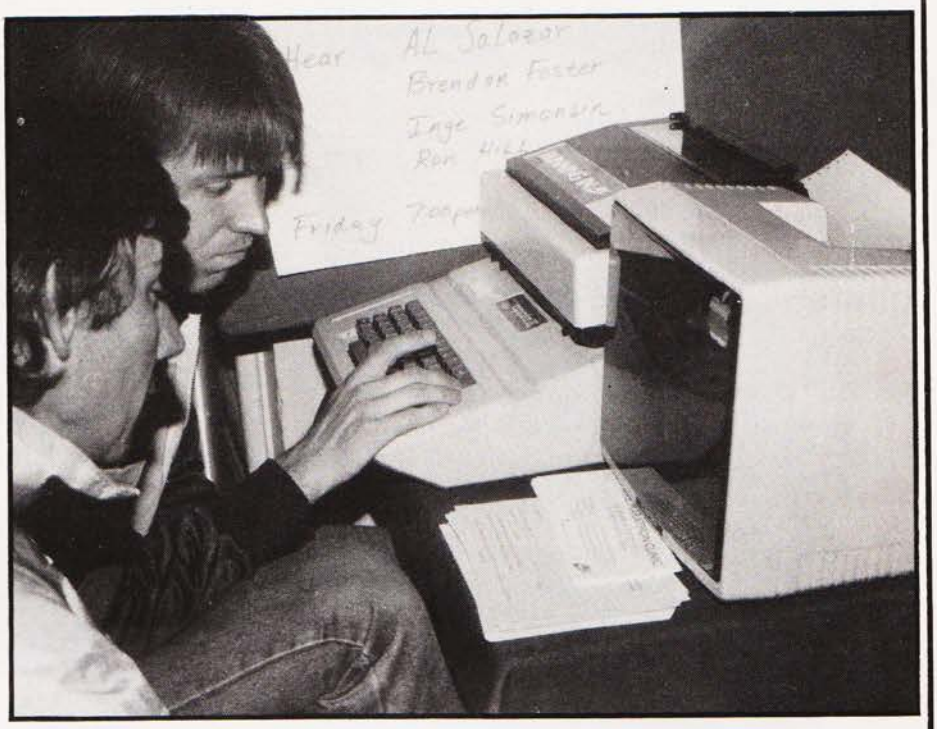
CLUB CALL

In response to the demand for up-to-date details on the various Computer Clubs and User Groups, we will now be publishing this page as a regular slot. This is your page, so keep the information coming.

To begin our round-up of the various Clubs and User Groups, we're starting off with those for the BBC Micro. This basic format will be adhered to for all the other major organisations so, if you'd like to be mentioned on this page, please drop a line to:

Club Call
Computing Today
145 Charing Cross Road
London WC2H 0EE

It would make life much easier if you could submit your information in the same format as we print it. Our thanks should also be extended to all the Clubs who faithfully send us their newsletters and magazines (please keep them coming!).



THE COMPUTER REFERRAL SERVICE

PO Box 7,
London W3 6XJ

This acts as the central clearing house for information about the BBC Computer Literacy Project. Please remember to enclose a large SAE and, most important, to write on your envelope just what information you require: User Groups, Software, General Query, etc. They have also just published a number of factsheets about various aspects of the project: Regional groups, Suggested books, Micros and the small business, Micros and education and Jobs in computing. These are available free on receipt of a large SAE, again ***please*** mark it clearly.

LASERBUG

The London And South-East Region BBC Microcomputer User Group
4 Station Bridge,
Woodgrange Road,
Forest Gate,
London E7 0NF
Contact: Trevor Sharples

The monthly newsletter, also called LASERBUG, contains reviews of books, hardware and software, as well as a number of programs to use on the BBC Micro.

Membership is £12 and includes 12 month's subscription to the newsletter.

BEEBUG

The National Independent User Group For The BBC Micro
35 St Julians Road,
St Albans,
Herts
Contact: D E Graham or Sheridan Williams

BEEBUG runs a regular newsletter (10 issues a year) including program listings, hardware and software tips, reviews and advice, all exclusively devoted to the BBC Micro. Membership is available for £4.50 for six months or £8.50 for the full year's subscription.

COMPUTER USERS CLUB

72 Sidmouth Road,
Welling,
Kent DA 16 1DS
Tel: 01-304 3910
Secretary: Tony Latham

The club produces a monthly printout of software ideas for the BBC Micro, programs and advice on programming technique.

NORWICH & DISTRICT BBC MICRO USER GROUP

Room B12a,
Norwich City College of Higher Education,
Ipswich Road,
Norwich,
Norfolk NR2 2LJ
Tel: 0603-60011 ext 233
Contact: Paul Beverley

A local support group, membership will cost you £2 for the rest of the year unless you are a student or an OAP in which case it is only £1.

COMPUTERTOWN UK!

7 Collins Drive,
Eastcote,
Middlesex HA4 9EL.

A nationwide network of computer literacy centres. The idea started in the USA and was brought across and championed by David Tebbutt, the then Editor of PCW. Many of the local centres are doing sterling work for the BBC Project and, as the whole idea of CTUK! is to provide free access, they are well worth checking out.

NEXT MONTH

BRAIN POWER

Over two years in the making, the Grundy NewBrain has finally been unleashed on the market. Originally designed as a hand-held data capture system and then modified to fill a gap in the personal computer market, it narrowly missed becoming the official BBC Micro. Now, following a change of ownership, the system appears to be unruffled by all the furore and may still have a large part to play in the lower end of the personal computer market.

Our reviewers have been looking at the system and its capabilities and their report is bound to make essential reading. So, if you want to know if the NewBrain has survived the transplant operation, get next month's feature packed issue of CT.

EDUCATION IN CONTROL

Controversy and argument have long raged about the ways in which computers should be used in the classroom, so it is refreshing to find a system designed for that environment which takes a different approach. British designed and built, the Midwich Microcontroller may look like an ordinary general purpose microcomputer but underneath it is decidedly different.

Our Special Report on the product examines its potential in the educational market and produces some interesting conclusions. What are they? You'll have to wait until next month to find out!

GREEN TO THE GAME

Program development is made so much easier when you have a task to achieve. In this delightful feature the author shows how a complete package was conceived and written for one specific application. As well as finishing up with a product, the feature also provides a number of interesting and useful ideas including a complete selection of sorting routines.

A MULTIPLE CHOICE?

Whether you have a use for a testing program at home for yourself or the children or you need one at school, this multiple choice program will provide the answer.

Already successfully used in the classroom, this package represents a basis on which more elaborate schemes can be built. Adaptability and clarity of programming are the keys to this kind of software, especially where the packages are to be used by unskilled personnel. So, if you have a need for any form of repetitive tests or examinations don't miss out on this one- it's the right answer!

BACK TO BASICS

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LITTLE LETTERS

One of the major complaints against the TRS-80 Model 1 system is that it cannot cope with lower case letters. You can buy all sorts of exotic add-ons to correct this failing but now Computing Today brings you what could well be the cheapest method of all time. For around £1 and about ten minutes of your time you can upgrade your system to full upper and lower case operation — that's a bargain compared to what some people will charge!

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

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Roger Munford

New products and old friends at the PET Show.

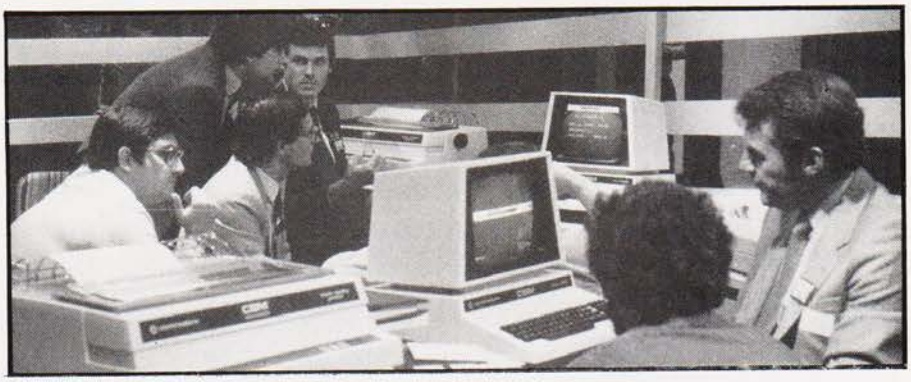
The time was when all computer exhibitions were filled with so many different machines that you really didn't know which to look at first. And now, well, just one glance around the third Commodore Computer Show would convince anyone that, as they say, 'the times they are a changing'.

From its modest genesis back in 1980 with a few rooms at the Café Royal, the PET Show (as it has become affectionately known) was held this year on two complete floors of the palatial Cunard Hotel, Hammersmith, West London. Indeed, even the organisers were surprised at the Show's success; they originally booked 18,000 sq ft for exhibitors — but after selling out in a matter of days decided to extend the available exhibition space by a further 14,000 sq ft.

At the Press conference preceding the show, all the important heads were there to be counted (and I'm not referring to the computer Press!). Welcoming the assembled was Irving Gould, Chairman of the Board of Commodore International Ltd, who announced that the sales figures for the third quarter were up by a significant (his understatement, not mine) 63.5%.

The next speaker was Jack Tramiel, Chief Executive of Commodore, who presented a short introduction to the new computers in the Commodore stable (of which more later). He went on to discuss some general market trends and Commodore's adopted plans to approach the marketplace. Tramiel estimated that by the end of 1985, computer sales in the world would exceed 50 million units a year; these figures could be further broken down into around half sold for home use, 30% sold for personal use and the remaining 20% used by the business world.

The Press presentation continued with a promotional video for the new Commodore 720 computer but the quality of the film left much to be desired and the room soon came alive to the sound of twitching journalists eager to enter the fray of the show — maybe the breakdown of the air conditioning had some small part to play too? **(One little secret that a friendly mole let slip was that the film was not quite what it seemed. Apparently the display seen on the 720 was produced by an 8032 and that of the 500 by a Commodore 64! I'm still convinced that the voice commentary was produced by a synthesiser chip but no-one was prepared to comment... Ed.)**



Above: Happy faces at the Mills Associates' stand.
Below: The 'Silicon Office' stand of the Bristol Software Factory.

Show Time

So, where do you start when there are over 154 stands to visit? The busiest, of course. And not surprisingly, the most crowded stand was that exhibiting the new range of Commodore products.

Commodore have decided to bless this year of Information Technology with five new microcomputers: the VIC 10, the VIC 30, the Commodore 64, the 500 range and the Commodore 720. All utilise the new Commodore 6509 eight-bit microprocessor; the 720 uses it in conjunction with the 8088 16-bit microprocessor.

The machine aimed mainly at the home market is the VIC 10. Complete with 2K of RAM, a 40 by 25 colour text screen, high resolution graphics, full keyboard music synthesis and the ability to use plug-in cartridges and BASIC, paddles and a light pen, the machine's obvious appeal will be for use with games. However, as the VIC 10 is probably going to be marketed as a personal/games computer, it will doubtless make very positive inroads into what has become known (almost traditionally) as the 'Sinclair end' of the market, especially as it will retail at less than £100.

The VIC 30 is the natural extension of the range combining the colour graphics capabilities of the VIC 10 with the computing power of the VIC 20. However, it was not in evidence at the show and is not due to be released in this country until early 1983. Still, an interesting point to note is that this product was initially named the VIC 40 — could it be that Commodore are saving this title for a new machine to dazzle us all in 1983?

Although not actually labelled as a VIC computer, the Commodore 64 certainly looks like one. Comprised of a full VIC keyboard, the machine contains 64K of RAM, 20K

of ROM and allows high resolution graphics. Yet the machine also includes a serial interface port, an eight-bit parallel user port and a memory expansion/cartridge port. Altogether, a more professional device.

Next up comes the 500 range of computers, a series with internal memory capacities ranging from 64K up to 256K. The keyboard is also upgraded to a full QWERTY keyboard plus 10 programmable function keys, four cursor control keys and a separate calculator key pad. The machines also contain an IEEE port, an RS232C port, a user port and a second processor slot.

The most impressive Commodore computer and obviously their 'baby', is the Commodore 720 which will retail at around £1595. As the price suggests, it's a fairly comprehensive device with an 80 by 25 monitor screen with swivel and tilt facilities, a similar keyboard to that on the 500 range, twin inbuilt floppy disc drives, 256K of RAM and the facility to add Winchester discs and the like. Commodore are expecting to introduce a 128K version of the 720 although no specific dates were mentioned.

Long Distance Information

Another Commodore innovation at the show was the development of KEYNET, a local networking system that allows as many as 250 systems to be linked together. The network comprises one master station to which the central disc drive is connected and however many of the 3000 series, 4000 series or 8032 Commodore computers you wish to add. The devices are coupled via a standard four twisted pair cable with data transmission speeds of 250K baud up to a maximum length of 1Km (this will, of course, depend on how many systems you introduce to the network).

The hardware allowing KEYNET to run consists of a PCB fitted to each computer in the network. The system also allows for any Commodore peripheral to be attached to the network. And if you have an 8096 or a VIC 20 system, not to worry, Commodore will be making KEYNET available to you later on this year.

On The Side

Before I leave the Commodore stand (well, after all, it was their show), perhaps a quick mention of the new peripherals available for the 8000 series would not go amiss.

Two new disc drives were on display: the 8250 dual disc drive unit and the 9060/9090 hard disc units. The first is an intelligent storage unit that actually adds to your computer's memory. The Commodore 8250 provides up to 2M of on-line storage from 5¼" double-sided diskettes. It also includes a plethora of built-in microprocessor-controlled firmware allowing such facilities as sequential file manipulation, append to sequential files, automatic directory search and program load and save.

The Commodore 9060/9090 units are intelligent Winchester hard disc drives providing up to 5M and 7½M of formatted storage respectively. The devices also include a very comprehensive range of facilities offered by microprocessor-controlled firmware.

The Best Of The Rest

The next most popular place was the VIC 20 stand. However, a rather discouraging game of the 'PACMAN' kind soon put paid to a prolonged visit!

The other 152 stands, if nothing else, were testament to just how popular the Commodore range of computers are. As well as stands maintained by the various user groups such as the Association of London Computer Clubs and the Independant Commodore Product Users Group, there was an excellent area devoted to the various educational uses of computers.

Among some of the more interesting products (and there were literally hundreds) was the BackPack available from Wego Computers Ltd of Surrey (22-49235). This small unit fits inside your PET or disc drive and provides power for a full 15 minutes should the supply be accidently or otherwise turned off.

The BeeBox system also caught my eye. Available from Beelines of Bolton (0204-385299), the device expands the VIC 20's facilities to 20K of RAM, a screen display of 80 columns, word processing capability and an RS232 port.

Another rather neat little device was the VIC Voice which when fitted to the VIC 20 allows it to speak. Utilising the Votrax chip SC-01, VIC Voice is able to pronounce all the words necessary to be proficient in English, French, Dutch, etc. Developed by Computer World, Hilvertsweg 99, 1214 JB Hilversum, Holland for £149 + VAT, this little device seems to be crying out for many useful applications in industry, games and education.

As you can imagine, there were applications for Commodore computers that I'm sure even Commodore would have to applaud. For example, the Rexagan system which allows the interfacing of a microcomputer with laboratory and process equipment for data acquisition and process control. Rexagan was developed by Dyson Instruments from Houghton-le-Spring, Tyne & Wear (0783-260433). Another diverse application for computer technology was a software and hardware package from 3D Digital Design and Development of Warren St, London (01-387 7388) which brings routine blood analysis a step nearer complete automation.

Softly, Softly

And yes, there were many stands devoted to software and I couldn't even begin to name all the good ones. However, JCL Software of Tunbridge Wells, Kent (0892-27454) provided an impressive array of professional software products for the Commodore PET.

There were also games in wild abundance. Rabbit Software of Harrow, Middlesex (01-836 0833) and Arfon Microelectronics Ltd of Gwynedd, Wales (0286-5005) seemed to be overwhelmed by potential 'savers of the universe' so I must presume the games were pretty good — I'm afraid I was never much good at pushing to the front of crowds, especially when they're mostly half my age and all better at the games than me! There was little on show that was innovative, mostly just adaptations of those annoying machines in pubs — however, I used to think most computer games were fairly innocent, if violence-oriented, until I discovered the rather tasteless 'Bomb Beunos Aires' on one stand.

Last Exit

It is rather impossible to provide a very meaningful review of a show so large in just two pages. However, the show was as enjoyable as it was professionally organised and I am certainly looking forward to next year.

Oh, by the way, did I mention how hot it was there . . .how about some air conditioning next year!

INNOVATIVE
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JUMBO

Fantastic new flying simulation

Occasionally a program comes along of such magnitude that it is hard to describe it, especially within the space allowable in an advertisement. Jumbo is such a program. There have, of course, been flying simulation programs before, but they have all rather fallen into the trap of trying to produce a graphic representation of the ground at some stage or other in the program, thus taking up space, and/or they have concentrated on the single act of flying. In other words, although one gets the feeling of flying a small aircraft, one is not going anywhere.

Jumbo is a fantastically accurate simulation of flying a Boeing 747. These planes are not small, and are not flown by eye. They are flown by eyes and instruments, and the instrument graphics in this simulation are really first class. As you may know, the primary instrument of an aircraft is the artificial horizon. This is simulated very well, and includes instrument landing approach indicators. Graphic maps of very high quality are produced and it is possible to fly in all of the British Isles including Southern Ireland, and to New York on the Eastern U.S. seaboard. The actual airports are at London, Birmingham, Manchester, Prestwick, Edinburgh, Belfast, Shannon and New York.

The program was written by two authors who combined their joint skills to produce a unique piece of software. The programmer got the last byte of performance out of the machine and the pilot the last drop of authenticity out of the simulation. Other simulation programs produce at best a similarity towards flying. With Jumbo you really feel that you are behind the controls.

The authors have used a number of gimmicks and programming techniques. For instance, it is possible to switch on an automatic pilot and to jump forward in time in increments of one minute or one hour — otherwise of course a flight from London to New York or vice versa would take some 8 hours to simulate. Whilst in this time skip the various controls are left as they are but fuel consumption and distance to go are taken forward at their correct rate.

A chart is supplied containing various items of data which you will need, including the take-off data for a 747 with various take-off weights, flap retractions, climb and cruise speeds and descent distances.

Realising that not everybody can fly a 747 and that there is even a large proportion of the population that cannot fly anything, two important items of assistance have been added. First of all is the documentation. This is split into two parts. The second is a "manual" on flying the 747. In other words, the instructions for running the program. The first part, however, is what amounts to an instruction manual for flying. It assumes that the user knows nothing about aircraft and although we do not purport that it gets anybody up to any sort of standard after it has been assimilated, the reader should have sufficient knowledge of flying and the theory of flight to fly in the program itself. The second feature of assistance to the novice pilot is a feature in the program which enables the user to practice landings. When the program is started, if one presses the P key, the aircraft is automatically put 11 miles out from London Airport approaching on an instrument landing.

The controls are pretty well complete, even to dive and wheel brakes. The flying track may be continuously monitored on the map display. Bearing and distance to your intended point of landing are available all the time. The instruments, incidentally, consist of:

- Artificial horizon
- Aeleron indicators
- Indicated airspeed
- Power setting
- Elevators
- Attitude
- Compass
- Turn indicator
- Flap indicator
- Altimeter
- Fuel
- Elapsed time
- Distance to landing
- Rate of climb

Six maps may be chosen, as follows:

Scotland, Northern England, Southern England, Ireland, Eastern U.S.A., The whole of the U.K.

Route information and present position are shown on the map displayed. It is very difficult to think of any factor that the authors have overlooked. Even the quite meaningful thinning of the air with increasing height, which greatly affects the airspeed indicator in real life, is taken into consideration. Rather than having a fixed stalling speed, this continuously changes with the flight configuration, the weight, height and power setting, again as it does in real life.

We like to think that we publish good programs. Jumbo is outstanding. It is available on tape or disk for 16K or 32K memory machines. It is compatible with the Model I Tandy, Video Genie, Genie I and Genie II machines.

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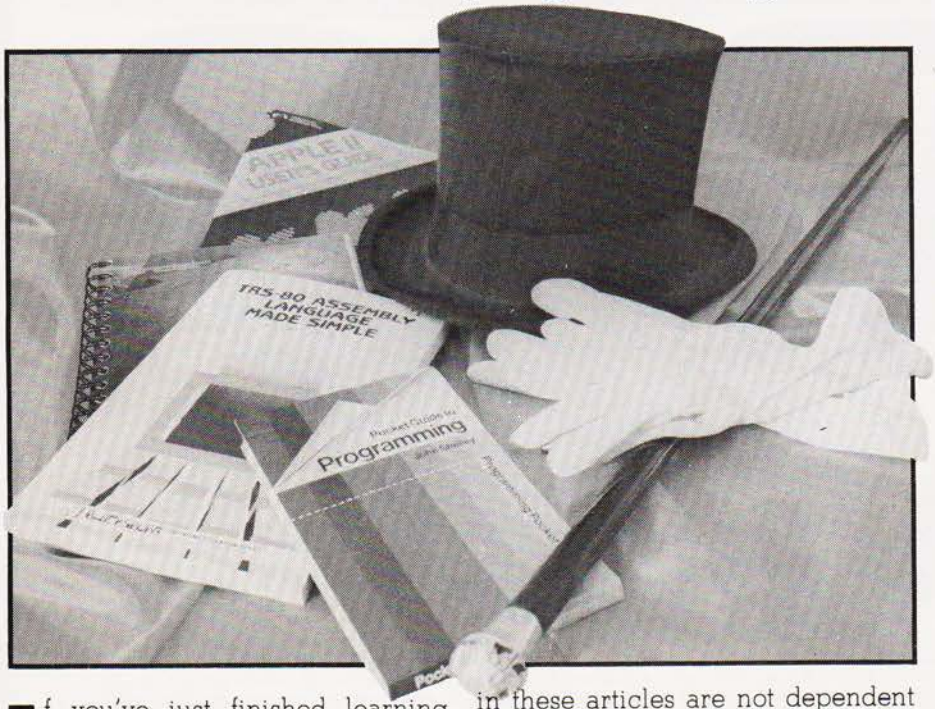
Mike James

If your programming has progressed to the point where you are wondering what problems to tackle then this new feature is designed to help. We start by explaining the difference between programming and coding.



If you've just finished learning your first computer language, you might be worried by the fact that even though you are convinced that you understand the language it is still very difficult to write programs. However, this should not come as any surprise because knowing a language and having anything sensible to say in it are two very different things! In other words:

Knowing a computer (or any other) language does not mean that you know how to ***use*** *it.*

The question which is immediately raised is 'how do you become a programmer?' The most obvious answer is that it is only experience and practice that changes a novice into a skilled programmer. It is the purpose of this series of articles to explain some general programming methods and ideas and so shorten the time it takes for a beginner to graduate to an expert. However, this is not to say that the expert will find nothing of interest!

The techniques to be discussed in these articles are not dependent on any particular computer language. However, to make it possible to give examples and illustrations, it is necessary to use a particular language and because BASIC is such a popular language there is an obvious advantage in using it. So, to be able to understand the examples, etc, you do need to be able to read BASIC.

Each part of the series will be as self-contained as possible but it will sometimes be necessary to make use of material introduced earlier (as if there aren't already enough reasons to subscribe to CT!). In this first part of the series we will look at what a program is and what methods can be used to help in its production.

Solutions And Programs

A program doesn't really have anything to do with a computer! People were using programs long before the invention of the digital computer, for example, recipes, knitting patterns and mathematical formulae are all examples of programs. A program is nothing more than a list of instructions leading to some predefined end — a meal, a scarf or the solution to a quadratic equation. It is unfortunate then that 'program' has come to mean something especially to do with digital computers as this causes the emphasis to be placed on 'computer' rather than 'program'. So 'to program' has come to mean the mastery of a computer language along with all its particular grammar. An expert programmer is supposed to be one capable of using many computer languages. Whereas, in fact, a programmer may know many languages and know nothing of programming!

The ability to program is in part the ability to find ***solutions*** — people who are good at solving problems usually turn out to be good programmers; those not too good at problem solving take a lot longer and some never make it at all! Problem solving in general can be taught and if you're not too good at it then don't give up — it is possible that no-one ever showed you how to tackle a problem.

Solving a problem gives you the solution.
Knowing how you solved the problem gives you a program.

Coders

To make things clear let's examine which stage in the production of a computer program is correctly called programming. First, some statement of the problem must be found. However, this is not programming. Second, a few basic requirements for achieving the solution are outlined. This is connected with programming but is more about what computers and humans can do. Third, a sequence of steps leading to the solution is proposed. This ***is*** programming. Fourth, the program is realised as a written program in a computer language. This is the stage that is most often referred to as programming. It is, in fact, the least skillful of all the stages and involves mainly the correct placement of commas and other matters of simple grammar. Given a program in the form of a detailed explanation or flow diagram, the translation to code

ELEGANT PROGRAMMING

can be done automatically, and if this were programming, it would be a very dull subject indeed. In short,

CODING is not PROGRAMMING.

Expressing Thought — Algorithms

All that we have said about programming is obvious from a consideration of normal human behaviour. Just as a thought is independent of the language used to express it — the colour red is the same concept whether written in English or German — a program is independent of the computer language used to express it. The fact that it is possible to convert a program from one computer language to another should convince even the most practical mind that something abstract lies behind any program: they both use the same ***algorithm***. In simple terms, an algorithm is a way of doing things and it can be expressed in many ways.

At this point it is important to realise that although it is convenient to think of an algorithm as something separate from a computer language, it is impossible to express an algorithm without using language. It is often thought that the flow diagram is in some way a 'pure' expression of an algorithm but it is certainly no better than expressing it in language. Indeed, it's much ***less*** useful as no one has produced a computer that reads flow diagrams (yet)!

Finding An Algorithm

So far it sounds as though producing a program is a very magical process. You read the problem, go off into a dark corner and an algorithm enters your head from nowhere and the rest is just coding! This is, of course, nonsense! Splitting the production of a program into finding an algorithm and coding doesn't make it any easier but it does help to identify ***where*** any difficulties lie. An algorithm is similar to an English sentence — it has a verb, telling us what to do, and a noun, the object that we do it to! For example, in BASIC the instruction:

```
B+C
```

tells us to add (verb) the contents of B (noun) to the contents of C (noun). In programming languages the nouns are usually called ***DATA*** and the verbs are given a wide variety of names including operators, functions, executable statements, etc . . . There is also another type of instruction that we might find in an algorithm as sometimes it is necessary to define what a 'noun' or 'data' object is. For example, in BASIC the statement:

```
DIM B(20)
```

contains a noun 'B(20)' but no verb! What it is doing is describing the object — ie it is an array of 20 elements.

Computer languages vary in the amount of data definition they require for a program. The language Pascal requires ***every*** data object to be defined before its use, but BASIC is a little more forgiving and supplies a wide range of predefined types such as 'standard' real variables and strings. Another way of looking at the sort of statement that describes data is to regard it as not just a passive definition but as an instruction to 'organise' simpler data types. For example, the statement used previously, DIM B(20), could be read as an instruction to organise 20 variables into an array called B. Seen in this light such statements are often referred to as structuring the data.

At this stage it should be clear that the problem of finding an algorithm comes down to finding out what to do and what to do it to. However, once you have solved the task of what objects/data types you're going to use, the problem of what to do with them very often solves itself! Which is fortunate because there is very little specifically helpful guidance that can be given. There are, however, a number of general methods which will help you tackle a large problem and produce a program which is useful to other people. One of these methods, stepwise refinement, is dealt with below but, before we move on to it, there remains one last difficulty in programming that is worth discussing — background.

Background Knowledge

It is suprising the way people expect programmers to move from one subject to another and still write useful programs. For example, professional programmers at various points in their careers might be asked to produce a stock control program and later find themselves working on a project involving graphical display in three colours. It is clear that, to make any progress with either problem, the programmer must first spend some time becoming familiar with the problem. The trouble is that all to often insufficient time is spent at this stage of building up a background in the area before starting to construct a program. The result is that the programs often work perfectly but do the wrong job or solve the wrong problem.

To sum up:

Difficulties in writing a program can come from three sources—
1) lack of knowledge and application of data structures.
2) lack of knowledge and application of problem solving methods.
3) lack of specific background information.

Stepwise Refinement

When you look at someone else's program or a program that you wrote so long ago you have forgotten all about it, the first thing to do is to try to get an overall feeling for what it is doing. You might identify the first twenty lines as an initialisation part, the middle as doing some calculation and the final part as output. Once you have this overall structure you can move on to seeing how each part does its job and find out how the calculation is done. Slowly your understanding grows as you identify the role of smaller and smaller parts of the program. Finally, you arrive at the point of view that the writer of the program must have had — you can see each instruction operating on every variable and know what each is for.

Now, let's return to the problem of writing programs rather than reading them. Instead of thinking of the program that you are trying to write as a long list of instructions, think of it as a collection of modules each doing part of the job of the whole program. This, of course, brings with it the difficulty of deciding how to split the program into modules but, once again, considering how someone understands a program usually suggests a method. When trying to formulate a program you start with an overview and work down to smaller and smaller modules. You could think about writing a program as trying to understand one that you haven't managed to write yet, so why not start at the top! For example, the problem of writing a chess program

is so overwhelming that most programmers have difficulty starting. However, to start the ball rolling the first attempt at a chess program would be something like:

start game
play chess until end of game
give results of game

This may not seem like very much progress but we can now look at each module and try to 'refine' its definition. The next step, of course, is to attempt to reduce each of the smaller problems yet further. For example, our next attempt might be:

start game —
print titles
set difficulty level and who is white
initialise board and other 'play' variables

play chess —
get move
record move
analyse board
make move
end of game?

results —
you win or I win message

This process can be continued until the program is complete. In fact, what normally happens is that the refinement continues until one of the modules can be written in BASIC and from then on, the refinement is carried out as part of program development on the computer.

This idea of taking a bigger problem and splitting it down into a number of smaller problems and then taking each one of the smaller problems and splitting them down further and so on is called ***stepwise refinement*** or ***top down programming***. It has a great many advantages but the one which people find most helpful is that it gets you started ! In practice, the neat theory that programs are written by successive refinement is a little way from the truth. Even the most skilled programmer sometimes gets it wrong and has to backtrack. Sometimes a stage in the refinement throws light on earlier versions and a better method can be seen or, sadly, sometimes a stage in the refinement can demonstrate that the overall approach is incorrect and there is no choice but to go back and start again. Still, at least you will now know one way how ***not*** to do it! However, it is very rare that it is impossible to salvage some part of the program designed during stepwise refinement.

Subroutines

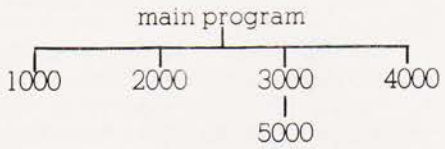
While we were discussing stepwise refinement, the idea of a module was introduced as a way of grouping together instructions with a common purpose. It would be an obvious advantage if the computer language the program was being written in made some provision to keep this grouping and, if possible, made it stand out in some way. Various methods are possible but the only one available in standard BASIC is the ***subroutine***.

In BASIC you can collect together a list of statements and, as long as you end it with RETURN, you can treat it as a subroutine. The list of instructions can be referred to by writing GOSUB N where N is the line number of the first line in the list. Most BASIC programmers will recognise this description of a subroutine but might be a little confused by the way in which they are being likened to modules. Instead of writing the list of instructions out every time they are needed, a subroutine is constructed and GOSUB used instead. This is a valid reason for using subroutines but what we have discovered is that subroutines are useful even if the list of instructions is only going to be used ***once!*** This use of subroutines as modules makes a BASIC program which has been constructed by stepwise refinement reveal the stages it has been through. The first stage gives rise to a program which is often nothing more than a list of GOSUBs. The second stage of refinement produces the BASIC which makes up the subroutines used in the first stage and so on until all the subroutines have been defined. Thus, the stages of the stepwise refinement are frozen into the final structure of the program — the hierarchy of subroutines.

This sort of programming is often referred to as ***top down modular programming*** (TDMP for short!). The advantages of TDMP are immense — programs are easier to change, easier to understand and easier to debug. The only real disadvantage of this sort of program construction is that it doesn't give the most efficient version of the program. It is difficult to give an example to show clearly the advantages of TDMP because it only becomes apparent in medium to large programs — short programs are easy to write using any method! However, a short example might help to show what a TDMP program looks like. Consider the problem of reading in a string of characters and reversing its order.

```
  10  GOSUB 1000  Initialise
  20  GOSUB 2000  Get input string
  30  GOSUB 3000  Reverse string
  40  GOSUB 4000  Print result
  50  STOP

1000  B$=""       Clear output string
1010  RETURN

2000  PRINT "TYPE ANY MESSAGE"
2010  INPUT A$    Read in string
2020  RETURN

3000  FOR I=LEN(A$) TO 1 STEP-1
3010  GOSUB 5000  Get Ith character
3020  B$=B$+C$    into variable C$
3030  NEXT I      and add it to B$
3040  RETURN

4000  PRINT
4010  PRINT "OLD STRING=";A$
4020  PRINT "NEW STRING=";B$
4030  RETURN

5000  C$=MID$(A$,I,1)
5010  RETURN
```

The subroutine structure for this program looks like this:



You may feel that having subroutine 3000 call another subroutine (ie 5000) to extract the Ith character is going a little too far but, apart from illustrating the idea of the second stage of refinement, the use of subroutine 5000 makes conversion to BASICs that do not have the MID$ function a lot easier.

The lesson to be learned is:

Use a subroutine unless you have a reason* not *to.

Parameters

The short example in the previous section shows up a number of the problems using BASICs GOSUB and RETURN instructions to write modules. Computer languages vary to the extent that they recognise the need to use modules — Pascal is very good and BASIC is terrible (indeed, BASIC's lack of a good method of forming modules is its biggest let down as a programming language).

The first problem with the BASIC GOSUB...RETURN is that it is impossible to give names to subroutines. Some versions of BASIC (eg BBC BASIC) do allow

ELEGANT PROGRAMMING

names to be given to a special form of subroutine (known as a procedure) but in most BASIC programs, the only real option is the extensive use of comments to make sure that the purpose of any subroutines used is obvious. One trick which can be used in any BASIC that allows expressions to be used in GOSUB statements is to define variables with the approprite names and assign the correct line numbers to them. For example, in Sinclair BASIC (used on the ZX81 and ZX Spectrum) you can write things like GOSUB 2*I+56. So instead of GOSUB 1000, etc, you could write:

```
10  INITIALISE=1000
20  GETSTRING=2000
30  GOSUB INITIALISE
40  GOSUB GETSTRING
```

A second and more serious limitation on the BASIC subroutine is that there is no way of using parameters (a parameter is perhaps most familiar to BASIC programmers from its use in functions). For example, in the function definition:

```
DEF FNT(A,B)=A+B
```

the variables A and B are parameters. They have nothing to do with any variable of the same name in the rest of the program. The parameters simply show what the function is to do — ie add the first parameter to the second. When a function is used, real variables are substituted for the parameters. For example:

```
10  C=2
20  D=3
30  PRINT FNT(C,D),FNT(D,C)
```

The reason why parameters are so useful is two-fold — first the function can be written without worrying about what variables have been used in the rest of the program and second, the function can be used any number of times with different data. These advantages would be no less welcome as part of a subroutine facility.

Unfortunately, standard BASIC doesn't make any sort of provision for parameters in subroutines. It is true that one or two versions of BASIC (BBC BASIC again!) do provide extended subroutine facilities that include parameters but if you want to stay with standard BASIC, you have to either abandon the idea of parameters or settle on a system of naming variables within each subroutine. Consider the string reversal example. Subroutine 5000 returns the Ith letter of the string A$ yet can be re-written in a form which does not depend on the particular variables I and A$.

```
5000  C50$=MID$(A50$,I50,1)
5010  RETURN
```

Using the subroutine is now a little more long winded:

```
3010  A50$=A$:I50=I:GOSUB 5000
3015  C$=C$50
```

but the subroutine can be used to extract the Ith character from any string variable and the answer can be stored in any other. The main advantage, however, is difficult to see in this 'static' example. Using the variables A50$ and I50, subroutine 5000 can be written ***before*** the rest of the program secure in the knowledge that no other subroutine will use its variables!

Next month we continue the saga of program construction with a discussion of the (possibly) infamous structured programming.

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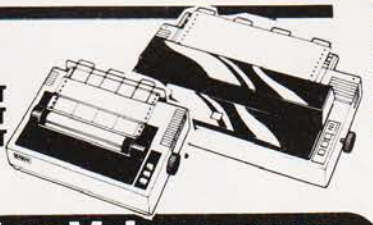

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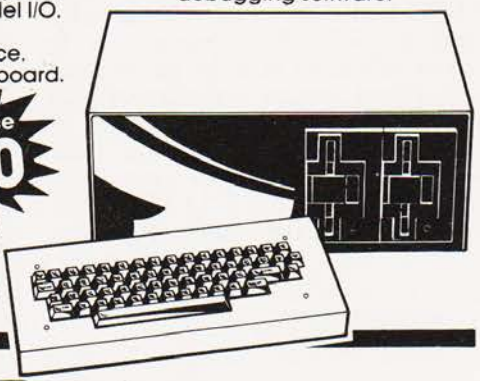

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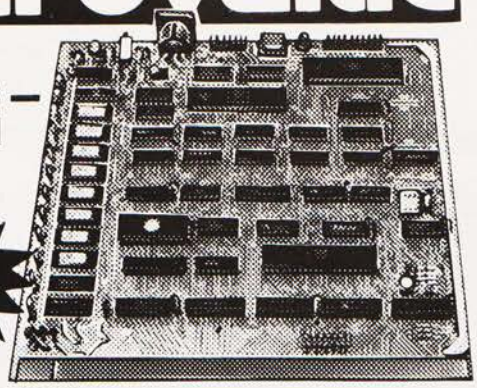

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G M Owen

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An escort of eight warships will be in the area, consisting of:

2 Submarines
2 Frigates
2 Destroyers
2 Battleships

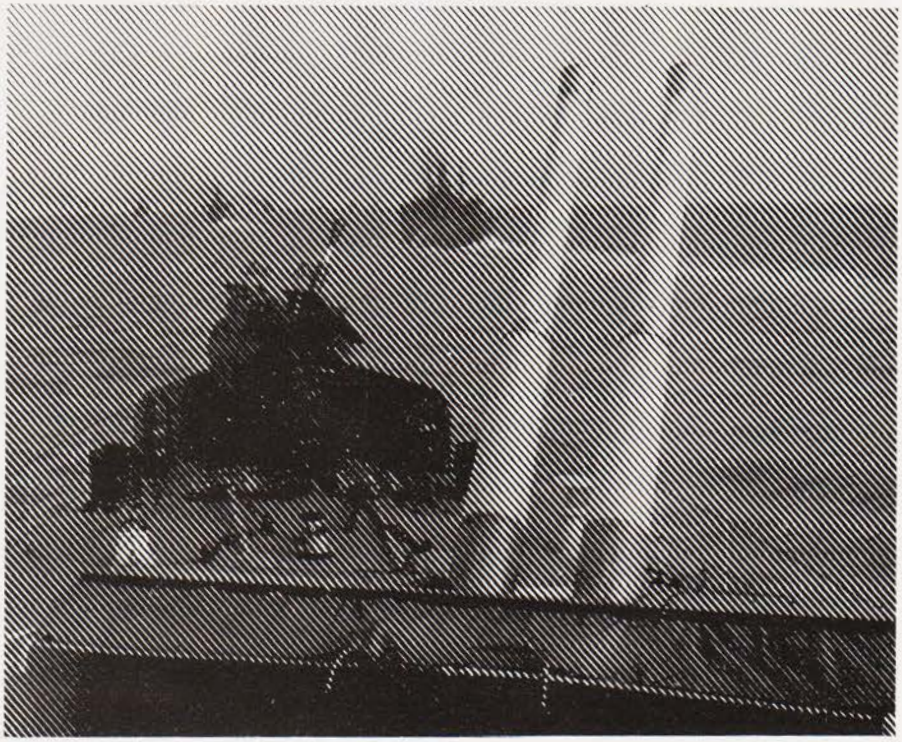
Your craft will be damaged (thus reducing its speed) by the return fire of the warships. The extent of the damage will depend on the number of enemy warships afloat. If your fire misses, or hits a cargo boat, expect immediate return fire which will damage your craft reducing its speed even further.

LAYOUT OF THE STRAIGHTS CHANNEL

Your strategy should be to sink as many warships as possible at the start to reduce damaging return firepower and then, to systematically sink the cargo vessels. Good luck!

If a warship is hit, depending on the condition and speed of your craft, further attacks may be made before the enemy returns the attack. For safety reasons, a clear space is kept fore and aft of every warship. This regulation prevents warships from occupying the same shipping lanes as the cargo vessels. Co-ordinates should be selected in the form: 0.1, 1.1 to 9.4.

A Submarine takes 1 hit to be destroyed
A Frigate takes 2 hits to be destroyed
A Destroyer takes 3 hits to be destroyed
A Battleship takes 4 hits to be destroyed



Program Listing

```
 10  VAC:C=10:D=8:K=50:WAIT 40:PRT "SINK THE CONVOY!"
 20  A(N)=INT(RAN#*4+1)/10+SGN N
 30  FOR N=N+1 TO 9:A(N)=A(N-1)+2:IF N=4;N=5:GOTO 20
 40  NEXT N:FOR N=10 TO 17
 50  L=INT(RAN#*4+1)/10:IF L=FRAC A0 THEN 50
 60  IF L=FRAC A5 THEN 50
 70  A(N)=L+INT(RAN#*10):FOR M=9 TO N-1:IF A(N)=A(M)
     THEN 50
 80  IF ABS (A(N)-A(M))=1 THEN 50
 90  NEXT M:NEXT N
100  INP "ENTER CO-ORDINATES",B
110  FOR N=15 TO 0 STEP-3:PRT CSR N;"◢◢◢";:NEXT N:PRT ""
120  FOR N=0 TO 17:IF B=A(N);NEXT N:PRT "SPLASH!":
     GOTO 220
130  IF N<10;PRT "CARGO SHIP SUNK-";B:GSB 270:GOTO 220
140  A=A+1:IF N<12;PRT "SUBMARINE HIT-";B:GSB 360
150  IF N=12;E=E+1:GSB 330:IF E=2;GSB 360
160  IF N=13;F=F+1:GSB 330:IF F=2;GSB 360
170  IF N=14;G=G+1:GSB 340:IF G=3;GSB 360
180  IF N=15;H=H+1:GSB 340:IF H=3;GSB 360
190  IF N=16;I=I+1:GSB 350:IF I=4;GSB 360
200  IF N=17;J=J+1:GSB 350:IF J=4;GSB 360
210  GOTO 310
220  IF D=0 THEN 100
230  K=K-INT(RAN#*D/0.6)
240  IF K>0;PRT "SHIPS SPEED ";K;" KNOTS ":
     A=0:GOTO 100
250  PRT "CRIPPLING DAMAGE":PRT "ABANDON SHIP!"
260  PRT "HOPE YOU CAN SWIM!":PRT "":END
270  A(N)=-1:C=C-1:IF C>0;RET
280  PRT "ALL CARGO SHIPS SUNK":PRT "RETURN TO HARBOUR"
290  PRT "SIGNAL READS:":PRT "CONGRATULATIONS!"
300  PRT "IMMEDIATE PROMOTION TO ADMIRAL":PRT "":END
310  IF A=INT(K/9);A=0:GOTO 220
320  GOTO 100
330  PRT "FRIGATE HIT-";B:RET
340  PRT "DESTROYER HIT-";B:RET
350  PRT "BATTLESHIP HIT-";B:RET
360  D=D-1:A(N)=-1:IF D=0;PRT "VESSEL SUNK!":RET
370  PRT "ALL WARSHIPS SUNK!":RET
```

T P Mervyn

EASTER

Do you know when it is next year?

Almost everyone must have come across a program which allows the user to generate a calendar for some given year in the future. These range from a brief, but useful, list of days of the week and dates, to full blown and sensational illustrated calendars showing either some bikini-clad beauty in profile or, more often, some exciting episode in the life of Snoopy.

Now far be it from me to criticise these undoubted works of computer art, but most of the published programs do not provide details of some of the more useful dates within a year. Sometimes, the programs allow Christmas Day and Boxing Day to be headlined in some way, but I have yet to see a program that gives details of the date on which Easter Sunday falls.

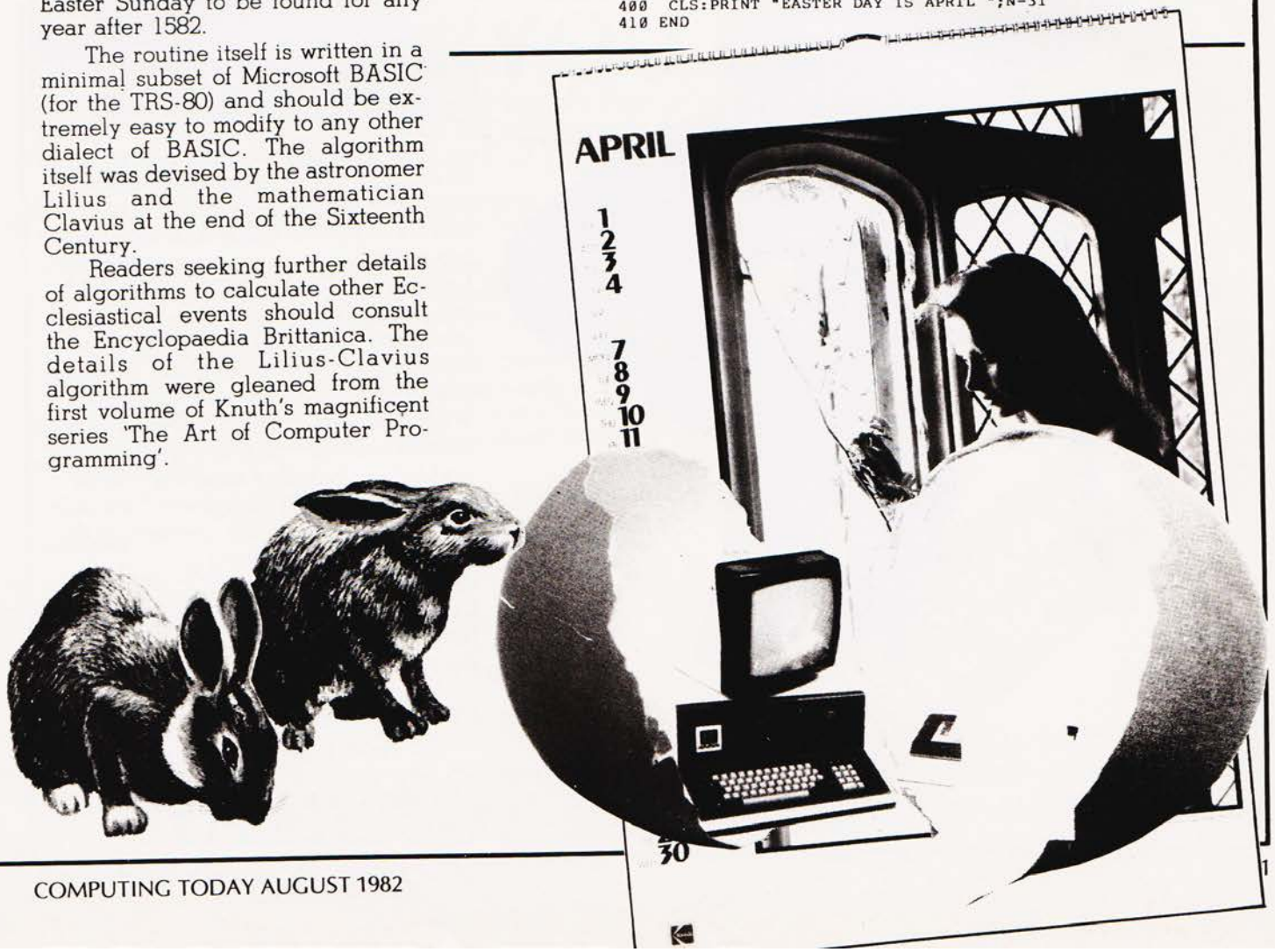
Now, potential calendar authors, your problems are over. Here presented are details of a small routine which allows the date of Easter Sunday to be found for any year after 1582.

The routine itself is written in a minimal subset of Microsoft BASIC (for the TRS-80) and should be extremely easy to modify to any other dialect of BASIC. The algorithm itself was devised by the astronomer Lilius and the mathematician Clavius at the end of the Sixteenth Century.

Readers seeking further details of algorithms to calculate other Ecclesiastical events should consult the Encyclopaedia Brittanica. The details of the Lilius-Clavius algorithm were gleaned from the first volume of Knuth's magnificent series 'The Art of Computer Programming'.

Program Listing

```
100  CLS
110  INPUT "YEAR FOR WHICH EASTER REQUIRED";Y
120  G=Y
130  IF G<19 THEN 160
140  G=G-19
150  GOTO 130
160  G=G+1
170  C=INT(Y/100)+1
180  X=INT(3*C/4)-12
190  Z=INT((8*C+5)/25)-5
200  D=INT(5*Y/4)-X-10
210  E=11*G+20+Z-X
220  IF E<0 THEN E=E+30
230  IF E<30 THEN 260
240  E=E-30
250  GOTO 230
260  IF E=24 THEN 290
270  IF (E=25) AND (G>11) THEN 290
280  GOTO 300
290  E=E+1
300  N=44-E
310  IF (N<21) THEN N=N+30
320  B=D+N
330  IF B<7 THEN 360
340  B=B-7
350  GOTO 330
360  N=N+7-B
370  IF N>31 THEN 400
380  CLS:PRINT "EASTER DAY IS MARCH ";N
390  STOP
400  CLS:PRINT "EASTER DAY IS APRIL ";N-31
410 END
```



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Jack Dikian and Damien Skracic

Our grand finale to this series on advanced graphics techniques is a three-dimensional program. Originally written for the Apple, it can be implemented on any system with line drawing commands.

How many of you at some time in your graphics programming have experienced the frustration of having a vivid picture of a three-dimensional surface in your mind, but not the mathematical background in order to write the appropriate display program? Worry no longer... this article will describe a method of producing three-dimensional wire mesh surfaces given the location of control points in the x-y cartesian coordinate system. The program uses the Bezier method (named after P Bezier).

The Bezier method uses parametric equations to represent a curve; these equations simplify the analysis of the curve since both the x and y axis can be treated separately as a function of a third parameter. For example, consider the equation of a simple parabola $y = x^2$. This can be represented in the parametric form by $x = t; y = t^2$ where t would take values in the range you desire.

It can be seen that curves can be described in more than a single representation. Thus the most suitable equation can be chosen for each particular purpose.

It is, however, usually quite difficult to define a single function to trace an entire curve, let alone a complex surface. So, instead of trying to find this function, a series of functions could be used which describe only small portions of the curve. These portions can then be pieced together to form curves which are as complex as you wish.

The Bezier method is a technique which goes as far as removing the need to define these sub-functions as it provides a relationship between control points which do not necessarily lie on the curve and the shape of the curve itself.

The Bezier Relationship

In two dimensions, a curve Q (t) can be defined in terms of the locations of n + 1 control points, Qi:

$$Qx(t) = \sum_{i=1}^{n+1} xi\, Bi,n(t)$$

$$Qy(t) = \sum_{i=1}^{n+1} yi\, Bi,n(t)$$

$$Qz(t) = \sum_{i=1}^{n+1} zi\, Bi,n(t)$$

where Bi, n(t) is the blending function and is itself a parametric function:

$$Bi,n(t) = \frac{n!}{i!\,(n-i)!}\, t^i (1-t)^{n-i}$$

In the two-dimensional case we could set all z co-ordinates to zero as is the case in Figs. 1 to 3. It turns out that the above analysis can be easily extended to describe the three-dimensional case, with the result of producing surfaces as in Figs. 4, 5, 6 and 7.

The technique is similar to that of plotting the super-position of two trigonometric functions mapped at 90 degrees to each other. In much the same way, the cartesian product of the two curves perpendicular to each other are taken along with two blending functions representing each set.

The equation then becomes:

$$\sum_{i=1}^{n+1} \sum_{j=1}^{m+1} (K_{i,j})\, \frac{n!}{i!\,(n-i)!}\, t^i (1-t)^{n-i}\, \frac{m!}{j!\,(m-j)!}\, p^j (1-p)^{m-j}$$

where t and p range from 0 to 1 with a stepping factor which will determine the accuracy of the surface. In Figs. 1 to 7, and indeed all curves of this kind, the blending functions are the solution to the shape of the curves. It should, therefore, be no surprise to anyone that these functions have some very important properties.

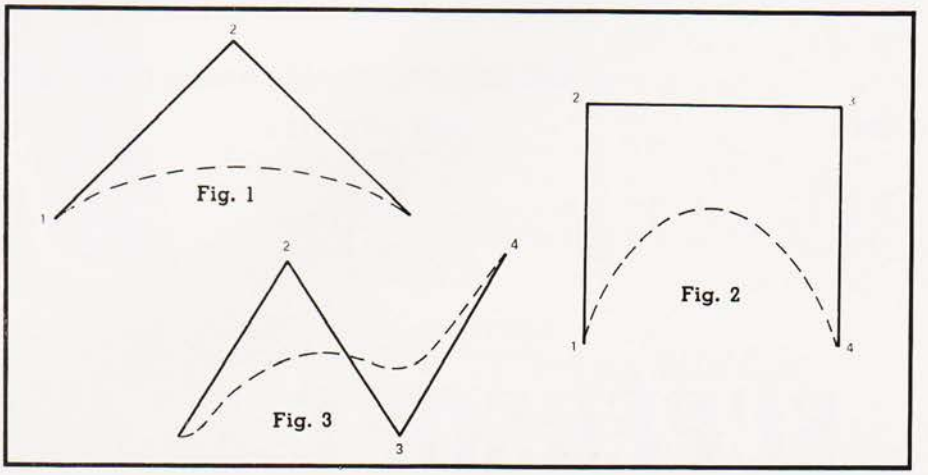
Some of these properties include:

1. Each of the control points exerts a pull on the curve.
2. The points have the effect of changing the entire shape of the curve as a consequence of property 1.
3. The curves pass through the end points.
4. Curves can be pieced together to form complex shapes.

To demonstrate how Bezier surfaces can be generated in order to comply with your intentions, let us first look at Figs. 1, 2 and 3 where the broken lines represent the surface. It should be noticed that by specifying a set of control points in the x, y co-ordinate system (the vertices of the unbroken lines), a curve is fitted between them such that it satisfies the properties above.

The effect of changing the location of even one of the control points will result in a change in the whole curve and not just in the vicinity of the particular point.

The program included within this article is itself a three-dimensional Bezier generator. As with the two-dimensional curves, one still needs to specify the location of the control points in the x, y co-ordinate system. However, unlike the two-dimensional case where the z ordinate was set to zero, we are also required to define the z value. It should be pointed out that this additional information is only used in the hidden line removal stage and has no effect on the way the surfaces are constructed in the first place.



The surfaces will behave according to the properties described above, but with the extra advantage of having a change in the location of the control points affecting the shape of the whole surface and not just the single curve.

How To Use The Program

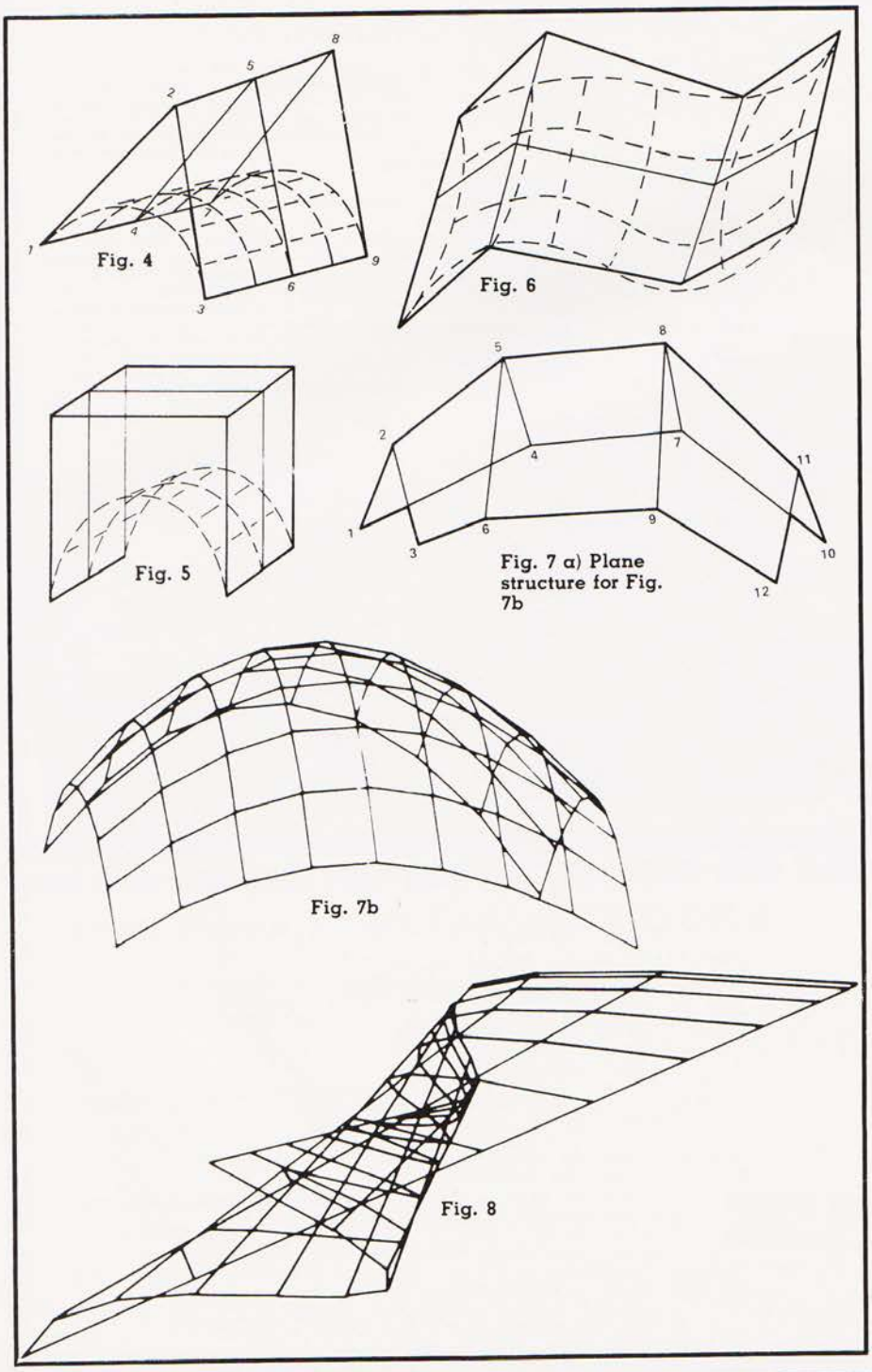
Extreme care should be taken when inputing the points as it is absolutely essential to define the points in the correct sequence. The vertices of Fig. 4 have been labelled to demonstrate the inputting sequence, ie the co-ordinates of vertix 1 are inputed first, then 2 and so on. This convention is called a 'bottom to top and left to right' style; you could if you wish input the points in a 'top to bottom and right to left' style.

You are also required to input the Planes Order, where the Planes Order is the dimension of the defining planes. For example, in Fig. 4 the difference between a 2 by 3 and a 3 by 2 is dependent on the choice of style in defining the points.

In all cases the Order should not be less than a 2 by 2; for example, (n + 1)*(m + 1) points need to be inputed if the Order is n by m.

Finally, one needs to specify the grids parameter as this will determine the number of surface defining lines which will be drawn. For example, grid = 6 will generate a surface with 6 lines along each of the axis; Fig. 4 has a grid value of 5.

There is a certain trade off associated with the grid value; the higher the value of the grid parameter, the better the resolution of the surface is. On the other hand, the computational time increases unproportionally — it has been our experience that a surface with a grid value of 5 or 6 can be completed in a few minutes. If you feel, however, that this is too long a time to wait, you could always try to convert the blending functions to the polynomial form where only addition and multiplication operations are performed.



Hidden Lines

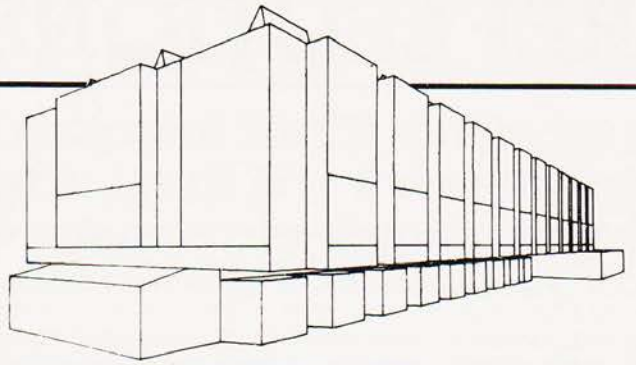
Viewing wire frame objects is often confusing as the image tends to turn inside out before your eyes. This is due to the fact that lines which would not normally be seen when viewing solid objects are still shown, so a need exists to remove these lines.

This brings us to one of the oldest and most intriguing aspects of computer graphics — the art of hidden line or surface removal.

There are almost as many ways of achieving this as there are days in a year, and no one way is the correct approach as it depends on the application and capabilities of your computer system. All hidden line elimination algorithms require massive calculations and data handling routines, thus they tend to run fairly slowly when implemented even on large machines.

We have written a relatively simple surface removal routine which executes fairly quickly on the Apple. To reduce calculation time the algorithm has little 'intelligence' but is never the less effective when working with Bezier surfaces.

We hope this will provide an interesting method of plotting your surfaces, with the added ability of removing undesired lines. Note that those of you with machines other then the Apple can still easily implement the program as long as you have the basic plot primitives. No bound checking is required as the surface will always lie within the points defined.



An example of 3D graphics with hidden line removal. NB this is not produced by the program shown here!

Program Listing

```
  10  GOTO 1000:INPUT "N BY M ?";N,M
  15  INPUT "GRIDS ";P
  17  J=P*P:H=(P-1)^2
  19  DIM S(3,J),PX(H,4),PY(H,4),PZ(H,4),PC(H,2)
  20  FOR J=1 TO N+1:FOR H=1 TO M+1
  30  INPUT X(J,H),Y(J,H),Z(J,H)
  35  NEXT J,H
  37  HGR:HCOLOR=7
  40  FOR C=1 TO 3
  50  W1=0
  60  ON C GOTO 70,90,120
  70  FOR K=1 TO N+1:FOR R=1 TO M+1
  75  B(K,R)=X(K,R):NEXT R,K
  80  GOTO 200
  90  FOR K=1 TO N+1:FOR R=1 TO M+1
  95  B(K,R)=Y(K,R):NEXT R,K
 100  GOTO 200
 120  FOR K=1 TO N+1:FOR R=1 TO M+1
 130  B(K,R)=Z(K,R):NEXT R,K
 140  REM ** STEPPING FACTOR DETERMINES RESOLUTION OF THE
      SURFACE
 200  FOR U=0 TO 1 STEP 1/(P-1)
 210  FOR W=0 TO 1 STEP 1/(P-1)
 220  W1=W1+1
 230  FOR I=0 TO N
 240  X=N:GOSUB 900:A1=FH
 250  X=I:GOSUB 900:A2=FH
 260  X=(N-1):GOSUB 900
 265  A3=FH
 267  REM ** BLENDING FUNCTION 1
 270  J1=(A1/(A2*A3))*U^I*(1-U)^(N-1)
 280  FOR J=0 TO M
 290  X=M:GOSUB 900:B1=FH
 300  X=J:GOSUB 900:B2=FH
 310  X=(M-J):GOSUB 900:B3=FH
 315  REM ** BLENDING FUNCTION 2
 320  K1=(B2*B3)*W^J*(1-W)^(M-J)
 325  REM ** STORE VERTICES
 330  S(C,W1)=S(C,W1)+B(I+1,J+1)*J1*K1
 340  NEXT:NEXT:NEXT:NEXT:NEXT
 350  RETURN
 370  REM ** NOTE, FOR MACHINES OTHER THAN APPLE
      HGR=HIGH RESOLUTION GRAPHICS MODE
      HPLOT X,Y POSITIONS GRAPHICS CURSOR AT X,Y
      HPLOT TO X,Y DRAWS VECTOR FROM CURRENT POSITION TO
      NEXT X,Y CO-ORDINATES
 390  REM ** CONNECT VERTICES
 400  N=1:W=0:HGR
 405  HCOLOR=3
 410  X=S(1,N):Y=S(2,N)
 420  HPLOT X,Y
 430  FOR J=1 TO P
 440  HPLOT TO S(1,N),S(2,N)
 450  N=N+1:NEXT:IF N>=W1 THEN 470
 460  GOTO 410
 470  W=W+1:N=W:X=S(1,N):Y=S(2,N):HPLOT X,Y
 480  FOR J=1 TO P
 490  HPLOT TO S(1,N),S(2,N):N=N+P
 500  NEXT:IF W>=P THEN RETURN
 510  GOTO 470

 900  IF X=0 THEN FH=1:RETURN
 910  Y=1
 920  Y=Y*X:X=X-1
 930  IF X=0 THEN FH=Y:RETURN
 940  GOTO 920
1000  GOSUB 10
1005  PRINT "FINISHED SURFACE GENERATION"
1010  GOSUB 2000
1015  PRINT "FINISHED POLYGON DEFINITION"
1020  GOSUB 4000
1025  PRINT "FINISHED PRIORITY ORDERING"
1030  GOSUB 6000
1035  PRINT "FINISHED DISPLAY"
1037  PRINT "PROGRAM TERMINATED"
1040  END
1999  REM ** ROUTINE TO DEFINE POLYGONS
2000  C=0:Z=0
2010  FOR J=1 TO P-1
2020  FOR H=1 TO P-1
2030  Z=Z+1
2040  PX(Z,1)=S(1,C+H)
2050  PY(Z,1)=S(2,C+H)
2050  PZ(Z,1)=S(3,C+H)
2060  PX(Z,2)=S(1,H+1+C)
2065  PY(Z,2)=S(2,H+1+C)
2070  PZ(Z,2)=S(3,H+1+C)
2075  PX(Z,3)=S(1,H+1+P+C)
2080  PY(Z,3)=S(2,H+1+P+C)
2085  PZ(Z,3)=S(3,H+1+P+C)
2090  PX(Z,4)=S(1,H+P+C)
2095  PY(Z,4)=S(2,H+P+C)
2100  PZ(Z,4(=S(3,H+P+C)
2110  MAX=1000
2120  FOR K=1 TO 4
2130  IF PZ(Z,K)<MAX THEN MAX=PZ(Z,K)
2140  NEXT K
2150  PC(Z,1)=MAX:PC(Z,2)=Z
2160  NEXT H
2170  C=C+P
2180  NEXT J
2190  RETURN
2195  REM ** SORT VERTICES
4000  FOR B=1 TO Z-1
4010  F=0
4020  FOR C=1 TO Z-B
4030  IF PC(C+1,1)<=PC(C,1) THEN 4100
4040  T=PC(C,1):U=PC(C,2)
4050  PC(C,1)=PC(C+1,1):PC(C,2)=PC(C+1,2)
4060  PC(C+1,1)=T:PC(C+1,2)=U:F=1
4100  NEXT C
4110  IF F=0 THEN RETURN
4120  NEXT B:RETURN
4199  REM ** DISPLAY SURFACE
6000  FOR Q=1 TO Z:NO=PC(Q,2)
6010  HCOLOR=3
6020  HPLOT PX(NO,1),PY(NO,1)
6030  FOR J=2 TO 4
6040  HPLOT TO PX(NO,J),PY(NO,J)
6050  NEXT
6060  HPLOT TO PX(NO,1),PY(NO,1)
6070  MX=0:MN=280
6080  FOR J=1 TO 4
6090  IF PY(NO,J)>MX THEN MX=PY(NO,J)
6100  IF PY(NO,J)<MN THEN MN=PY(NO,J)
6110  NEXT J
6120  FOR J=1 TO 4
6130  WX(J)=PX(NO,J)
6140  WY(J)=PY(NO,J)
6150  NEXT J
6160  WX(5)=PX(NO,1):WY(5)=PY(NO,1)
6170  MX=MX-1
6175  IF MX=MN THEN 6270
6190  B2=MX
6200  GOSUB 7000
6210  HCOLOR=0
6220  IF WX(1)<WX(2) THEN 6250
6225  REM ** APPLY BACKGROUND COLOUR
6230  HPLOT WX(2)+1,WY(2) TO WX(1)+S2,WY(1)
6240  GOTO 6170
6250  HPLOT WX(1)-S2,WY(1) TO WX(2)+S2,WY(1)
6260  GOTO 6170
6280  NEXT Q
6290  RETURN
7000  W=0:T=0
7010  FOR H=1 TO 4
7015  REM ** CALCULATE INTERSECTION OF LINES
7020  IF WX(H+1)=WX(H) THEN X=WX(H):GOTO 7060
7030  A1=(WY(H+1)-WY(H))/(WX(H+1)-WX(H))
7040  B1=A1*-WX(H)+WY(H)
7050  X=(B2-B1)/A1
7060  Y=B2
7070  IF (X<=WX(H) AND (X>=WX(H+1)) OR (X<=WX(H+1) AND
      (X>=WX(H)) THEN W=W+1
7080  IF (Y<=WY(H) AND (Y>WY(H+1)) OR (Y<=WY(H+1) AND
      (Y>=WY(H)) THEN W=W+1
7090  IF W<>2 THEN 7150
7100  FOR J=1 TO T
7110  IF NX(J)=X AND NY(J)=Y AND T>1 THEN RETURN
7120  NEXT J
7130  T=T+1
7140  NX(T)=X:NY(T)=Y
7150  W=0
7160  NEXT H:RETURN

8000  DATA 8,28,1,56,158,3,88,7,6,260,28,1
8010  DATA 216,158,3,184,7,6,260,28,1,216,158,3,184,7,6
```

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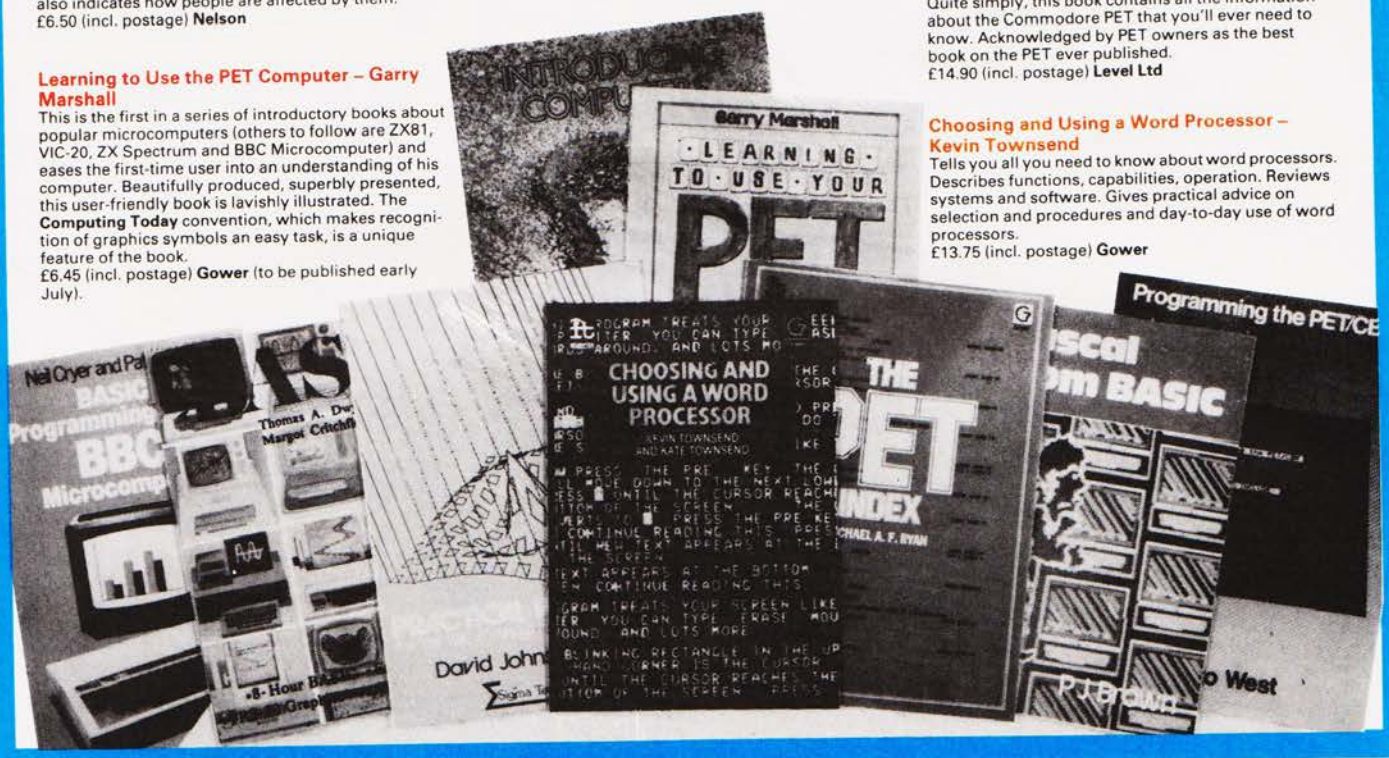

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6 82/

Don't let its size fool you.

If anything NewBrain is like the Tardis.

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NEWBRAIN

A P Stephenson

Continuing our series on the ins and outs of computer interfacing, we look at the subject of analogue information.

The integrated circuit known as the Operational Amplifier has become the general dogsbody of electronic circuitry. Wherever there is a need for voltage or current amplification in any part of a circuit, a modern designer will use discrete transistors only as a last resource.

An op-amp is a very high gain (typically approaching a million to one) voltage amplifier. There is a choice of two inputs depending on whether the amplified output is to be inverted or not. Thus, if the non-inverting input is grounded and the signal is applied to the inverting input, the output is upside down . . . and vice versa.

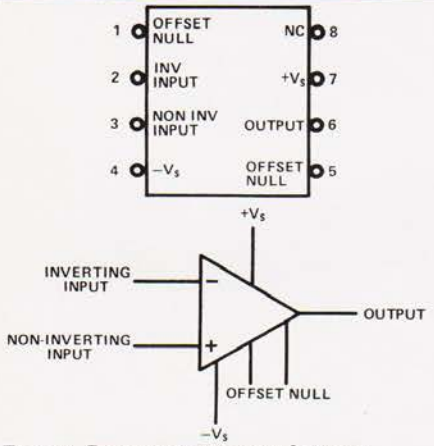

Fig. 14. Pin connections and circuit symbol for the 741 op-amp.

An op-amp is a very high gain (typically approaching a million to one) voltage amplifier. There is a choice of two inputs depending on whether the amplified output is to be inverted or not. Thus, if the non-inverting input is grounded and the signal is applied to the inverting input, the output is upside down . . . and vice versa.

The device can be used with balanced power supplies, say, + 15V and − 15V each with respect to earth, but the power supplies can be as low as 4 V if necessary. The terminals marked 'offset null' can be used to balance the output to zero volts if both inputs are strapped and grounded. To use op-amps to their full potential demands much study of the data sheets and details beyond the intended scope of this article. However, the following treatment should prove adequate for simple applications.

Feeding Back

A gain of about a million sounds very nice but can be very unwieldy in practice — a few microvolts input could overload the output! To get rid of this surplus gain, the op-amp is normally used with a negative feedback loop from the output back to the inverting input. (If the feedback were taken to the non-inverting input, the gain would be *increased* to the point of self-oscillation.)

In return for the reduced gain, negative feedback bestows many virtues including a stable and predictable gain and an increased bandwidth. Figure 15 shows an inverting amplifier using feedback.

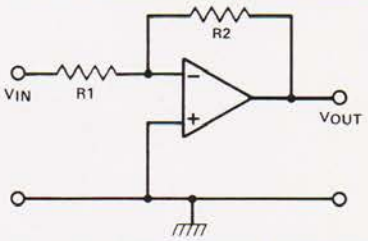

Fig. 15. The op-amp wired as a inverting amplifier.

The feedback via R_2 reduces the gain and leads to a surprisingly simple equation for what is called the closed loop gain (A'). To find the close loop gain we use:

$$A' = R_2/R_1$$

The signal V_{IN} 'sees' the amplifier input as a load called R_{IN} which is the input resistance:

$$R_{IN} = R_1$$

Mixing It

Figure 16 shows how input voltages can be added and, if required, given individually chosen gains as well. This is achieved by noting the equation for the output voltage:

$$V_{OUT} = \frac{V_1(R_F/R_1) + V_2}{(R_F/R_2) + V_3(R_F/R_3)}$$

Supposing the resistors to be equal, the equation simplifies to:

$$V_{OUT} = V_1 + V_2 + V_3$$

illustrating the ability of the network to ADD.

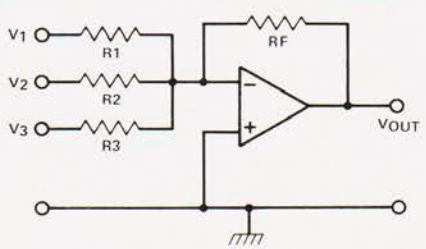

Fig. 16. How to make an 'adder' (mixer) using an op-amp.

Figure 17 shows the idea behind the construction of a A/D converter which can accept a four-bit binary word in and produce an output voltage analogue proportional to it. The values have been chosen for simplicity rather than for practical design.

To aid comprehension, assume the binary inputs are 1 V = logic '1' and zero volts = logic '0'.

The binary input marked '8' has been given a gain of 8.

The binary input marked '4' has been given a gain of 4.

The binary input marked '2' has been given a gain of 2.

The binary input marked '1' has been given a gain of 1.

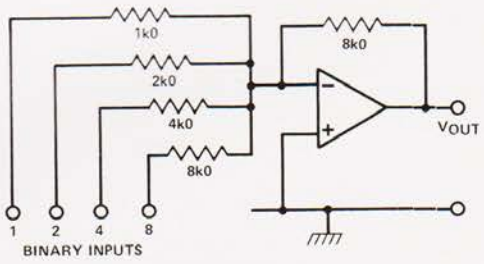

Fig. 17. The device can be configured as a simple four-bit digital to analogue converter.

From previous equations, it follows that:

1111 in will give 15 volts out.
1000 in will give 8 volts out.
0001 in will give 1 volt out.

For an eight-bit D/A converter, there would be eight input resistors with values chosen to preserve the normal binary 'weighting'.

It would be fair to mention at this point that few practical D/A converters use this kind of circuit exactly as drawn — in practice, the

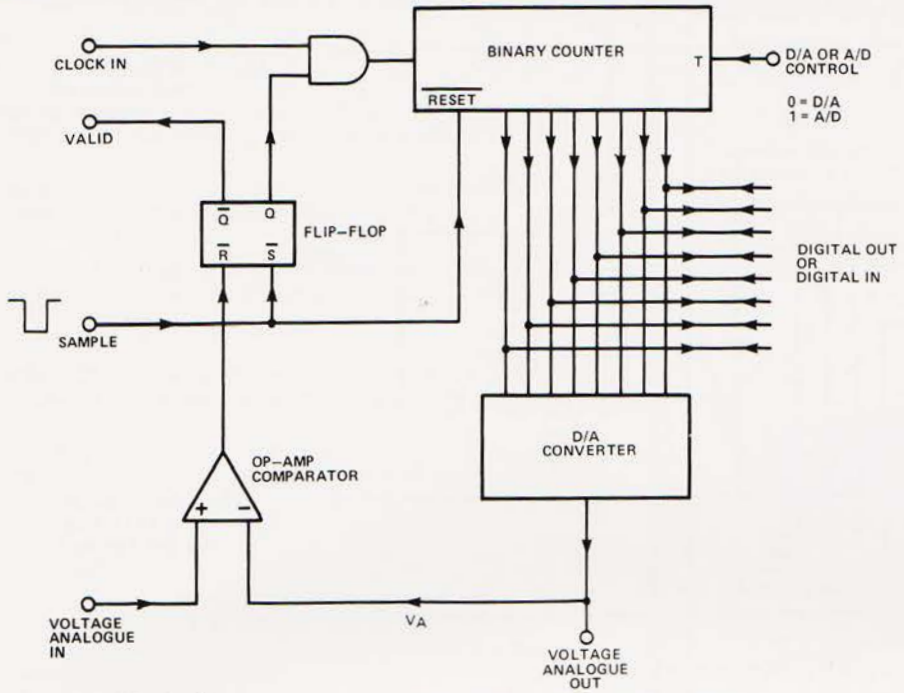

Fig. 18. The block diagram of a dual function A to D and D to A device.

resistors are normally arranged in a special way known as a 'R-2R' ladder. However, apart from this variation, the principle is basically the same.

Conversions

Figure 18 illustrates the idea behind a popular chip, the Ferranti 425E, which can be used as either a D/A converter or an A/D converter.

As a D/A converter: The control marked T (Tristate), is held a '0' which effectively disconnects the counter from its binary outputs. This leaves the binary inputs free to enter the D/A converter and develop the analogue output. The remainder of the circuit is unused.

As an A/D converter: The T terminal is now held at '1' to energise the counter outputs.

On receipt of a negative-going sample pulse, the counter is reset and the AND gate is enabled by the flip-flop going to 'set'. The clock pulses now enter the counter. The D/A converter produces an analogue output voltage, V_A, which 'grows' until it equals the input analogue voltage. The op-amp comparator switches over to the other side and resets the flip-flop. The AND gate is now disabled and the clock extinguished. The digital outputs now reflect the analogue input voltage and the 'Valid' line goes High.

On receipt of any future sample pulse, the sequence repeats to produce an up-dated digital version of the analogue input.

Comparisons

In case the op-amp comparator is a bit of a mystery, bear in mind that if signals are simultaneously applied to both inputs the output must go to zero volts... because one signal is trying to pull ***down*** and the other to pull ***up***. The output thus goes into a state of dispair and produces nothing. Because of the enormous gain without feedback, the slightest difference (even a few microvolts) is enough to swing the output away from zero. Thus the device is a sensitive detector of exact equality between two signal levels.

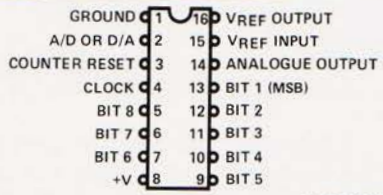

Fig. 19. The pin-out of Ferranti's ZN425E dual purpose converter.

Figure 19 describes the Ferranti ZN425E pin connections which is the practical version of the above A/D and D/A converter.

On The Buffers

If the usual negative feedback is applied to the inverting input but the signal is applied to the non-inverting input, the signal sees a higher input resistance. In other words, the load on the signal is lighter and therefore less likely to degrade the signal quality or its stability. Figure 20 shows the arrangement.

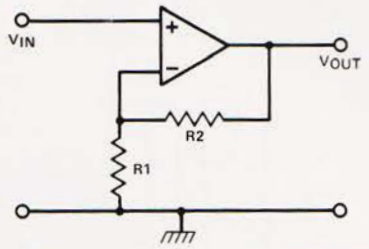

Fig. 20. How to wire up an op-amp as a straight amplifier.

The equation for closed loop gain is similar to that of the inverting amplifier only it is slightly higher by a factor of one. For example:

$$A' = R_2/R_1 + 1$$

If both resistors are the same the gain A' would be two, although the trivial increase in gain would never be the deciding factor if faced with a choice of inverting or non-inverting.

The main use of the circuit is for amplification ***without*** signal inversion and to act as a 'buffer' between signal source and load. Many integrated circuits, although capable of producing sophisticated results, can only deliver tiny currents at their output circuits. A buffer, such as the circuit in Fig. 20, can be interposed between source and load to improve the current delivering properties. Notice from the equation that if R_2 is made a variable, the gain will ***increase*** as we increase R_2.

Using the Ferranti 425 in a practical circuit will employ an external non-inverting amplifier in order both to buffer the output and allow calibration.

Figure 21 uses the ZN425E with its analogue output (pin 14) buffered by a 741 op-amp used in the non-inverting mode. This arrangement allows two important preset calibration adjustments to be made prior to operation. To calibrate the 'zero' state, the binary inputs are all grounded (00000000) and the 'set zero' adjustment twiddled until the op-amp output reads zero volts (with respect to ground). This relies on the pins 1 and 5 (the 'offset-null') across the 1K pot with the slider connected to the −5 V supply.

The binary inputs are now freed from ground allowing them to float

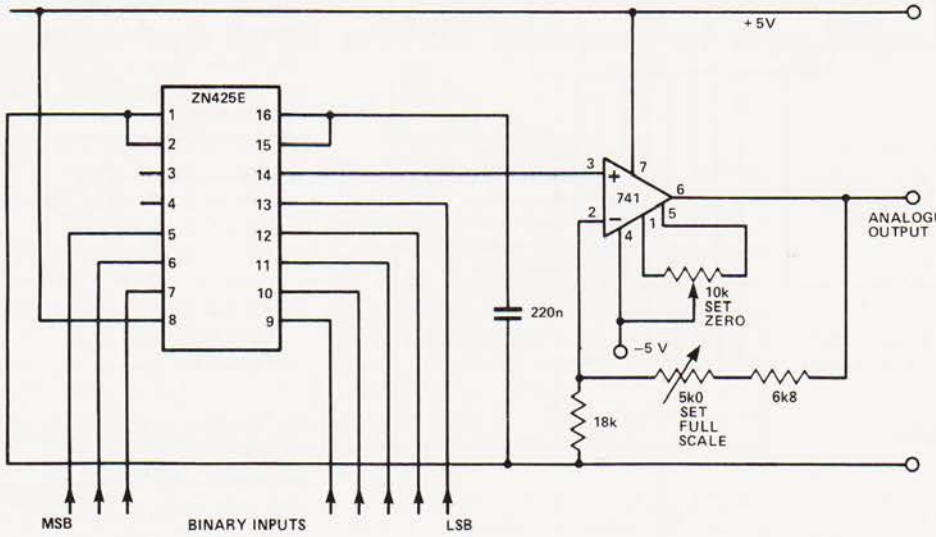

Fig. 21. A practical D to A converter circuit...

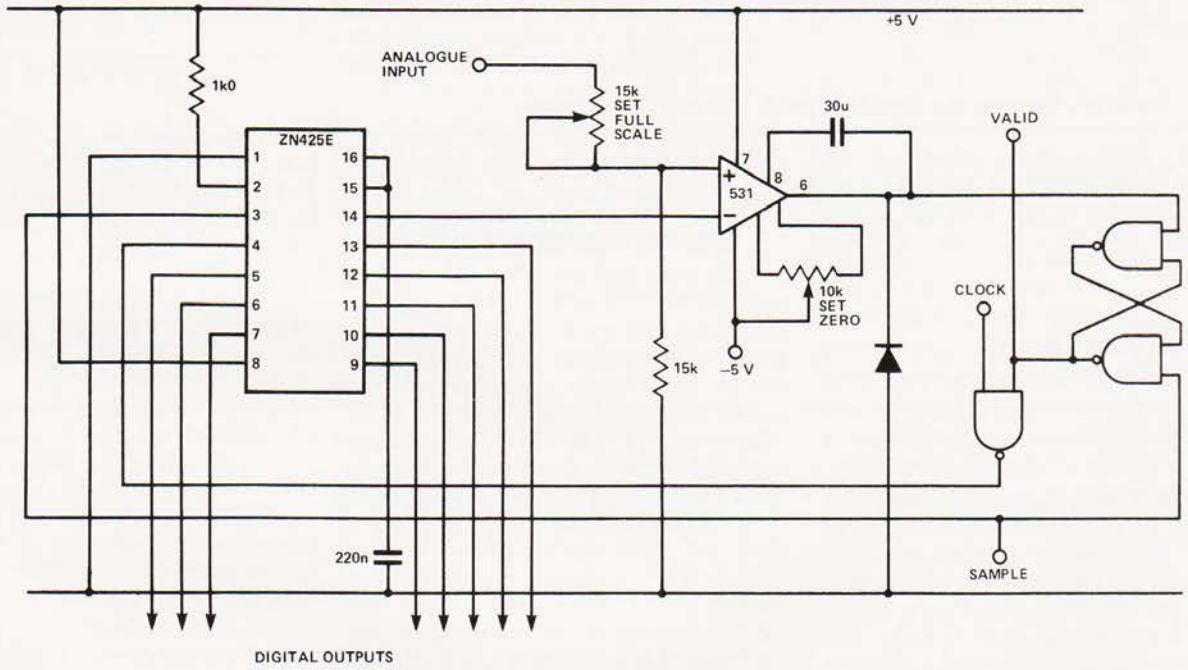

Fig. 22. ...and its converse A to D. Both use the Ferranti device.

high (11111111). The feedback, and hence the gain, is then adjusted altering the 5K resistor in the feedback loop until the output reaches the 'desired value'. The desired value is obviously optional but whatever the choice, this will present 11111111 or 255 decimal. It is convenient arithmetically to adjust to 2.55 volts representing a scaling factor of 10 mV per binary bit.

Notice that pin 2 on the ZN425E is grounded because the counter is not required. Note also that pins 15 and 16 are strapped together and decoupled to ground via the 220 nF capacitor. Pin 16 is the output of the internal stabilised voltage V_{ref} and pin 15 is the input pin requiring a reference voltage to supply the resistor ladder network. In most cases the internal V_{ref} is quite suitable so it is simply returned back.

Figure 22 shows the faithful ZN425E is used again but the op-amp chosen is the 531 which has been optimised to function as a voltage comparator. To understand the action of this circuit, it is better to refer back to the simplified diagram in Fig. 18. Notice that the flip-flop uses a pair of cross-strapped NAND gates. Also, that pin 2 on the ZN425E is this time connected to the high rail (5 V supply rail) to enable the counter outputs.

The conversion commences with a negative-going edge on the sample pin which sets the flip-flop and allows the clock pulses to enter the counter. Until the counter has climbed to the required level, the analogue input voltage holds the comparator output voltage high. The counter will eventually cause the voltage on pin 2 of the comparator to rise *just* a fraction higher than pin 3. The comparator output will then swing violently downwards towards zero volts resetting the flip-flop which extinguishes the clock; the holding count will now determine the valid binary output. The resetting of the flip-flop also causes the Valid pin to go low which informs the computer accordingly. The diode across the comparator output and ground prevents the output swinging negative.

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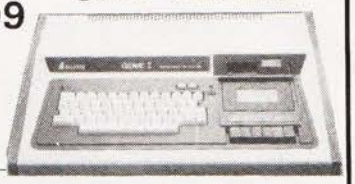

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VALLEY VARIATIONS

Andrew Bain

We always intended that The Valley should be an ongoing project, software-wise. This month, we present one man's view of the game and its variations.

I recently programmed your real-time Adventure game, 'The Valley', into my Sharp MZ-80K, and discovered one or two possible deficiencies in the program as published. It is, for instance, possible to leave a Temple or Lair having failed to 'come up with the goods', and then to re-enter immediately to find the thing sought. Having announced your presence there, I should imagine that any self-respecting Lord of Evil would cause it to vanish, rather than allow you back for a second visit!

Another point is that the code for the 'Circle of Evil' causes an increase(!) in combat strength. To a hardened adventurer like me, that goes very much against the grain, as does the lack of a dramatic ending. When the hero returns to the Safe Castle with the Helm, the program just says, 'Wilt thou leave the valley?', as it has done several times before. What it needs is some great (albeit visual) fanfare, that *you* have finally made it.

So, I have made some amendments to the original source which I would like to pass on to fellow players. And, since nothing happens in Adventures without some reasonable explanation, I have concocted a little scenario of my own to explain the changes...

THE VALLEY

It is now several months since I, Alarian, returned to the Valley and discovered it once again under the spell of Vounim, Prince of Darkness. Since then, I have seen many brave young Tybolleans ride out against Him. Some have returned to be refreshed and revitalised, all of them wide-eyed at the magical and mystical things they have seen, full of tales of battles fought and monsters slain. Then, snatching only a quick respite, they return eagerly to the fray. Although several of them returned more than once to the sanctuary of the Castle, few have succeeded in the quest.

In all this time though, I have not been idle. Apart from protecting those who ride for me, by my persuasive oration, I have won over the Sprites that inhabit the Marsh grasses around the Temples of Y'Nagioth to our cause. They now watch over my apprentices as they ride by, protecting them from the surrounding Evil. And I, myself am striving daily to perfect a spell of Banishment to assist my trainees in their quest.

Vounim has, however, been busy too! He cannot have failed to notice the stream of people riding out of this Castle aginst Him, and has sought to kill many of them by a spell of Vanishment. This he cast several times, causing a Temple or Lair to vanish with my followers inside. I can cast a holding spell against this, but it only lasts long enough to allow the endangered person to escape from the building. I cannot manage better than this, as my power is greatly diminished and I fear that the recent effects of Vounim's 'Circles of Evil' demonstrate this only too well. Where once in these Black Magic Rings I was able to turn a Psychic loss into a gain in Combat Strength, I am no longer able to do it and these 'Circles of Evil' sap both Strength and Psi alike.

While this may serve to make their task more difficult, I submit that it still does not render it impossible. And with the Marsh Sprites to watch over my novices, I am able to concentrate my dwindling powers where they are most needed: in guiding those who make it through the Swamps into the more sinister regions of the Black Tower, and even into the very Lair of Vounim, the Evil One himself. With that working for us, who can doubt that we must eventually win.

Program Changes

The inclusion of the following line turns the 'Tufts' in the Swamps into a form of 'Safe Ground'. This allows novices to find their feet before they enter the rigours of the first major stage of the game:

```
2205  IF PK=45 THEN DF=5:GOTO 2250
```

Amending line 12210 to read as follows, causes the Temple or Lair to vanish as soon as the player exits:

```
12210  IF Q1=104 THEN M=MW:W=M:PRINT
       "[HOM]";D2$;R2$;"[3 CD][2 CR]
       [SPC]":REM ** WIPE LAIR ON EXIT
```

In my version, I have included an array of Rating Classification texts, which are loaded from DATA at the start, and I have also amended the 'EGO' code such that line 45030 becomes:

```
45030  PRINT "Your Rank Is ";RT$(RT)
```

Including the next block of code causes the program to produce a rather dramatic ending, if you return to a Safe Castle with the Helm:

```
48015  IF T(2)=1 THEN DF=50:GOSUB
       36000:GOSUB 45000:GOSUB 49000

49000  REM ** DRAMATIC ENDING
49010  PRINT "[CLS]I, the Wizard
       Alarian, pay tribute to [CD]"
49020  PRINT "the skill of ";J$;" the
       ";P$
49030  PRINT "[CD]Thou hast returned
       the Helm of Evanna[CD]"
49040  PRINT "to its rightful place in
       her castle.[CD]"
49050  PRINT "[3 SPC]By this act, thou
       hast defeated[CD]"
49060  PRINT "[9 SPC]Vounim, The Evil
       One[CD]"
49070  PRINT "[SPC]and ensured the
       safety of The Valley[CD]"
49080  PRINT "[11 SPC]F O R E V E R !
       [2 CD]"
49090  GC$=J$+",[SPC]"+RT$(RT)
49100  PRINT SPC(INT((38-LEN(GC$))/2))
       ;GC$;"[2 CD]":END
```

The next line may be added as an extra option:

```
49085  PRINT "[4 SPC]I salute you, and
       proclaim you[CD]"
```

New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

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Games

Cassette G1: Super Programs 1 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
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Cassette G3: Super Programs 3 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess, Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?

Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Events in British History. British Monarchs.
Description – From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Addition/Subtraction. Multiplication/Division.
Description – Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Composers. Musicians.
Description – Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Inventions 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Inventions before 1850. Inventions since 1850.
Description – Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series – Spelling 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Series A1-A15. Series B1-B15.
Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Collector's Pack, plus blank tape or side 2 for program/data storage.
Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
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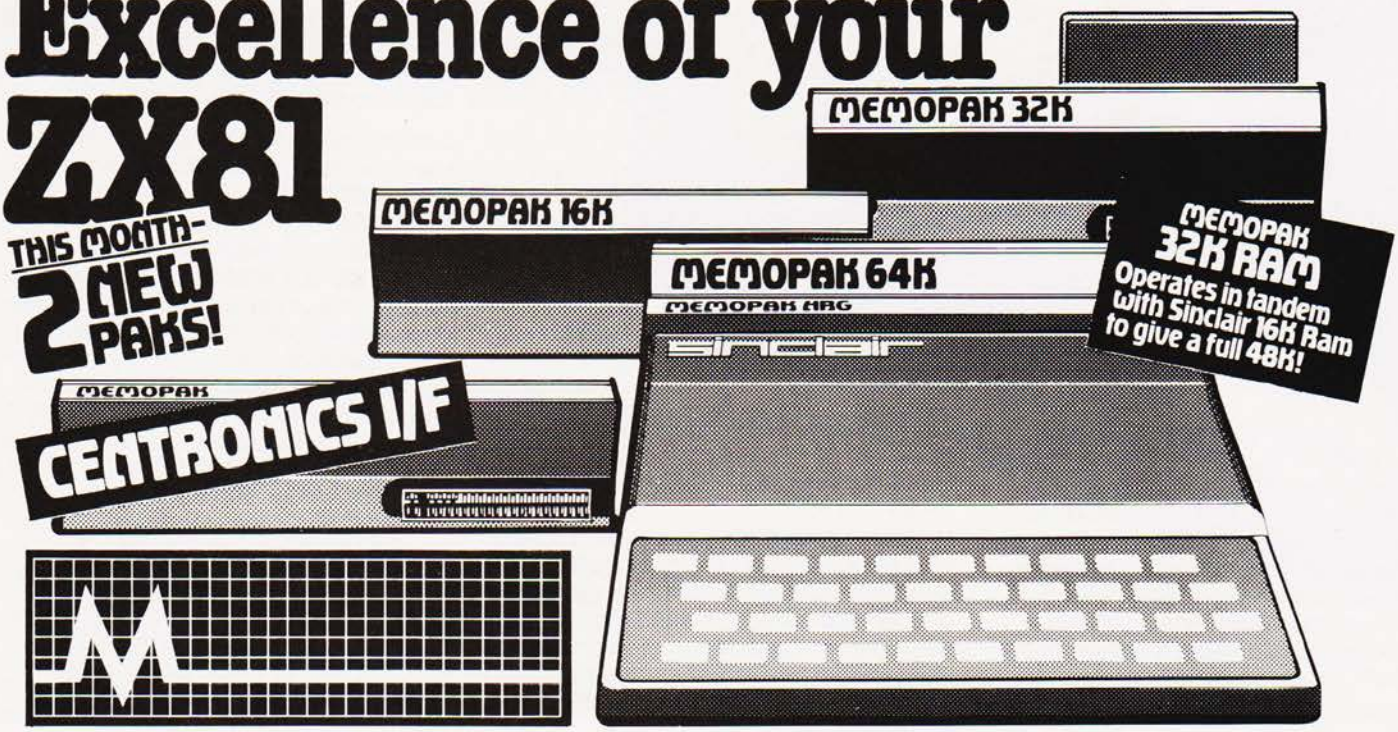

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THE ART OF DATA STORAGE

D S Peckett

If you really want to get more out of your micro then using it to store and recall information is one of the main areas to tackle. We show you how to go about it in this new series.

This is the first of three articles in which I will take a close look at ways of using cassette tape more effectively as a microcomputer data storage medium. Although cassettes are the standard way of storing data for small micros, their effective use is an area which has not received a lot of attention. Many micro handbooks are unjustifiably weak on the topic but, by the end of this series, I will have provided you with a number of tools which, when combined, will help you to solve particular problems.

Wherever possible, the series will not be specific to any particular micro in order to provide the most useful information. However, since I use a Video Genie, some of the information will inevitably be biased to the Level II BASIC of the Genie and TRS-80. In some ways, this may not be such a bad thing since these computers are among the worst around when it comes to effective data storage; if you know how to solve their problems, most other computers should be pieces of silicon cake!

Problems Of Cassette Storage

A good place to start is the beginning, and in this case that means looking at just why cassettes are so widely used, and at some of their characteristics.

Cassettes are used because most small personal computers — the sort you might have in your home rather than your office — generally come with cassette facilities as standard. Failing that, the interface is there and all you have to do is provide a cassette machine as a not-so-optional extra if you want to save programs and/or data. Why are they provided on small micros? That's easy — because they are cheaper than any other long-term program and data storage medium. Compare the cost of a reasonable cassette drive (£25?) with that of floppy disc mechanisms, which cost from £250. Don't forget that to use the disc you will probably also require extra memory, a disc interface and a Disc Operating System (DOS) — total cost, say another £300.

Cassettes themselves are also very cheap in terms of storage capacity when compared with other possibilites. A standard C60 cassette, used with a common micro, can store around 225K; that's around the same volume as a typical mini-floppy disc for maybe a quarter of the price.

Of course, we all know of, and are often frustrated by, the fact that tape has disadvantages. The main ones are that tape is slow and that it only provides sequential storage.

In terms of speed, not many tape systems can transfer data at much more than 200 characters per second whereas a decent disc system can read and write at around 20,000 characters per second — a 100:1 speed advantage. To put that in perspective, and allowing for DOS overheads, a good tape system can load a 16K program in 80 seconds, while an average disc system should load the same program in around 3-5 seconds.

The fact that tape is a sequential storage medium only becomes apparent when we start to store more than one program or set of data on a single cassette. Unless we know roughly where on the tape a particular item of data is, and can find it via a tape counter, the computer must start at the beginning and search all the way along the tape until it finds what it is looking for — this could take up to 45 minutes! (**The use of C90 cassettes is just about tolerable, C120s simply aren't worth the trouble they can cause. Better by far to stick to special C12 or C15 tapes. Ed.**) A disc system, on the other hand, is like an ordinary LP record. Just as you can set the pickup arm directly to track 5, the computer can set the floppy disc's read head directly to the position of the data or program it needs. Disc read time is therefore almost independent of where on the disc the information is stored; for this reason, we call discs 'random-access' devices.

At home, however, there is not usually the sort of pressure which demands virtually instantaneous access; after all, computing is meant to be a hobby! We can often position the tape by hand in order to read in a particular program, or organise a set of data so that the micro can read it in the order in which it is needed. Problems arise, however, when we cannot predict what data the program will need and when it will need it.

With a random-access system, there is little difficulty — the system goes straight to the data. With tape, however, unless the next item(s) of data are physically after the last one(s), we cannot leave the computer to find information as it needs it. We have to manually rewind the

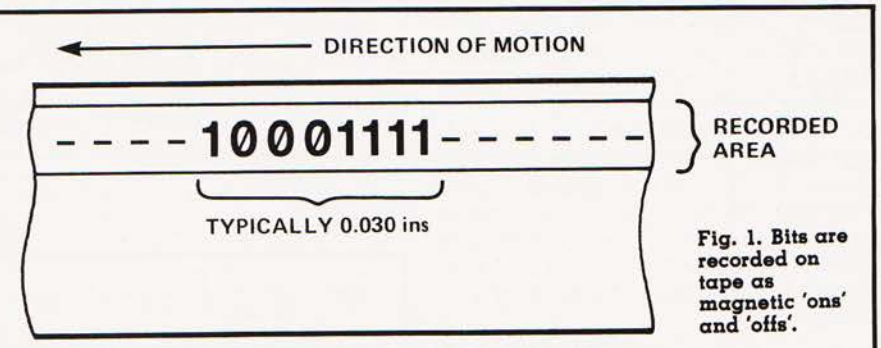


Fig. 1. Bits are recorded on tape as magnetic 'ons' and 'offs'.

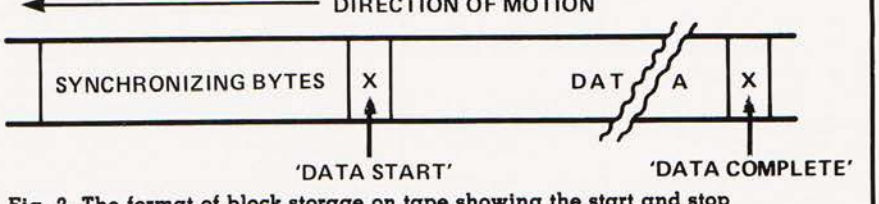


Fig. 2. The format of block storage on tape showing the start and stop information.

tape to the correct point, as instructed by the program. This is, of course, a fundamental limitation of any sequential storage medium. Although there are relatively low-cost alternatives, such as the Aculab 'Floppy Tape', there is really little to beat the disc, in its various guises, for random-access.

Data Storage On Cassette

First, though, let's take a look at just how the data is physically recorded on to the tape. Information is stored in a totally sequential manner; Fig. 1 is an impression of a single byte with value 8F Hex (143 decimal or 1000 1111 binary) stored on tape. What can we see? First of all, the data only occupies half of the width of the tape — cassette drives for cheap computers are standard domestic mono machines and so use the mono recording format. Next, and more importantly, the data is stored bit-by-bit, with the Most Significant Bit (MSB) first. The way in which the 1s and 0s are actually coded on the tape is beyond this series and, in any case, virtually every computer is different.

That then, is the storage of a single byte. Figure 2 shows how a single block of data may be stored on tape. There are four distinct parts: the first is an identifying sequence, containing no data, but is needed to give the computer something to lock onto and to stabilize its circuits before it starts reading the data. The second item is a single byte, or more likely a group of a few bytes, identifying the start of the data area. Then comes the data itself, followed by another distinctive byte or group of bytes to indicate that all the data has been transferred and that the computer should stop reading and switch the drive off.

Virtually all computer systems use this sort of scheme, although the details obviously differ from machine to machine. As an example, TRS-80 and Video Genie use the following format for DATA tapes (other sorts of tapes have other formats):

a. 255 bytes, each of value zero, as a synchronizing leader.
b. A single byte of value A5 Hex to mark the start of the data.
c. The data itself, with individual items separated by ASCII commas (2C Hex).
d. A single Carriage Return character (0D Hex).

The Level II data block itself can contain a maximum of 249 bytes, including any commas used as separators.

It is important to realise that this format is always used for data tapes, whether the data is just one byte or the full allowance of 249 bytes. Every time a block of data is written to tape, there is an automatic overhead of 257 bytes of leader, sync bytes, etc. At the system's standard 500 baud transfer rate, this overhead takes approximately four seconds to write. (A 'baud' rate is a measure of how fast data is sent along a communications link — for our purposes, it is the same as 'bits/sec'; ie '500 baud' means 500 bits/sec.) The TRS-80 Model III has a faster data transfer rate of 1500 baud, but still uses the same format. (**Note that the terms baud and bits per second are not necessarily synonymous. Ed.**)

You can see that, even if we use the full 249 byte allowance every time, only 49.2% of the tape actually contains data. In the worst case, writing single bytes to tape only, 99.6% of the tape is full of material that actually contributes nothing to what we are trying to save. Our first thoughts on making a more effective use of tape for data storage should obviously concern the reduction of this overhead.

Unfortunately, the Level II data rate and tape format, like those used by all micros, are controlled by the computer's operating system and are normally buried in the depths of the micro's ROM. The only way to alter them is to delve into the system's machine code, writing new cassette read and write routines to suit your particular purposes. For most people, this sort of solution is not realistic, and so we have to put up with whatever the computer's designers have deemed appropriate.

If we want to make more effective use of tape storage, the only way is to get as much data as possible into each block we write. That, in turn, means using the full allowance (249 bytes in this case remember) and packing whatever we are trying to save into that allowance as efficiently as possible. In the next part of this series I will take a look at how to pack numbers onto tape, but for now we will stick to string storage only.

Efficient String Storage

Suppose that we have a program which handles lists of one sort or another — a simple data base system to keep a record of who sent you Christmas cards last year, say. In a case like this, the strings representing the data will probably be stored in an array — call it DT$(). The easiest way of storing that data on tape is by a routine of the form:

```
 9999  REM ** STORE DATA TO TAPE
10000  FOR I=1 TO N:REM ** N ITEMS
10010  PRINT#-1,DT$(I)
10020  NEXT
10030  REM ** CONTINUE
```

```
 9999  REM ** PACK MULTIPLE STRINGS INTO A SINGLE STRING
       ON TAPE
10000  Z1=LEN(DT$(1)):REM ** GET LENGTH OF EACH ITEM
10010  Z2=INT(249/Z1):REM ** HOW MANY CAN WE PACK?
10020  FOR Z3=1 TO N STEP Z2
10030  ZA$="":REM CLEAR DUMMY STRING
10039  REM ** ENOUGH TO FILL THE STRING?
10040  IF (N-Z3)>Z2 THEN Z4=Z2 ELSE Z4=N-Z3+1
10050  FOR Z5=Z3 TO Z3+Z4-1:REM ** LOOP Z4 TIMES
10060  ZA$=ZA$+DT$(Z5):REM ** PACK DUMMY STRING
10070  NEXT Z5
10080  PRINT#-1,ZA$:REM ** SAVE PACKED STRING
10090  NEXT Z3:REM ** DO IT AGAIN
10100  RETURN:REM ** DONE
```

Listing 1.

```
10999  REM ** UNPACK MULTIPLE STRINGS FROM A SINGLE ONE
       STORED ON TAPE
11000  Z1=[LENGTH OF EACH ITEM]:REM ** GET ITEM LENGTH
11010  Z2=INT(249/Z1):REM ** HOW MANY IN EACH TAPE STRING
11020  Z3=INT(N/Z2+0.9999):REM ** NO OF BLOCKS ON TAPE
11030  FOR Z4=0 TO Z3-1:REM ** LOOP Z3 TIMES
11040  INPUT#-1,ZA$:REM ** THIS IS A LEVEL II COMMAND
11050  Z5=LEN(ZA$)/Z1:REM ** NO OF ITEMS IN THIS STRING
11060  FOR Z6=1 TO Z5
11070  DT$(Z4*Z2*Z6)=MID$(ZA,((Z6-1)Z1)+1,Z1):REM **
       EXTRACT DATA
11080  NEXT Z6
11090  NEXT Z4
11100  RETURN:REM ** DONE
```

Listing 2.

THE ART OF DATA STORAGE

Unfortunately, like most 'easiest ways', this routine is a very inefficient. Why? Because every time we use PRINT # −1, . . .a new 255-byte header, etc, is written to tape. Certainly, the data is saved, but most of the bytes actually on the tape are of no direct use to us. We have to find a way of packing the data onto tape as fully as possible.

There are two options here:

a. If every item of data has the same length.
b. If each data item's length is unpredictable.

Packing Uniform Data

The very easiest case arises when we know at the time of writing the program how long each data string will be. Suppose that we know we can pack 'P' items into 249 bytes, we can thus modify the program fragment above to become:

```
 9999  REM ** STORE DATA TO TAPE
10000  FOR I=1 TO N STEP P:REM ** N
       ITEMS
10010  PRINT#-1,DT$(I),DT$(I+1),...,
       DT$(I+P-1):REM ** SAVE P ITEMS
10020  NEXT
10030  REM ** CONTINUE
```

We simply modify the PRINT # −1, to include the correct number of data items.

That's too easy though. Let's stick with the fixed-size data strings, but assume that the size is actually fixed by the program. This means that we cannot define in advance the number of items we will write. That, in turn, means we cannot use a multiple-item statement like that in line 10010 above, but must write a single string, as near to 249 bytes long as possible, to tape each time. Listing 1 is a subroutine to do just that job. It should be clear how it works and, like all the subroutines I will present in this series, it uses variables beginning with 'Z' as 'local variables'. If you avoid Z-variables elsewhere, you can use my offerings in your own programs.

The only significant point to note in the listing is line 10040, which makes sure that there are enough strings left to completely fill ZA$. If there are not, it forces a reduced-length final save; in this way, we avoid trying to access possibly non-existent positions in DT$() at line 10060.

That's good — we are saving data to tape as effectively as we can. How do we get it back again? Listing 2 is the answer. Again, the listing should be fairly clear. Line 11020 extracts the total number of reads from tape which the routine must make; it should work correctly unless there are more than 1000 items on the tape. Line 11070 actually extracts the data; it uses the MID$() function, present in most Microsoft-type BASICs.

Variable Length Data

The sort of routines I have just described will do the job but sometimes we have to save strings of different, unpredictable lengths. Since the object of the exercise is still to make the best use of tape storage, we have to arrange to:

a. Fill up the available space as much as possible.
b. Not overflow the available space.
c. Recover the data afterwards.

Filling up the space is easy — simply measure the space available and see if the data string which comes next will fit. If it will, join it onto the 'tape' string we are preparing; if it won't, write what we have to tape and start a new tape string.

The problem comes when we have to get the data back afterwards. In this case, since we do not know how long each string is, we must read it one character at a time. In turn, this implies that we can identify the end of each item. I find the best way is to use a separator between each item; the separator must itself be a character, but one which is not likely to be in any of the data strings. A good one to use is CHR$(127), which is not normally found on micro keyboards.

With these constraints, look at Listing 3, which shows a way of saving variable-length strings to tape. The routine is, once again, straightforward. Z1 is used to keep track of how much space is available in the dummy string — its initial value is 248, not 249, to allow for the separator which will be at the end of the last item in each block of data written to tape. The code in lines 12110 and 12120 takes care of the fact that, when the routine leaves its main loop, there may still be some unwritten data because the final ZA$ was not full. It also checks to see if there is anything in ZA$ and, if there is, writes it to tape.

So, we have got the data onto the tape, all we have to do now is get it back again! Listing 4 is one solution to the problem. The key lines in this subroutine are:

13050, 13060. These lines look for a separator, and jump past the concatenation routine if one is found. Each character is read into the dummy ZP$ to speed up an in-

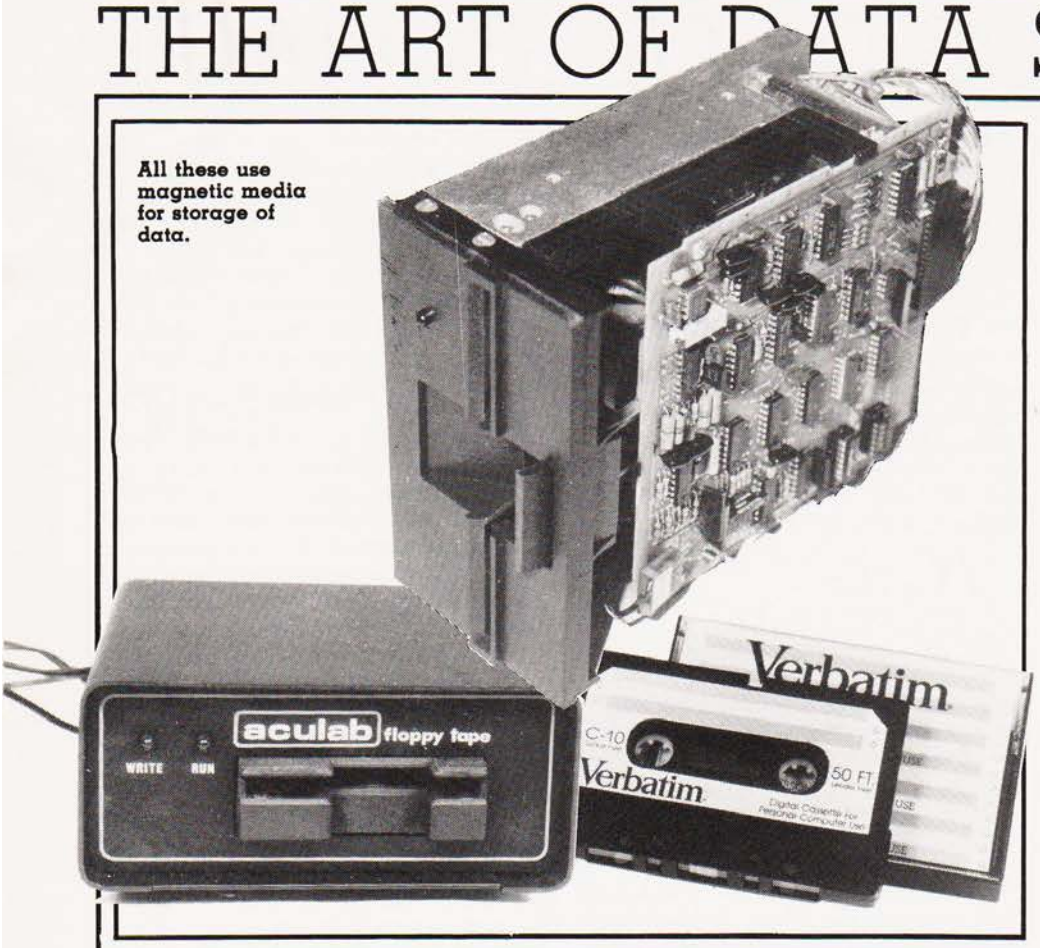
```
11999  REM ** PACK VARIABLE LENGTH STRINGS
12000  Z1=248:REM ** RECORD OF SPACE LEFT
12010  ZA$="":REM ** CLEAR DUMMY STRING
12020  FOR Z2=1 TO N
12030  IF LEN(DT$(Z2))<=Z1 THEN 12070:REM ** IS THERE
       ROOM?
12040  PRINT#-1,ZA$:REM ** NO ROOM - SAVE IT
12050  ZA$="":REM ** CLEAR IT AGAIN
12060  Z1=248:REM ** RE-INITIALISE COUNTER
12070  ZA$=ZA$+DT$(Z2)+CHR$(127):REM ** ADD DATA AND
       SEPARATOR
12080  Z1=Z1-LEN(DT$(Z2))-1:REM ** ADJUST COUNTER
12090  NEXT Z2:REM ** BACK FOR MORE
12099  REM ** AT END, SEE IF ANYTHING LEFT
12100  IF Z1=248 THEN 12120
12110  PRINT#-1,ZA$:REM ** THERE WAS - SAVE IT
12120  RETURN:REM ** DONE
```

Listing 3.

```
12999  REM ** UNPACK VARIABLE LENGTH STRINGS FROM TAPE
13000  INPUT#-1,ZA$:REM ** GET FIRST STRING
13010  Z1=LEN(ZA$)-1:REM ** HOW MANY CHARACTERS?
13020  Z2=1:REM ** POINTER TO CHARACTERS
13030  FOR Z3=1 TO N
13040  DT$(Z3)="":REM ** INITIAL VALUE
13050  ZP$=MID$(ZA$,Z2,1):REM ** CHARACTER POINTED TO
13060  IF ZP$=CHR$(127) THEN 13100:REM ** SEPARATOR?
13070  DT$(Z3)=DT$(Z3)+ZP$:REM ** ADD CHARACTER TO STRING
13080  Z2=Z2+1:REM ** INCREMENT POINTER
13090  GOTO 13050:REM ** GET ANOTHER CHARACTER
13100  IF Z2<Z1 OR Z3=N THEN 13140:REM ** IS THERE MORE
       TO READ?
13110  INPUT#-1,ZA$:REM ** IF SO, READ ANOTHER STRING
13120  Z1=LEN(ZA$)-1
13130  Z2=0:REM ** NEXT LINE WILL INCREMENT POINTER
13140  Z2=Z2+1:REM ** GO PAST START OR SEPARATOR
13150  NEXT Z3:REM ** GET NEXT DT$()
13160  RETURN:REM ** DONE
```

Listing 4.

THE ART OF DATA STORAGE



All these use magnetic media for storage of data.

```
19999  REM ** ADD 128 TO EACH CHARACTER IN ZA$
20000  Z8=128:REM ** CONSTANT
20010  ZB$="":REM ** NEW DUMMY
20020  FOR Z9=1 TO LEN(ZA$)
20030  ZB$=ZB$+CHR$(Z8+ASC(MID$(ZA$,Z9,1))):REM **
       ACTUALLY DO IT
20040  NEXT Z9
20050  ZA$=ZB$:REM ** RESTORE ZA$
20060  RETURN:REM ** DONE
```

Listing 5.

herently slow process.

13100. This line decides whether there is any more data in the existing ZA$ and if there is more data to read. If necessary, it forces another read from tape and re-initializes Z2 to 0.

13140. Line 13140 increments the pointer past the separator and advances the zeroed Z2s to their starting valeus of 1.

Problems

That looks pretty good but, in Level II BASIC at least, there are still two problems left. You will recall that we are trying to pack data into single, maximum-length strings and write them to tape. What happens if the data contains commas ',' or colons ':'?

The system treats these as input separators and, if it is looking for a single string (INPUT#−1,ZA$), stops as soon as it reads a comma or a colon. If that happens to be the fifth character of a 240-byte string, tough — you just get the first four characters, an 'EXTRA IGNORED' error message and a program crash!

The way out of this corner is to enclose ZA$ in quotes whenever it is written to tape. You can do this with code of the form:

```
PRINT#-1,CHR$(34)+ZA$+CHR$(34)
```

Quotes are represented by the ASCII code '34'. If you do this, the quotes will be written to tape (and so you only have 247 bytes to play with each time), but will not be read back. However, all the commas and colons will be read correctly.

Just a minute though — what if ZA$ itself includes a quote? The tape read operation will stop when it reaches the embedded quote and will never reach the terminating one. At best, this will ruin the data input but the most likely result will be another program crash.

There is a way out of this problem too. Forget about quotes — remember that we are saving characters in the form of strings. Usually, we will be saving the normal text characters which have ASCII values from 32 to 125. However, a byte can contain values up to 255. We can therefore offset each character in ZA$ by adding 128 to it before writing it to tape and stripping 128 from it when we read it back. This approach slows down the read/write routines, but it does allow us to save any normal character on tape.

How to do it? Listing 5 is a subroutine to add 128 to the ASCII value of each character in ZA$; if you insert GOSUB 2000 as line 10075 in Listing 1 and as lines 12035 and 12105 in Listing 3, that should do the trick.

To recover the data, there are two possibilities. If you are using the Listing 2 approach, use another subroutine with the format of Listing 1 but with line 20030 replaced by:

```
20030  ZB$=ZB$+CHR$(ASC(MID$(ZA$,Z9,
       1))-Z8)
```

If, however, you are using the variable-length record approach of Listing 4, the answer is rather easier. Simply re-write line 13050 as:

```
13050  ZB$=CHR$(ASC(MID$(ZA$,Z2,1))
       -128)
```

Remember that offsetting is slow. If you can guarantee no problems with commas, colons and quotes, don't use it.

Conclusions

And there we have it — ways of making the best use of tape storage for string handling. I've described subroutines to pack fixed- and variable-length strings to tape, and read them back again. Because of the way that Level II BASIC works, there is a great deal of fiddling about with individual characters in strings, which inevitably slows things down a bit. Nevertheless, it is still an advance on the 'obvious' approach of writing each item of data to tape in splendid isolation which wastes a lot of time and tape.

Next month, I will go on to look at ways in which numbers are stored in the computer, and how we can best store them on tape. As in this article, I will give a number of subroutines which can be adapted as you wish to suit your own requirements.

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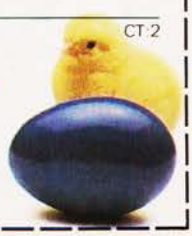

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Henry Budgett

Once again, Clive Sinclair has lit the fuse on his annual rocket under the computer industry. Will his ZX Spectrum turn out to be another flier or just a damp squib? We bring you the results of our review.

For the past two years, with a regularity like that of a good digital watch, Clive Sinclair has handed the microcomputer industry its annual Spring headache. As far back as last Autumn we had all guessed it had to be coming — the only subjects left dark were the name of the beast and its vital statistics.

Once again the last minute tales filtered through to the various magazines: it's got colour graphics; the damn cassette's not going to load ZX81 programs; something about miniature discs — but with an almost universal reluctance to be proved wrong once again, the stories were spiked. I first received firm word of the impending machine, with an almost uncanny accuracy too, from a certain 'well known' gentleman. Honour dictates that he should remain nameless as he was a little unsteady on his feet by the end of the evening . . . but the word was OUT!

Sadly I didn't make it to the ZX Spectrum's launch, that now annual gathering of almost everybody in the industry armed with loaded questions and ready notepads, but I gather it went according to the well established pattern. The main problem was obviously going to be getting my sticky little fingers on one before the rest of the known universe beat me too it! In the event, the first machine that was loaned turned out to be a rather sick pre-production version which died after some 20 minutes of use. I decided to wait for, as they say in the ads, the real thing and then give it a thorough going over.

What You Get

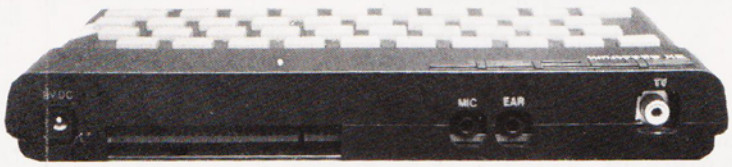
The delivered package was suprisingly less bulky than I'd expected — not really that much bigger than the old ZX81 box — but once open, a whole new world emerged. The ZX Spectrum is bigger than its predecessor; it measures some 233 by 144 by 30 mm and features an almost full sized keyboard with the usual Sinclair-style single key programming legends — more on this in a moment.

Also packed into the box are the power supply unit, all the necessary leads and two manuals. The first of the two manuals is really a 'get you going' booklet and a welcome addition to the family. It covers all the simple things like connecting the system up for the first time and loading and saving programs on cassette. However, its style leaves something to be desired as it reads like it was written by an 'expert' who couldn't really be bothered with the chore of expanding the various points of the system to the beginner. I'll say more about the main manual in a later section of this review.

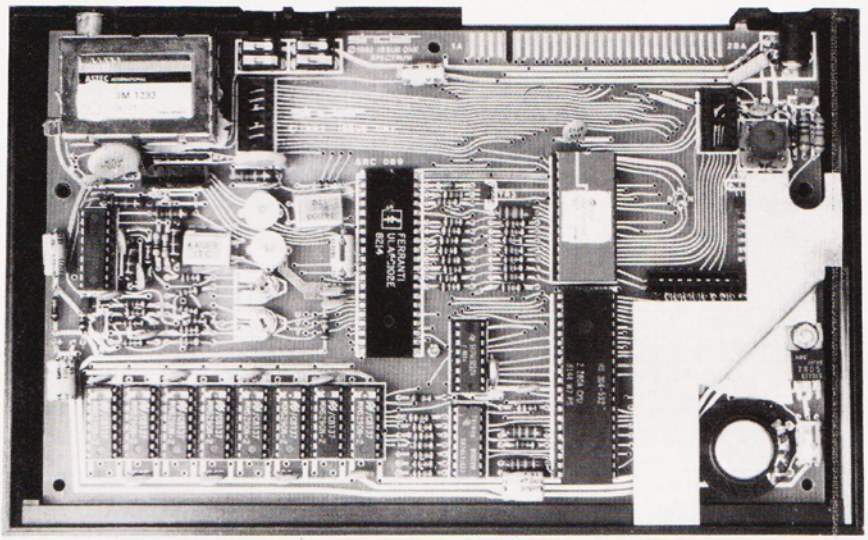
The Hard Facts

According to the various advertising and promotional material sent out by Sinclair, the ZX Spectrum features a moving keyboard. Well, it certainly moves but not in the way that one might have expected!

Each of the 40 keys is part of a moulded rubber sheet which covers a larger version of the standard ZX81 touch keyboard. Now, each key moves up and down a fraction but it feels nothing like any keyboard I've ever used before! Indeed, it felt so odd that I 'blind tested' a number of friends and colleagues on it. The comments varied from 'cold custard' to 'a cat's tongue' and 'dead flesh'! You'll never become a touch typist using it but it is an improvement on the earlier types.



Above: The rear panel of the ZX Spectrum carries all the I/O connections. Note that the bus connector is bigger than the one on the ZX81.
Below: The internal layout is very neat; the standard 16K RAM is at the bottom left. Note the two IC sockets towards the top of the case — this is where the RAM expansion sits on a daughter board.



The second major development of the ZX Spectrum is the dramatic upgrading of the facilities you get for your money: 16K user memory, Hi res colour graphics, bit mapped display, high speed cassette interface that's reliable and the possibility of adding on the ZX Microdrives, a 100K micro disc unit. The system is certainly impressive and at the price Sinclair is asking, it probably represents one of the real bargains currently on offer. However, all is still not roses in the designs department.

On the hardware side a number of minor, irritating faults soon emerge. On both the samples I've tried, the metal keyboard surround seems determined to unstick itself and peel up, in one case jamming some of the keys. The internal bleeper is supposed to sound as each key is depressed — I say supposed to because it's so quiet you can hardly hear it. This means that you really do have to watch the screen to see what is going on, you cannot rely on the beep telling you that you've pressed the key. All the character keys feature auto repeat; the delay before this starts is sufficient and the speed of repeat makes moving the cursor around the line quick and easy.

There was also a wierd buzzing sound somewhat akin to a trapped bluebottle in the next room coming from inside the case. Internal investigation revealed an unsealed coil as the culprit. Now, these points ***are*** very minor but they do detract from the useability of the package.

Inside The Box

The internals of the ZX Spectrum are very well laid out, all the main chips are neatly arranged and socketed (with the exception of the ULA) so it is obvious that a lot of careful thought has gone into the design. The main device is the Z80A and this, together with the now inevitable ULA, form the heart of the package. Expansion within the case to a total of 48K of user RAM is catered for, the expansion board fitting into the rear of the box in a piggy-back arrangement.

Connections with the various I/O devices are fairly standard: two ribbon cables link the keyboard, the cassette interface links through two 3.5 mm jack sockets, and the power comes through a sleeve socket (an improvement over the earlier use of another jack). The main difference is the size of the expansion connector — it is bigger and has five extra connections. Indeed, those signals that are present on this connector, with the exception of the data lines, are almost completely different from the layout for the ZX81. This means that, while the ZX Printer is still compatible, a large number of independently produced add-ons cannot be transferred from the ZX81. The 16K RAM expansion that was available for the ZX81 is also a non-compatible item, which is a little sad as it would have represented a cheap way to upgrade.

The biggest cheer came when the crystal was spotted; one of my major criticisms of both the previous Sinclair systems was that they were not crystal controlled — something that may well have contributed to their sometimes unstable performance. The ZX Spectrum uses a crystal for the clock circuitry and a second one to control the colour display circuitry.

The Language Barrier

One of the points over which Sinclair has received much criticism in the past is the non-Microsoft nature of his BASIC. Well, with as many machines in the marketplace as he has he undoubtedly took the correct decision in maintaining general compatibility with the BASIC on the ZX81. Whilst a number of commands are missing such as FAST, SLOW, etc, there are some new ones, notably READ, DATA and RESTORE which have been long awaited. The cassette interface side has been bolstered by the addition of both a VERIFY and a MERGE command and there are a number of commands included specifically for the graphics functions.

The BASIC is still programmed using the single-key technique which the ZX80 and ZX81 exploited but, and it is a big BUT, this has now got to the point where it is rather silly. Because there are so many functions crammed onto each key, generally five, there are now two levels of Shift. In fact, to type in some of the more commonly used BASIC commands takes more key presses than there are letters in the command!

One other nasty little point is that the chosen legend colours are not as good as they could be — the key legends are in white with the shift symbol in red (almost, but not quite, too small too read). However,

Benchmark	Time
BM1	4.88
BM2	9.02
BM3	21.93
BM4	20.68
BM5	25.22
BM6	62.8
BM7	89.96
BM8	25.07

Table 1. The Benchmark timings for the ZX Spectrum. All are in seconds and timed using the internal clock function. Note that BM8 is taken over 100 loops instead of the usual 1,000.

Functions

ABS	CHR$	INT	POINT	TAN
ACS	CODE	LEN	RND	USR
AND	COS	LN	SCREEN$	VAL
ASN	EXP	NOT	SGN	VAL$
ATN	FN	OR	SIN	
ATTR	IN	PEEK	SQR	
BIN	INKEY$	PI	STR$	

Operations

+ − * / = > < <= >= <>

Statements

BEEP	DIM	LIST	PLOT
BORDER	DRAW	LLIST	POKE
BRIGHT	ERASE*	LOAD	PRINT
CAT*	FLASH	LPRINT	RANDOMIZE
CIRCLE	FOR..TO..STEP	MERGE	READ
CLEAR	FORMAT*	MOVE	REM
CLOSE*	GOSUB	NEW	RESTORE
CLS	GOTO	NEXT	RETURN
CONTINUE	IF..THEN	OPEN*	RUN
COPY	INK	OUT	SAVE
DATA	INPUT	OVER	STOP
DEF FN	INVERSE	PAPER	VERYIFY
DELETE	LET	PAUSE	

Table 2. The ZX Spectrum's range of BASIC commands and functions. Those 'starred' apply to the microdrive.

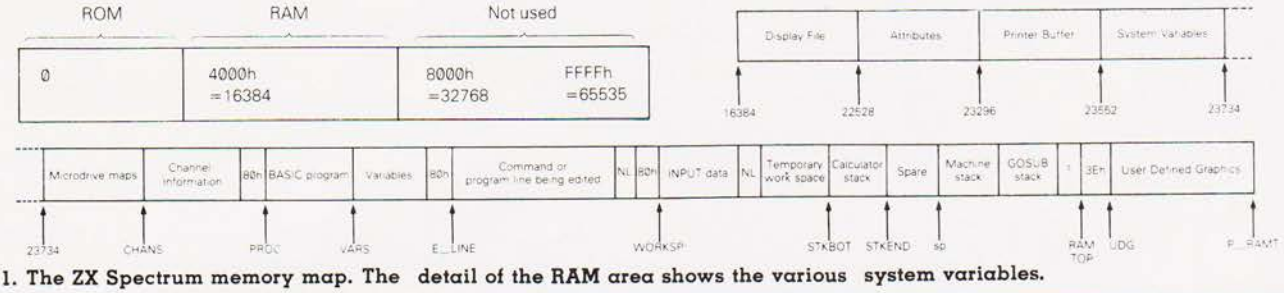


Fig. 1. The ZX Spectrum memory map. The detail of the RAM area shows the various system variables.

the crunch comes when the extra functions above and below the key are required — these are printed in red and green. Obviously no-one told Sinclair that the commonest type of colour blindness was that of red/green distinction! (Apparently more recent versions of the machine will have new colours).

The BASIC is slow, well, 'snail like' would be a better description, and the standard Benchmark results are given in Table 1. The last test was done with a loop of 100 instead of 1,000 as I thought that you might like to read the review before the Christmas holidays.

Pretty As A Picture

With the addition of the graphics facilities the ZX Spectrum really comes into its own. The usual DRAW and PLOT functions are there but the user is presented with a number of delightful extras. As an example of the thought that has gone into the system, the colour of the screen is called PAPER and the foreground or drawing colour is called INK. The screen border is logically known as BORDER and the quickest way to produce a round object is to use CIRCLE. Actually, the algorithm used for the latter leaves a lot to be desired but it is quick. Several other interesting features are included: OVER lets you draw over an existing character without deleting it, INVERT does exactly that and the DRAW command can be made to plot segments of a circle by adding a radius variable.

The ZX Spectrum is the first machine I've come across in this price bracket to feature the BRIGHT command. OK, so there are only two levels of brightness but with this and the FLASH function in operation, highlighting areas of text or games displays is really effective.

The standard block graphics set of the ZX81 has been retained but with the added facility of allowing the user to program keys A to U with his or her own patterns. These are based on an eight by eight character cell and rather than having to convert all the patterns of 0s and 1s into hexadecimal, the system has a built-in BIN or binary command which makes life just that little bit easier.

There are, however, a number of drawbacks with the colour graphics. If you define the colour of any pixel within a character cell, the whole of that cell assumes that colour — this can lead to interesting effects when you are plotting lines in various colours and they almost intersect.

The worst problem of all is the wierd way in which the memory map is arranged. Being a bit-mapped display you might expect the second row of each character to follow the first — not so. After trying a couple of simple moving graphics programs and getting nowhere fast, I read the manual line by line and discovered, on page 164, that the beast is a real mess. The screen is divided into 24 lines of 32 characters — this is further divided into a top section of 21 lines which normally display the listing as it is entered. In this 21 line section, the memory map is subdivided into three seven-line blocks which are arranged from the top line of the top left-hand character through all the top lines then back to the second line of the top left-hand character, etc. I did warn you it was a bit of a mess! Figure 1 shows the system memory maps so you can try this out if you wish.

The above means, in simple terms, that POKEing characters around the display is going to a very longwinded job indeed. But the manual comes to the rescue suggesting a number of alternatives.

Needless to say, the ZX Spectrum features some sort of sound generating function and this is controlled by the BEEP command. Now, no-one would accuse it of being

SPECTRUM ANALYSIS

FACTSHEET	ZX Spectrum	
CPU	Z80A	
Clock	3.5MHz	
ROM	16K	
RAM	16 or 48K	
Language	Sinclair BASIC	
Keyboard	40 key multifunction Moving rubber membrane	
Display	24 lines of 32 characters on TV Bit-mapped graphics, 256 by 192 resolution 16 block graphics plus 21 user definable characters Eight colours plus flash and two brightness levels Independent border colour	
Cassette I/O	1500 baud System bus connector	
Options	ZX Printer	NYA
	ZX Microdrive	NYA
	RS232 interface	NYA
	NET	£125.00
Costs	ZX Spectrum 16K	£175.00
	ZX Spectrum 48K	£ 59.95
	ZX Printer	
Supplier	Sinclair Research Stanhope Road Camberley Surrey GU15 3PS 0276-685311	

sophisticated, it's a single tone which can be varied above or below middle C, but you can have fun with it. Because it uses an approximately 'true' musical progression, you can write some nice simple tunes using it — games and educational programs take note — and it has one extreme blessing . . . it is ***very*** quiet! In fact, it is so quiet that I began to wonder whether my review machine was behaving properly. If you, or the younger members of the computing fraternity, want something a little more raucous then you can always play the sound through the cassette port at much higher volume levels.

The BASIC command set is listed in Table 2. Most of the remaining functions are straightforward except for the curious VAL$ which, assuming I haven't gone ***totally*** mad, returns the value of a string . . . as a string!

Taped Up

As I mentioned earlier, the cassette interface seems reliable, to the extent that my experiences with the ZX81 would not have led me to expect. The instructions mention that you should disconnect one of the EAR leads while recording, a nuisance and something which can be forgotten. If you ignore this, your program simply never gets recorded. Now, surely it would be possible to either design around the problem or to fit a switch either in the cable or on the box. Pulling leads out and plugging them in can only result in unnecessary wear on the jack sockets and also carries the risk of half unplugging the other lead if you do it in a hurry.

The messages and displays produced while loading and saving also deserve some mention. When saving, you are briefly told what to do (at least there is some sort of message) and the screen border goes blue. While the program is being written to tape, the border alternates betwen blue and yellow stripes — very pretty but a little too overpowering. The loading function carries no message at all, the border simply turns blue. Now, given that you have remembered to re-connect the EAR lead and then started the tape, the border will start to alternate between red and blue. As soon as the header is found, this is written onto the screen and then those yellow and blue stripes start flashing again. Personally, I'd rather have had a couple of simple messages and no technicolour but then I'm probably old-fashioned!

The tape firmware supports data files; you can save arrays and variables plus the very useful capability of saving the screen picture.

The Book Of Words

Both the introductory book and the main manual were written by Steven Vickers and edited by Robin Bradbeer, a man who has recently made much out of Clive's arch rivals — the BBC. Now, the former is reasonable but the latter . . . ugh! As a manual it does its job in exemplary fashion. All the information is there but it always stops about ten words short of the point you want. Each of the BASIC commands is explained and there are copious examples, but never any real depth. Once again there is going to be a market for simple and advanced books for the ZX Spectrum!

Sadly, many of the example programs and some of the text contained errors. In one or two cases these were not the sort of error a beginner could solve which makes the rapid publication of an errata essential. The other sad thing about the book is that it does try so hard; what other manuals explain the tape recording format, the way arrays and variables are stored and list all the system entry points? Yet, almost in spite of this attempt to be so good, we find phrases like . . . '. . . The opposite of POKE is PEEK, and this allows us to look at the contents of a memory location . . . They will be dealt with properly in Chapter 28.' Innocent enough, you might say as you thumb towards the back of the book — but the expression on your face may change when you find no explanation and no Chapter 28!

Using It

In operation, the ZX Spectrum performed almost flawlessly. My feelings as to the programmability of the machine are, however, somewhat less enthusiastic. How anyone could produce such an amazingly compact and clever design and completely ignore the user interface I don't know. To operate the keyboard successfully you either need to have an octave span capability or use two fingers, one off each hand. At times the number of Shift levels becomes confusing, for example, the top row of keys can perform up to eight functions, and it may be that the use of single key programming has gone too far this time. Still, first time users will love it as they are prevented from entering bad programs and, if they do manage to fool the syntax checker, the run-time messages are excellent — surely only a really ***nice*** guy would have thought of 'Nonsense in BASIC'?

In Summary

It would be foolish to try to call the ZX Spectrum anything other than excellent value for money, at £125 for the 16K version it is certainly that. However, there are still signs that various rough edges have not been tidied up in its production. This is more than a little sad as, with all the threats to the BBC Micro and the oncoming battle with the Electron and the VIC 10, Clive's new system may have somewhat more of a fight on its hands than was expected.

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VIDEO DUMP

Get a hard copy of your TRS-80/ Video Genie display.

This program enables a TRS-80 or Video Genie owner to send pictures of the display produced by a program to a graphics printer. The illustrations show some of the effects that can be obtained using a standard Video Genie parallel interface and a Microline 80 printer. The program will also work with an Epson MX-80.

Program Requirements

Before it is possible to send a picture to the Video Genie printer it is obviously neccessary to find out what characters are on the screen. These are stored in RAM between addresses 15360 and 16383 so that, for instance, the BASIC statement POKE 16383,49 will cause a figure '1' to appear in the bottom right-hand corner of the display. Conversely, PEEK(15424) will return the ASCII code of the first character on the second line of the screen.

It is possible to write a BASIC program to PEEK the contents of the computer's screen memory and output characters one by one to the printer. The printer normally has lines 80 columns wide but the video display of the computer has only 64 columns, so a Newline code 13 (Carriage Return) must be sent to the printer after every 64 characters.

This system has three main disadvantages. It is slow (compared with machine code) and it only works with BASIC programs. You can add the printer routine to a BASIC program as a subroutine that is called whenever you press a certain key — but you cannot use it to print the display of an assembly language program since it is extremely difficult to modify a machine-code program so that it calls a BASIC subroutine.

The third snag is that not all the character-codes PEEKed from your screen memory will be correct! In the far-off days when Tandy invented the TRS-80, they decided to save money by only using seven-bit memory to store the video display. Even though the TRS-80 is an eight-bit computer, it has 1024 bytes of seven-bit memory. Needless to say when EACA developed the Video Genie they decided (at first) to do the same thing. The effect is that a standard computer has no bit 6 between addresses 15360 and 16383. Character codes 64-127 represent capital letters and punctuation symbols; codes 192-255 represent graphics characters.

In the fullness of time TRS-80 users discovered that they would like to be able to display lower-case letters, and Tandy and various TRS-80 users decided to add the missing RAM chip to their systems. The snag with this, however, is that computers with the extra chip display capital letters and punctuation by storing codes 0-63 in memory, using 96-127 for lower-case and 128-191 for graphics. The TRS-80 hardware is arranged in such a way that codes 0-31 and 128-191 display the same characters as codes 64-95 and 192-225 respectively, so that the computer works regardless of the configuration of your system. Printers, however, tend to use a single set of standard codes and the numbers you PEEK will have to be changed accordingly.

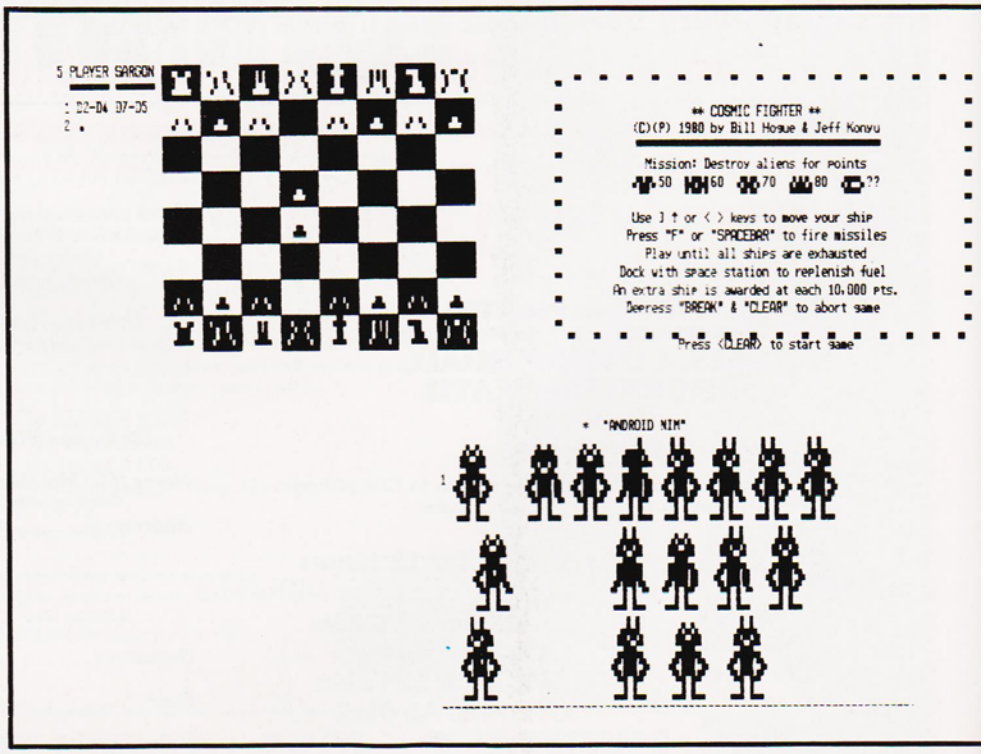
Last year Tandy released the Model III computer, which has at last put an end to the confusion by having all eight bits of the video RAM fitted as standard. Later versions of the Video Genie have also been re-designed.

The Program

This screen-print subroutine is written in assembly language, since that is faster than the equivalent BASIC. The routine listed, SCREEN, converts character-codes as they are read from either seven- or eight-bit video RAM. Codes less than 32 are stored by an eight-bit machine and must have 64 added to convert them to ASCII code. Conversely codes greater than 191 must have been stored by a seven-bit machine (or a program written on a seven-bit system). They must have 64 subtracted from them to convert them to Microline 80 graphics codes.

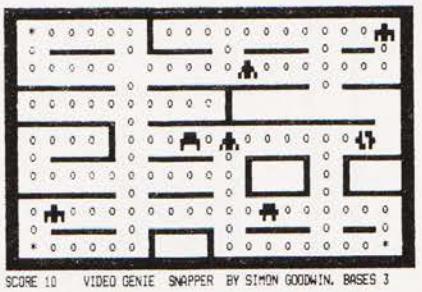
Starter For 1024

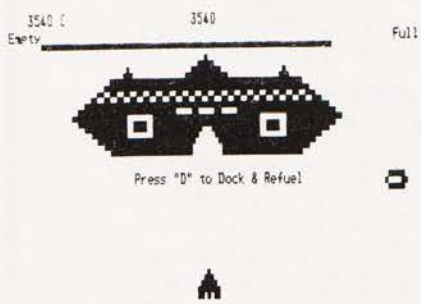
One snag with a 'universal' printer routine is that it requires a universal way of calling it into action. Cassette users of the TRS-80 or Video Genie will be aware of a simple way of interupting a program, be it BASIC or machine code — you simply press the Reset button on the back of the computer and that takes you back to the BASIC READY prompt. Some machine code programs try very hard to disable this button



— and if someone can disable something, surely someone else can put it to use . . .

It turns out that whenever the Reset button is pressed the Z80 inside the computer does a sudden jump to memory location 102 in ROM, which causes it to tidy up a few BASIC facilities which might have been disturbed. On a cassette system it then jumps on to a routine which prints READY and waits for a BASIC command — but, shortly before the message is printed, the interpreter calls at location 16812 in RAM. Normally, there is only a RETurn instruction there and the ROM program continues as if nothing has happened. However, there is just space for a machine code JuMP instruction there which will cause BASIC to execute a subroutine of your own devising before it prints anything on the screen. If a jump to the print routine is stored at 16812, you will get a picture of whatever is on your display whenever you press the Reset button with the printer on-line. If you want to Reset normally, either POKE 16812,201 beforehand (thereby replacing the JuMP with a RETurn) or switch the printer off-line before you press the button.





Some examples of games displays captured on the printer using this routine. From left to right: Sargon chess game, Cosmic fighter and Snapper. On the lower row we have Android NIM and another 'frame' from Cosmic Fighter.

Unfortunately, on a computer with an expansion interface fitted, the Reset button will either try to reload the Disc Operating System or clear the computer's memory. If your system is in this category, you will have to patch the program that you want to print out by adding a machine code CALL instruction or a BASIC USR call at an appropriate place.

Incompatible Interfaces

The next snag comes when we try to output characters to the printer. A TRS-80 uses a memory mapped latch to send characters and to detect the status of the printer. As R N Braybrooke pointed out in his article in CT November 1981, the Video Genie prefers to print via a Z80 port. The article explained how to modify TRS-80 programs to use the Video Genie hardware. But it would still be convenient to be able to write a program that would work on either machine without changes.

When the programmers at Microsoft wrote TRS-80 BASIC, they aimed to make it as independent of specific hardware as possible. Subsequently, programmers adding to the facilities of the TRS-80 with monitors, assemblers and editors, each wrote their own routines to check the status of the computer printer and to print characters. What few of them realised was that there are already two 'printer-driver' routines in the BASIC interpreter! A CALL to location 1439 in TRS-80 or Video Genie ROM will automatically check whether or not the printer is busy. The code inside the subroutine differs between the two machines so that wherever the printer is mapped it will be tested. There is another routine at location 58 in ROM that sends the character in the Z80's Accumulator to the printer.

How It Works

The program listed uses these two BASIC routines to work the computer's printer. At SCREEN, the computer tests the status of the printer via a ROM call. If the printer is ready, the zero flag is set — if not, the program returns (back to the BASIC READY prompt) in line 280.

When printing, the computer uses the HL register-pair to point at the character in video memory to be output next. Register B contains the number of characters yet to be printed on the current line and

register A contains the character to be printed. After each line of 64 characters, register B becomes zero and a Carriage Return character is printed moving the printer to the start of the next line. Before a new line is commenced, the program checks that HL still points to characters on the display. If not, the program returns to BASIC in line 330.

The code of SCREEN is entirely relocatable and can be loaded into any convenient 39 byte area of memory without changes. It will work on other Z80 based computers if the ROM calls are modified accordingly. Remember to change the jump instruction at 41AC Hex so that it points to your re-located version of SCREEN.

Conclusion

The program is a fun way to generate decorations, as can be seen from the examples of its use. It is also useful when you need to modify a display layout, since it makes it possible to take a 'snapshot' of the picture on the display at any time.

Program Listing

```
                        0100  PRINT SCREEN CONTENTS AFTER NMI
06CC                    0130  BASIC   EQU  1740     Entrypoint
003A                    0140  ROMPR   EQU  58
BF68                    0150  RAMTOP  EQU  49000    32K system
3C00                    0160  VDU     EQU  15360    Video address
05D1                    0170  TSTPR   EQU  1489     Printer there?
000D                    0180  CR      EQU  13
0044                    0190  VDUEND  EQU  68
41AC                    0200  READY   EQU  16812    'READY' vector
0040                    0210  LNLEN   EQU  64       Line length
41AC                    0230          ORG  READY
41AC C3 68 BF           0240          JP   SCREEN   Calls routine
BF68                    0260          ORG  RAMTOP
BF68 CD D1 05           0270  SCREEN  CALL TSTPR    Printer on?
BF6B C0                 0280          RET  NZ       No!
BF6C 21 00 3C           0290          LD   HL,VDU   Screen pointer
BF6F 06 40              0300  NXTLIN  LD   B,LNLEN  Line length
BF71 7C                 0310          LD   A,H      Get pointer MSB
BF72 FE 44              0320          CP   VDUEND   End of screen?
BF74 C8                 0330          RET  Z        Yes, finished
BF75 7E                 0340  LINE    LD   A,(HL)   Get character
BF76 FE 20              0350          CP   32
BF78 30 02              0360          JR   NC,PR1
BF7A C6 40              0370          ADD  A,64     Make it ASCII
BF7C FE C0              0380  PR1     CP   192      Graphic?
BF7E 38 02              0390          JR   C,PR2
BF80 D6 40              0400          SUB  64       Yes, correct it
BF82 CD 3A 00           0420  PR2     CALL ROMPR    Print it
BF85 23                 0430          INC  HL       Next one
BF86 10 ED              0440          DJNZ LINE
BF88 3E 0D              0450          LD   A,CR     Print CR
BF8A CD 3A 00           0460          CALL ROMPR
BF8D 18 E0              0470          JR   NXTLIN   Do next line
06CC                    0490          END  BASIC
```

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PROGRAMMING LANGUAGES

N Stang MSc

If you are into serious business programming then you should have heard about COBOL. If not, then this feature will relieve some of the mysteries.

Microcomputers finally reached maturity as business computers with the introduction of COBOL. Perhaps the best known example of this language is CIS COBOL by MicroFocus, which is available on a wide range of CP/M-based machines as well as on Apple II.

The development of the microcomputer as a business tool has shown some similarities to the development of the mainframe computers some 30 years earlier. In both cases the pioneers were not businesses, but universities, research establishments, and in the case of the microcomputer, the hobbyist. Also, programming the early machines was something of a speciality, although the microcomputer did have a language quickly established as a *de facto* standard (namely BASIC).

Right through the 1950's, the mainframe computer programmer generally had available assembly languages and occasionally, a high level language. Unfortunately, there was often no standardisation or portability of programs, even between different models of computer produced by the same manufacturer.

In 1959, the Department of Defence, acting on behalf of the US Government (the world's largest purchaser of computers), set up a committee to create a standardised business-oriented programming language. The committee was composed of representatives of computer users in industry, government and computer manufacturers. In 1960, the first specifications of COBOL (COmmon Business Oriented Language) were presented by the Conference on Data Systems Language (CODASYL). Three requirements had to be met:

(a) a standardised input format usable by all computers,
(b) a source language that was easily understood, and
(c) the inclusion of business terminology.

COBOL as a language fitted the bill in that it was machine independent and used a syntax which followed the English language fairly closely.

RCA and Univac quickly implemented the first versions of the language and by the mid-1960s, COBOL compilers were available on all major mainframes. Of course, there were some difficulties. To be acceptable, the version had to contain a minimum sub-set of the language, but no limitations were placed upon extensions to the language (and such extensions reduced portability). Nor were there any standards or rules governing speed of compilation, and some of those early compilers were dreadfully slow!

The current standard is the 1974 ANSI version, though discussions are currently going on about the possiblities of a new standard. CIS COBOL, which is available on many microcomputers, is based on the 1974 ANSI standard and has been available since 1979. In November 1981, the version written for the Apple II was nominated for a RITA award (Recognition of Information Technology Achievement).

The Nature Of The Language

It must be emphasised that COBOL was designed to cope with business data processing, where the emphasis is essentially on file handling with relatively little computing. Furthermore, it was designed for batch processing and not for interactive use. However, CIS COBOL has extensions for interactive processing. (The accompanying example of a COBOL program is for interactively inserting and/or amending customer file records.)

The structure of the language makes for verbosity, though the language contains many optional words which exist only to make the program more readable to the non-programmer. Variable and procedure names may be up to 30 characters in length thus enabling reasonably meaningful names to be used without much restriction.

All COBOL programs are composed of four Divisions. These are:

(a) IDENTIFICATION DIVISION, which serves only to identify the program.

(b) ENVIRONMENT DIVISION, which describes the equipment used in the compilation and execution of the program, and indicates to the compiler which files are to be used and assigned to which hardware devices.

(c) DATA DIVISION, in which the file and work data elements are defined (ie named) and given information as to size and nature (ie whether numeric).

(d) PROCEDURE DIVISION, which contains the instructions.

Each of the Divisions contains Sections and/or Paragraphs; each Paragraph consisting of one or more sentences. Sentences are composed of one or more Statements, each Statement containing one or more words (the structure is thus similar to normal English). The only compulsory punctuation mark is the period (full stop), which must appear at the end of Division, Section and Paragraph names and at the end of each Sentence.

Words are essentially of two types, reserved words and programmer-defined words. Reserved words have specific meanings to COBOL (CIS COBOL lists about 200 such words). The most important reserved words are key words, which must appear in the appropriate place, eg READ or ADD; optional words which are used only to make the program read better include IS, and figurative constants such as ZERO and SPACE.

Programmer-defined words may be up to 30 characters in length, must contain at least one alphabetic character and may contain any number of numerals and/or hyphens, but not start or end with a hyphen.

Files

COBOL allows for three types of files. Most programmers will be familiar with sequential and relative files but also allowed is the indexed file. This enables the user to write and retrieve records sequentially and/or randomly where the keys may be complex and perhaps not even numeric.

Relative files may be able to achieve the same effect by means of a key transformation algorithm but there could be large wasteful gaps

on the disc file. An indexed file relieves the programmer of the need to design such an algorithm and there are no unfilled record positions in the file.

However, there is a price to pay for such convenience. The indexed file is in fact two files — the data file, stored in the sequence in which the data is written, and the index file which contains one record (consisting of the key) for every data record stored. The index file could occupy as much floppy disc storage as the data file and further, if the file contains many records and the key is long and complex, searching for the data could take several seconds. Thus, the indexed file is slower than its relative file counterpart.

As can be seen in the sample program, the file is given a specific name by which it is stored in the disc directory. Where the file is stored, the type of file organisation and access method are described in the Input-Output Section of the ENVIRONMENT DIVISION.

Describing Data

The structure of each file to be used in the program is defined in the File Section of the DATA DIVISION. A file is made up of one or more data records which are fixed in length. The data is defined in a hierarchical manner using a system of level numbers. The record is defined at level 01, the fields which make up the record at level 02, sub-fields that make up fields at level 03, and so on.

The record is an example of a group item whereas a field is an elementary item unless it is further sub-divided into sub-fields. Elementary items must be defined in terms of size and nature of contents. This is done by means of the PICTURE clause, one element for each character in the item. Thus, the statement IN-VOL PIC 99 tells us that the field is two characters in length and both characters are numeric. Implied decimal point can be specified and the PICTURE clause could also contain editing features such as leading zero suppresion, insertion of currency symbols and actual decimal point.

The size of the group item need not be stated as it is implied from the sum of the sizes of the elementary items of which it is comprised.

Interactive Processing

Screen handling in CIS COBOL is quite easy. Facsimiles of forms can be created on the VDU screen,

```
IDENTIFICATION DIVISION.
PROGRAM-ID.  UPDT.
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SPECIAL NAMES.  CONSOLE IS CRT.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
    SELECT CUST-FILE ASSIGN "B:CUST.DAT" ORGANIZATION INDEXED
        ACCESS RANDOM  RECORD KEY IS CUST-NO.
  DATA DIVISION.
FILE SECTION.
FD  CUST-FILE.
01  CUST-REC.
    02  CUST-NO          PIC 9(4).
    02  CUST-NAME        PIC X(24).
    02  CUST-ADDRESS     PIC X(20)  OCCURS 4 TIMES.
WORKING-STORAGE SECTION.
77  STORE-NO             PIC 9(4).
77  INSERT-SWITCH        PIC 9.
01  SCREEN-HEAD.
    02  FILLER           PIC X(20).
    02  SCREEN-HD1       PIC X(20) VALUE "CUSTOMER FILE UPDATE".
    02  FILLER           PIC X(60).
    02  SCREEN-HD2       PIC X(20) VALUE "--------------------".
    02  FILLER           PIC X(50).
    02  SCREEN-HD3       PIC X(11) VALUE "CUSTOMER NO".
    02  FILLER           PIC X(8).
    02  SCREEN-HD4       PIC X(6) VALUE "]    [".
    02  FILLER           PIC X(55).
    02  SCREEN-HD5       PIC X(4) VALUE "NAME".
    02  FILLER           PIC X(15).
    02  SCREEN-HD6       PIC X(22) VALUE "]                      [".
    02  FILLER           PIC X(39).
    02  SCREEN-HD7       PIC X(19) VALUE "ADDRESS - LINE 1  ".
    02  SCREEN-HD8       PIC X(22) VALUE "]                      [".
    02  FILLER           PIC X(47).
    02  SCREEN-HD9       PIC X(11) VALUE "- LINE 2  ".
    02  SCREEN-HD10      PIC X(22) VALUE "]                      [".
    02  FILLER           PIC X(47).
    02  SCREEN-HD11      PIC X(11) VALUE "- LINE 3  ".
    02  SCREEN-HD12      PIC X(22) VALUE "]                      [".
    02  FILLER           PIC X(47).
    02  SCREEN-HD13      PIC X(11) VALUE "- LINE 4  ".
    02  SCREEN-HD14      PIC X(22) VALUE "]                      [".
01  IN-DATA  REDEFINES  SCREEN-HEAD.
    02  FILLER           PIC X(190).
    02  IN-NO            PIC 9(4).
    02  FILLER           PIC X(76).
    02  IN-NAME          PIC X(20).
    02  IN-ADD  OCCURS 4.
        03  FILLER       PIC X(60).
        03  IN-ADDRESS   PIC X(20).
    02  FILLER           PIC X.
PROCEDURE DIVISION.
BEGIN.
    OPEN I-O CUST-FILE.
    DISPLAY SPACE.
    DISPLAY SCREEN-HEAD.
ACCEPT-INPUT.
    MOVE SPACE TO IN-DATA.
ERR.
    ACCEPT IN-DATA.
    IF IN-NO = SPACE GOTO FINISH.
    MOVE IN-NO TO STORE-NO CUST-NO.
    READ CUST-FILE INVALID GO TO INSERT.
    MOVE 0 TO INSERT-SWITCH.
    MOVE CUST-NAME TO IN-NAME.
    MOVE CUST-ADDRESS (1) TO IN-ADDRESS (1).
    MOVE CUST-ADDRESS (2) TO IN-ADDRESS (2).
    MOVE CUST-ADDRESS (3) TO IN-ADDRESS (3).
    MOVE CUST-ADDRESS (4) TO IN-ADDRESS (4).
DISPLAY-DETAILS.
    DISPLAY SCREEN-HEAD.
    ACCEPT IN-DATA.
    IF IN-NO NOT = STORE-NO GO TO DISPLAY-DETAILS.
    MOVE IN-ADDRESS (1) TO CUST-ADDRESS (1).
    MOVE IN-ADDRESS (2) TO CUST-ADDRESS (2).
    MOVE IN-ADDRESS (3) TO CUST-ADDRESS (3).
    MOVE IN-ADDRESS (4) TO CUST-ADDRESS (4).
    MOVE IN-NAME TO CUST-NAME.
    IF INSERT-SWITCH = 1 GO TO PUTOUT.
    REWRITE CUST-REC INVALID GO TO ERR.
    GO TO ACCEPT-INPUT.
INSERT.
    MOVE 1 TO INSERT-SWITCH.
    GO TO DISPLAY-DETAILS.
PUTOUT.
    WRITE CUST-REC INVALID GO TO ERR.
    GO TO ACCEPT-INPUT.
FINISH.
    DISPLAY SPACE.
    DISPLAY "END OF CUSTOMER FILE UPDATE".
    CLOSE CUST-FILE.
    STOP "JOB".
```

which would be divided into protected and non-protected areas.

Screen records are defined in the Working-Storage Section of the DATA DIVISION. Elementary items defined as FILLER are protected, ie they cannot be overwritten by the operator. The normal practice is to define the headings to be used as one set of elementary items and then redefine the area as a series of permitted items. (In the example program, the group item SCREEN-HEAD contains the headings, and IN-DATA is simply a redefinition of that group item to allow for operator entry of data.)

It ought to be mentioned that MicroFocus also supplies a software package called FORMS II which enables the user to create forms on the screen while the software creates the WORKING-STORAGE entries which correspond to the created form. These entries can easily be incorporated in the source program code.

The use of libraries of precreated source code is one of the strengths of COBOL. Any prewritten source coding can be written onto disc as a file and later incorporated into any COBOL source program by means of the COPY statement. As yet there is no facility to incorporate coding in assembler, BASIC or any other language.

PROCEDURE DIVISION Elements

The execution of instructions is controlled by the PROCEDURE DIVISION.
The instruction set may be grouped in the following categories:

(a) data manipulation (ADD, SUBTRACT, MULTIPLY, DIVIDE, MOVE, INSPECT).
(b) file handling (OPEN, READ, WRITE, DELETE, REWRITE, CLOSE).
(c) screen handling (ACCEPT, DISPLAY).
(d) sequence control (ALTER, GO, PERFORM).
(e) inter-program control (CALL, CANCEL).
(f) conditional (IF).

Most mainframe versions of COBOL have more powerful computing facilities by means of the COMPUTE verb. Some mainframe versions even have facilities for sorting files and generating reports. However, for most business data processing purposes, the range of verbs available is quite adequate.

A facility certainly worthy of mention relates to the debugging of programs. The programmer can specify that a program be compiled in debug mode and that a special register called DEBUG-ITEM can be set up to inform about the conditions that caused the execution of a debugging section.

Is It Worth Using

COBOL as language has been much criticised over the years. Supporters of structured programming do not like it accusing it of being verbose and lacking powerful numbercrunching facilities. So who wants it? Certainly not the hobbyist, the scientist or the engineer. But the business user who finds Pascal confusing and BASIC lacking in business facilities may well be attracted to the language, which despite its limitations and faults is easy to use and understand and in possession of good screen handling capabilities.

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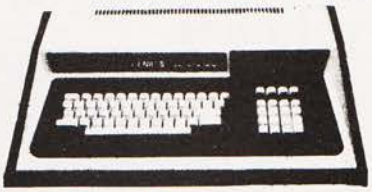

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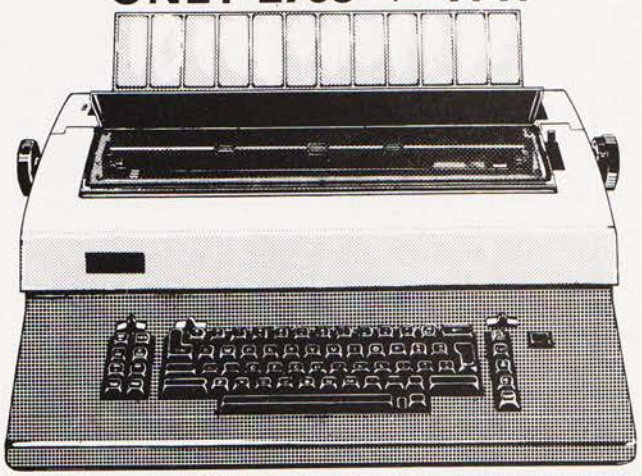

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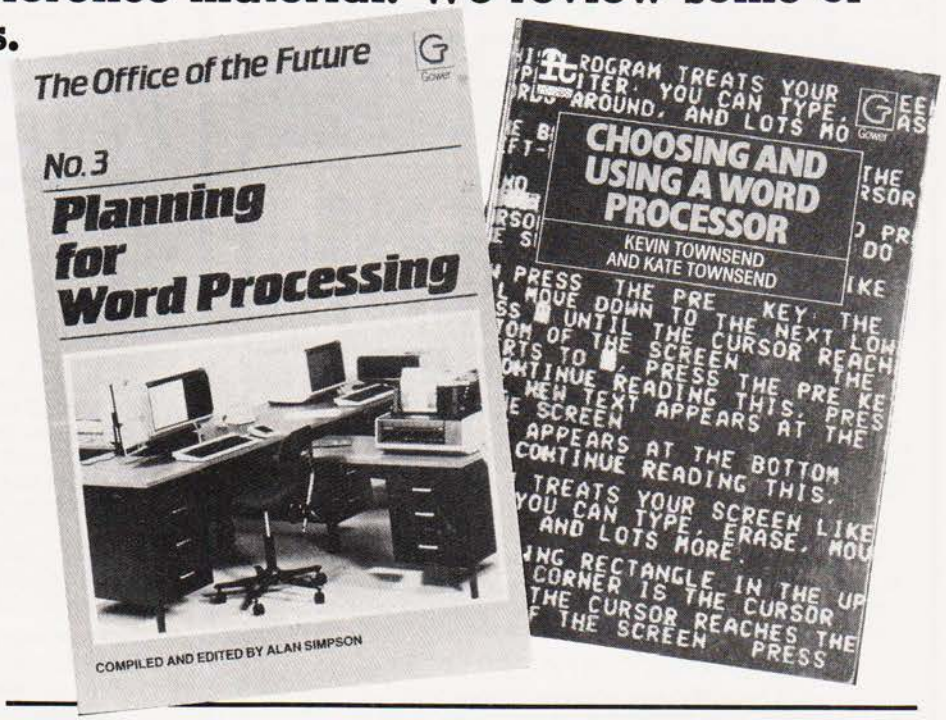
S M Gee

If you've been bitten by the word processor bug then you'll need some reference material. We review some of the current volumes.



If anybody was to ask you or me, or even the 'man in the street', what computers are most useful for, the most likely reply would be 'for doing complicated sums'. However, while we've all been conditioned to think that computers are good at handling large numbers, the truth of the matter is that computers, especially microprocessors, are actually often better at handling text! The reason for this is simply to do with the way computer memory is organised into eight-bit chunks (bytes). You can only squeeze two decimal digits into this amount of memory — which obviously means that arithmetic operations soon become hard to handle — but it's easily sufficient for one text character.

Although word processing is probably not even considered by most people when they buy their micro, personal computer owners quickly discover lots of text handling uses for them — routine personal correspondence, circular newsletters to members of your local computer club, up-to-date lists of your record collection, etc. Word processing is also particularly useful if you need to produce similar documents time and time again. The list of examples is infinite — from architectural specifications to zoo diet sheets!

My comments so far have suggested that word processing is an extra that you can use your personal micro for. However, there is another approach — the single-purpose word processor which is currently making its professional debut in offices and typing pools. Why, when micros are so much more versatile, is there a market for the dedicated word processor costing up to ten times as much as a personal computer plus printer? The simple answer is that they are much easier to use for the purposes of manipulating text because that is their only function. Stripped of all other functions, it is possible to design a keyboard which makes word processing very much more straightforward and sophisticated than is otherwise possible.

In short, both approaches have an important role and anybody faced with the decision about what system to buy need be aware of the possibilities offered by both camps. The problem is that they are so distinct that is possible to know everything there is to know about one without having the first inkling about the other. For this reason I've chosen to review books from both fields.

Planning for Word Processing is a selection of readings written by the professionals involved in selling word processing systems. Its stated purpose is to 'make clear how word processing technology can offer considerable rewards and benefits to the enlighted company executive and manager'. In parts it reads like extended sales literature and even the sections which are presented as impartial discussion are written by people who have a product or position to promote. Even with this caveat, it could still be a useful compilation for someone faced with choosing a word processing system.

However, my biggest criticism is that it virtually ignores the possibility of using a multi-purpose micro for word processing. The glossary defines a personal computer as 'A small computer, usually costing under a £1,000' and the Apple actually has an entry which states that it is 'A Home Computer made by Apple Computers'!!

A practical, fairly technical introduction is presented in **Choosing and Using A Word Processor**. It first gives a very brief history of word processing and an overview of its uses and benefits followed by a long chapter which is actually a well anotated glossary devoted to equipment. There is also a chapter of advice about acquiring a word processor, which includes warnings about how to withstand sales pressure as well as a very technical section about specification requirements. The next chapter on using a word processor is even more disjointed, starting as it does by pointing out the disadvantages and problems of word processing and continuing with sections about word processing output and concluding with a review of health hazards. The final chapter is about financing options.

There follows an Appendix about suppliers and equipment. This again omits any references to microcomputer options; this cannot simply be an oversight as Wordstar (a popular word processing package) is mentioned more than once but always with reference to stand alone word processors.

Computer based word processing systems are given a fairer crack of the whip in the NCC's **Introducing Word Processing.** This book also devotes a section to 'the people aspect' of word processing which covers the impact on training and motivation as well as on employment and health. All in all, this publication presents a balanced view which

BOOK PAGE

puts word processing into technical and social perspective.

For a very different introduction to word processing I'll turn next to **Introduction to Word Processing**, published by Sybex which, as well as starting from a less office-oriented position, takes account of the personal computer and actually uses the Apple as an example. It includes a good overview of all the hardware available, covering both dedicated systems and personal computers, with word processing software. This book makes the subject an enjoyable challenge — rather than hard work — and can be recommended to anybody who has cold feet about office automation.

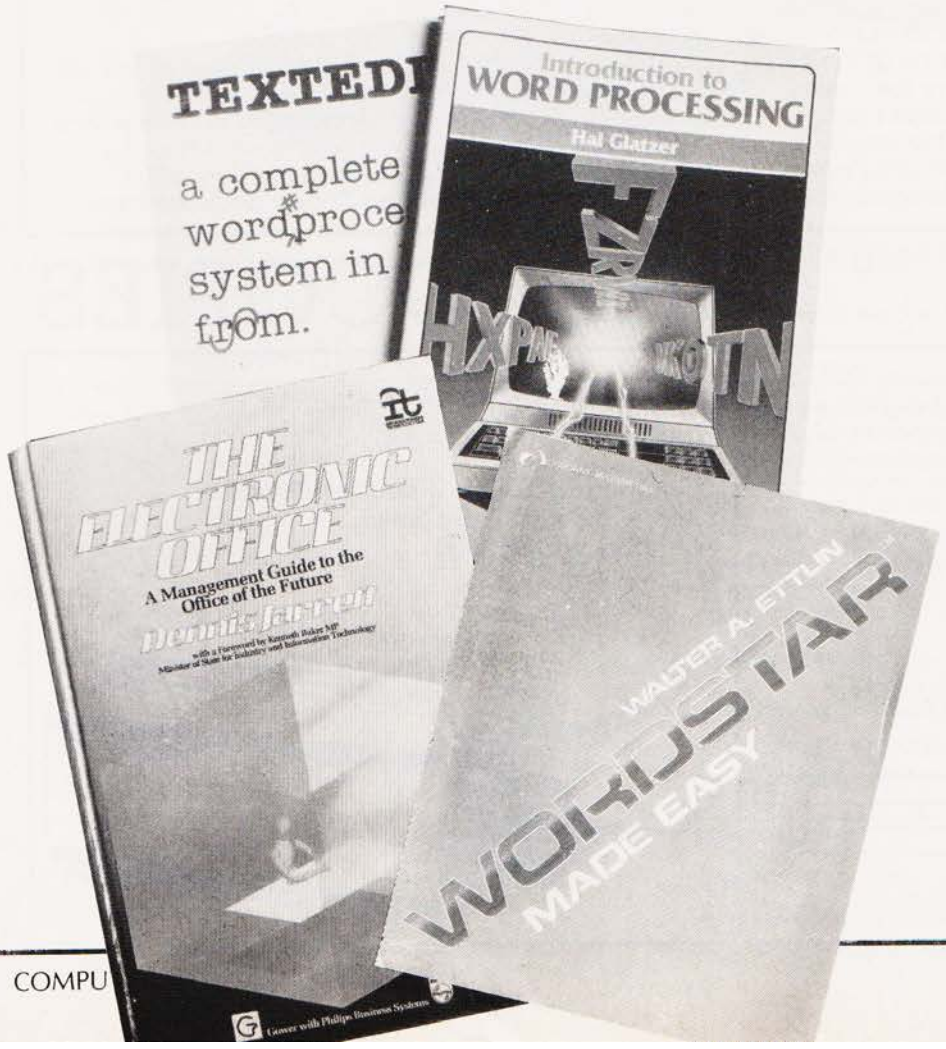
I'm including **The Electronic Office**, which is a general introduction to the effect of the new technology on office working and office management, because it includes an overview of word processing and therefore serves to give a useful idea of where it fits into the overall office revolution. It is a well presented book, illustrated with lots of photographs, and includes much factual and technical information highlighted by being presented against blue backgrounds. This book is a very readable source for the highly technical information that all business and commerce has to absorb in order to keep pace with the revolution happening right now.

Wordstar is probably the best known and most widely used word processing package and is available on all CP/M machines. However, in my opinion it is far from the easiest to use. I was therefore pleased to come across **Wordstar Made Easy**, a tutor which is intended to supplement the manual provided. It consists of a set of lessons (each dealing with just a few commands) containing a set of instructions, sample exercises and example text to use to obtain the same output as is given. This is a patient approach which should enable anybody to be able to make Wordstar work properly.

What if you've got a personal computer but cannot afford a text processing package (after all Wordstar will cost you £250) or want to write your own. Where to start could be quite a problem! However, it is one that is solved by **Textedit** which is 'a complete word processing system in kit form'. As far as I know this is the first book of its type and is a great idea. It presents the code for a complete word processor in BASIC for a TRS-80. Each chapter introduces a particular part of the text processor, describes what it is supposed to do and how it does it.

The idea of this 'kit' is that you can select modules to build exactly the word processor you want. As Rappaport points out, the advantages of kit building are that it enables you to 'take it apart with confidence, modify it more easily, have a better idea of how it works and try out parts before continuing'. An important disadvantage to consider, however, is that, having modified it to do exactly what you want, you'll be the only person who can possibly use it — unless you are also prepared to write the manual to go with it!

The minimum TRS-80 system required is a Model I with TRS DOS 2.2 or 2.3, two disc drives and 32K of RAM. It is also compatible with the TRS-80 Model III. Putting together this kit is obviously a lot of hard work but it's also a very much cheaper way of obtaining a word processor than buying one ready-made. So, if you're a TRS-80 owner and want to be able to customise a word processor to your own requirements, it is to be recommended.



The books included in this month's selection were:

Planning for Word Processing edited by Alan Simpson, published by Gower (1982), 150 pages, £9.50.

Choosing and Using a Word Processor by Kevin and Kate Townsend, published by Gower (1982), £12.50.

Introducing Word Processing by G L Simons, published by National Computing Centre (1981), 228 pages, £9.50.

Introduction to Word Processing by Hal Glatzer, published by Sybex (1981), distributed by Computer Bookshop, 210 pages, £11.45

The Electronic Office by Dennis Jarrett, published by Gower with Philips Business Systems (1982), 176 pages, £12.50.

Wordstar Made Easy by Walter A. Ettlin, published by Osborne/McGraw-Hill (1981), 125 pages, £9.25.

Textedit by Irwin Rappaport, published by Wayne Green Inc, Peterborough, New Hampshire, USA (1982), 90 pages, $9.97.

BACKNUMBERS

DECEMBER 1979
Artificial Intelligence, AIM 65 reviewed, Speech Synthesis, Stock Control on the TRS-80, Graphics Unit, Life with NASCOM.

JULY 1980
Battle of Britain simulation, Multiple choice exam program, Address list program, Kingdoms game.

NOVEMBER 1981
Adler's Alphatronic examined, Teletext explained, Speech synthesis board reviewed, New beginners' guide to BASIC.

DECEMBER 1981
Micros in the classroom, Exidy's Sorcerer revisited, DIY DOS for NASCOM, Making sense out of Reverse Polish, Viewdata explained.

JANUARY 1982
Superbrain revisited, PC 1211 programming, Programming in the FORTH language, Tandy and Sinclair printers reviewed.

FEBRUARY 1982
The Computer Programme investigated, Graphics for Apple, Sorcerer and Tandy, User programmable graphics for ATOM.

MARCH 1982
User report on BBC Micro, DIY computerised security system, Terminology translated, Classroom computers reviewed.

APRIL 1982
The Valley progrm, TI 99/4 and Tand, Color Computer reviewed, Report on Centronics 737/739 printers, Interfacing series.

MAY 1982
Reflections, The Argus, Compilers, SoftCard, The Valley on the TRS-80, APL language.

JUNE 1982
Two-Pass Assembler, Reflections, Osborne 1 reviewed, Program Protection, NAS Draw, Forth Simulator, Connections.

Last month's issue is still available as well but has not yet reached the end of its 'shelflife' and is not included for this reason.

If you are thinking of trying to plug some of the holes in your collection of Computing Todays then some fast action is required. Stocks of past issues are running extremely low, we only have the issues shown remaining in stock. If you are missing one of these then **now** is the time to order it because the chances are that it won't be in the list next month. All backnumbers cost £1.25 each.

To order backnumbers, simply fill in the form on the page opposite, cut it out and send it to the address given making sure your letter bears the important words **Computing Today Backnumbers.**

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For those of you who want copies of articles that are located in issues not available as backnumbers we do offer a photocopying service. Each copy costs £1.25 and information as to its title and publication date should be given. Ordering photocopies could hardly be easier, just fill in the coupon, cut it out and send it to the following address:

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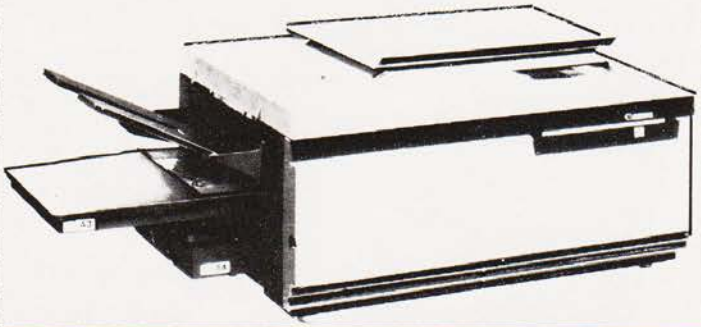

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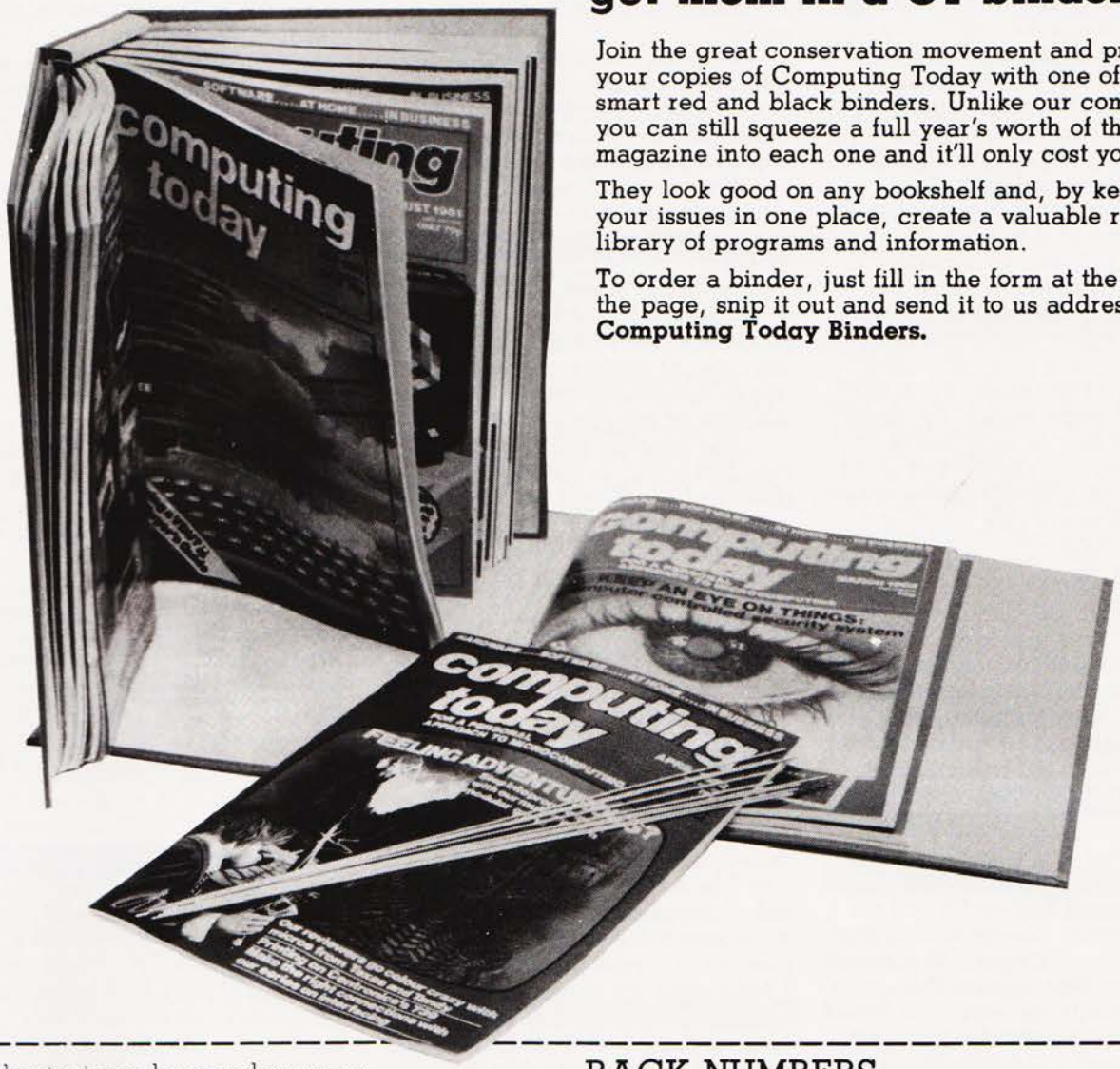

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Dear Sir,

In the plethora of inconsequential computer magazines, your publication illuminates the British computer scene like an omnipresent beacon. You have brilliant writers writing in an incisive way clearing the fog of confusion with commendable clarity. All your articles also have an immediacy and friendly presentation which is so lacking in publications of this kind.

Since all your writers are obviously destined to shine like stars in the firmament of computer writers of today and in the future, it seems to me a great pity that your table of contents fails totally to identify these writers by name.

I hope that in your future edition, you will rectify this small lapse in giving credit where credit is most definitely due.

Yours faithfully,
Prince Radala
London

(* We do actually name our authors, on the pages that they contribute. Nevertheless, your comments are appreciated! Ed. *)

Dear Sir,

I have recently received a BBC Micro Model B. During operation of the micro it would switch off, usually when I had just typed a large program. The switching was very rapid so I assumed that mains interference was responsible.

After much experiment I found that a mains transient suppressor and a capacitor (Maplin Pt. Nos. FF55K and HW13P) across the live and neutral in the socket eliminated this problem.

Hope this information will assist anyone else with the same problem.

Yours faithfully,
Rod H Elliott
Tamworth

Dear Sir,

A home Computer Club has been organised in the North Hertfordshire area. Meetings will be held at 7.30pm on the first and third Friday of each month at The Settlement, Nerells Road, Letchworth.

For more information please contact: R. Crutchfield, 2, Durham Road, Stevenage, Herts.

Yours faithfully,
R Crutchfield
Stevenage

Dear Sir,

We are a small software house, supplying ZX80/81 machine code programs on cassette by mail order.

Recently we discovered that one batch of cassettes from our supplier were badly recorded, consequently some customers have experienced loading problems.

Having established the dates and quantities sent out, we replaced 300 cassettes free of charge.

No doubt some of our customers will also be your readers so we would like to extend the offer of replacement under the above circumstances through the medium of your letters page.

The Sinclair ZX81, although a fine computer, is notoriously difficult to load and we do supply a printed sheet of loading hints and tips which is available along with our catalogue on receipt of an SAE.

Yours faithfully,
Frank A Dewey
Hull

Dear Sir,

I have bought the Video Genie EG602 Printer. It is an excellent printer, but unfortunately lacks true descenders.

The reason I am writing is to ask if anyone out there knows how to program the printer (BASIC, please) to create graphic patterns. I have read the owners manual over and over again, but I cannot understand how the CHR$() codes conform to the input data formats on page 19 of the manual.

Whenever I try to create any pattern, all I can get the printer to do is line feeds without anything being printed. Would it be possible for anyone to send me listings of how the printer can be coded, with written explanations as to how they achieved the programming? When I say explaining the code, I would appreciate the coding block to be bracketed and something said like 'graphic data', etc.

I think the printer was designed by the Centronics firm, so I was wondering if the EG602 codes are compatible with those of the Centronics 739. The EG602 has a maximum of 80 character per line up to a maximum of 480 dots wide.

I saw the wonderful 'face' produced by the Centronics 730 printer in the April 82 copy of Computing Today and wondered if it was possible to achieve something like that on the EG602 printer.

Here's a tip for all you printer users. My printer ribbon went dry recently, so I rang my dealer to see if he had any, but he hadn't. He advised me to spray the dry ribbon with WD-40 — yes, the stuff that cleans and lubricates metals — and it worked. But please remember to take the ribbon out of the printer first!

Yours faithfully,
David Beale
Corbridge

(*Firstly, the Genie printer is, as far as we know, made by Seikosha and not Centronics. Secondly, the tip you give regarding the revival of printer ribbons is **NOT** to be recommended under any circumstances. It will almost certainly lead to reduced head life and, judging by the quality of the letter you sent, does not have any lasting effect. DON'T use stamp ink to rejuvenate you ribbons either, this is actually abrasive and will wreck your print head in no time at all! Ed*)

Dear Sir,

I saw Mr. Sinclair's very impressive advertisement for the ZX Spectrum in last month's Computing Today — and indeed for £125 it does look good value for money. However, I was annoyed at Sinclair's naive attempt to undermine the BBC Micro with his irrelevant comparison of the printed circuit boards in the ZX Spectrum and the BBC Model A; he states that the ZX Spectrum's board is 'more elegant' than the BBC board. So what! The reason the ZX Spectrum's board is 'more elegant' is that unlike the BBC board, it does not allow (or have) space for speech synthesis chips, analogue/digital converters (for paddles, etc), the 'Tube', full size floppy disc controller, RAM, 320 x 256 resolution graphics, advanced machine code handling system, teletext chips, etc, etc, etc.

I would add that if Sinclair had planned his computer to compete directly with the BBC Model A he is in for a dissapointment as over 70% of BBC orders have been for the superior Model B. I would also point out that for around £30 the

memory of the Model A can be expanded enabling it to take full advantage of many more sophisticated features (eg 80 column text screen) making Sinclair's comparison table in his advert redundant.

Finally I say to Sinclair, that over 16,000 people (including myself) paying on average £350 each, over only four months, on the strength of only the reviews in the Computer Mags, would tend to prove that the BBC make the world's best television programmes AND the world's best computers.

Brian Beattie
Carrickfergus

Sinclair replies:

Our opinion of the relative merits of the ZX Spectrum versus the BBC Model A computer, both on grounds of specification and price, has been shared by other independent sources. Tim Hartnell writing in 'Your Computer' concluded "with powerful colour and sound commands, the ZX Spectrum is a remarkable computer, exceeding the BBC Model A computer, both on Robin Bradbeer in 'Sinclair User' noted that at £125 it "undercuts the BBC Microcomputer Model A, its direct competitor, by around £175", and went on to say that "the 48K RAM (version) is potentially as powerful as the Apple II costing around three times the price". Unbiased assessments, not just advertising.

Yours faithfully,
Nigel Searle
Head of Computer Division
Sinclair Research

Dear Sir,

More news of the East London Amateur Computer Club. But first, a correction to my last letter — I am not the Public Relations Officer, I am the Publicity Officer. Apologies for my error. I am informed that I have no public relations.

The newsletter continues to be published each month, and the diary of events for the future looks very promising. With the Club involvement in the 3rd London Computer Show at the North London Polytechnic and other public displays, we have been quite busy trying to acquaint the public with micros and their applications.

I am available at the telephone number given below most of the day and also in the evenings.

Yours sincerely,
J Turner
Publicity Officer
East London Amateur
Computer Club
63 Millais Road,
London E11 4HB
01-558 3681

Dear Sir,

I was interested to read your excellent introduction to FORTH which ran in Comupting Today, January-April.

We at Computer Solutions have been using FORTH Inc's poly FORTH, a multi terminal multi tasking version of the language, for two years now and can testify to its efficiency and the improvement in productivity which it has provided. May we recommend the book 'Starting FORTH' by Leo Brodie to any who wish to pursue their investigation of this powerful language. This book is available for £13.20 including post and packing from:

COMPUTER SOLUTIONS LTD
Treway House
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Surrey
KT16 9LA

Yours faithfully,
C L Stephens
Chertsey

Dear Sir,

The letter from T G R Lawrence in your June issue regarding the lengthening waiting list for the BBC Microcomputer prompts me to inform you that I ordered a Model B version in late October, 1981 and still have not received it at the time of writing (May 9th).

Fortnightly telephone enquiries to BL Marketing in Kettering over the past **two months** have produced the same reply every time: 'It should be despatched within the next ten days to a fortnight'. No explanation from the BBC has been received since a stock letter of 12th January informing me that all outstanding orders should be cleared by the end of March.

QUESTION! Since Acorn are now pulling out all stops to produce the Electron, a competitor for the newly announced ZX Spectrum, have they perhaps lost interest in the BBC machine and all its promised hardware and software? In the urgency of establishing the Electron in a highly competitive market, would not Acorn want to give priority to a machine they are manufacturing for themselves?

BIGGER QUESTION? Could the BBC Micro become the biggest white elephant in the short history of microcomputing?

Yours faithfully,
Alan Baker
Watford

Dear Sir,

The BBC Microcomputer is aptly named, I recently looked inside one in order to cure an unpleasant buzz emanating from the small speaker. Thinking it might be due to a noisy component in the audio circuitry, I tried touching components in the amplifier area with a small screwdriver. On touching pin 1 of IC 19 the buzzing stopped and was replaced with, would you believe, Radio 2.

If anyone knows the modification required to change this to Radio 4 or Radio 3, I would be pleased to hear about it.

Yours faithfully,
Andrew Donald
Ilford

Dear Sir,

I have recently purchased a NASCOM 3 from a dealer in Kenilworth, together with a printer and some software. The software included a record management system called 'MANOR', and I must admit to being concerned when I noticed that my copy was serial number 14. The program suite has proved to be very powerful, and for around £60 is tremendous value for money.

However, the really astonishing thing is the speed and quality of the supporting service, both from the dealer and Lucas Logic. Three or four problems have arisen with the system, one due to operator error (me) and another due to my monitor (the TV). In all cases, a phone call to Kenilworth or Warwick has resulted in the problem being solved immediately.

All in all I could not be more satisfied with the system, the software and most of all, the service.

Yours faithfully,
C R Case
Rugby

PRINTOUT

Dear Sir,

I must say how much I like your magazine and agree with the comments of Mr Ragheb of Colorado who wrote a letter in the June edition. I disagree that the content has **declined** *— just because I don't understand what is written it doesn't mean that the quality has changed in any way — but I do think that the standard of technicality has risen to the point where it is increasingly difficult for amateurs and hobbyists to follow. (For example, I couldn't even rewrite your 'The Valley' from the few meagre hints that were given in the folowing issue.) You know so much, I think you may have forgotton how little some of us know.*

Which brings me to my last point and that is, can you run a series of articles, or can you recommend a good book to cover the huge gap between the basic, say, TRS-80 manuals on programming and the much more advanced programming that you write about so glibly in your magazine? It may be that the gap is so large that it would not be possible to cover this in anything less than a huge tome or a year's course, but the gap is there and even the odd stepping stone would be a help. I feel like one stuck on the side of a river; everybody else has gone to the picnic, but I just can't cross. And I'm quite sure that there are hundreds if not thousands of your readers who are in the same predicament — I nearly said boat! How about helping us?

But, keep up the good work. Come down from the clouds just a little or some of us will have to desert you. We don't want to, you have a good magazine there.

Your sincerely,
R H Statham
Somerton

(*There are now a vast number of books related to certain machines like the TRS-80 which are intended to 'fill the gap'. Two of them are currently lingering on my bookshelves; Explore Computing with the TRS-80 by Richard and Josephine Andree (published in the UK by Prentice Hall at £8.95) and TRS-80 Assembly Language Made Simple by Earles McCaul (again published in the UK by Prentice Hall at £9.05). Whilst I wouldn't like to claim that these are the best in the field — I haven't read enough of them to make such a comparison — they represent the sort of book that is widely available. Probably also worth a look are the series of books produced by a number of publishers which contain a large number of simple and medium standard programs. These books are generally identical except that they are re-written for the various different micros. However, they do provide a useful source of general programs too. Ed. *)

Dear Sir,

My son and I have found it an interesting and instructive task to adapt the Valley game to a TRS-80, on the lines given by Peter Green in the May article.

In the TRS-80 adaptation, line number 9210 needs modification, indeed an extra line, as different symbols are recommended for the Temple and the Lair in the swamp and wood scenes. Also POKE code 91 is the one for trees, not 90.

We find POKE code 173 gives a nice border for woods and swamps, but 128 as recommended does not give a border on the TRS-80. Code 149 gives nice lakes which avoid the confusion referred to in Peter Green's article.

Please, what is the purpose of line 3170? The condition RF> 23 should never occur, if it does wouldn't it give a BS error?

Besides learning some interesting programming, we find it a very good game which keeps its fascination as the 'character' develops.

Yours faithfully,
P F Knewstubb
Cambridge

(* Congratulations Mr Knewstubb, you've discovered the single redundant line in the program! It is actually left over from an earlier and bigger version of the game where certain monsters didn't appear until you had sufficient resources to fight them. The solution is simply to delete it. Ed. *)

Want to air your views or pass on information? Why not drop a line to

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and we'll do our best to make them public.

Dear Sir,

CT is, undoubtedly, the best computing magazine on the stands today, but still seems to underrate the Micron and, even that superb language, FORTH.

Could you publish FORTH programs (or failing this, at least publish structured programs). The Valley is impossible to convert although it is very likely that it would have fitted in my 8K, once compiled.

Also, if you do publish FORTH, can I plead for either the use of the 79-standard, or the publishing of an article listing useful words (and their definitions) with which lesser (ie more-standard) implementations can be brought into line.

Keep up the good work.
Yours,
T A Browning
Southampton

(*We would love to publish programs written in FORTH, if anyone wants to send them in. Our series certainly sparked off considerable interest in the subject — see last month's Printout. However, I would take exception to your comment that we underrate the Micron as we were the first magazine to look at the system and we still publish software for it, again see last month's issue. Ed. *)

Dear Sir,

Please notice for your information and your reader's that we are starting a BBC (National) Users Group.

The purpose of the group is to have a central point where anything advantageous to the members can be pursued. We hope to follow the example set by the TRS-80 (National) Users Group, based at Milton Keynes, which is surely the best run group in this country.

We will have regular monthly meetings leading eventually to workshops, arranging discounts where possible, a members free software library and a monthly newsletter giving news, views and hints on the BBC Computer.

The annual fee of £8.00 is payable to BBC (National) Users Group: J Graig (Secretary).

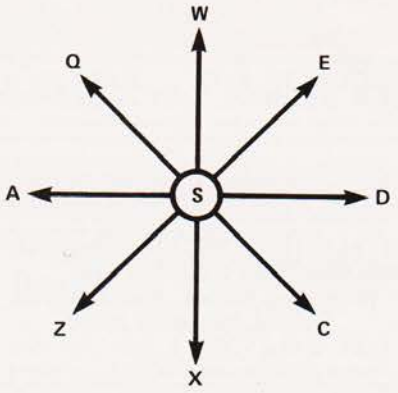
Yours sincerely,
J Craig
40 Mount Pleasant Avenue
Wells
Somerset

AD INDEX

J Schofield

TIE DAIED

Simple colour patterns with the DAI.



This program is written specifically for the DAI 48K computer but by substituting line 70 with a 'string' and an 'INKEY$' statement and deleting the brackets and 'ASC' instructions, it should run quite well on most machines.

Various other lines would have to be amended slightly, but anyone with some understanding of Microsoft BASIC should be able to do this and run the program effectively.

For those who possess a DAI, the following features will be of interest. In MODE 5 the program allows the user to select any colour from 0 to 15 and create dots, with single keystrokes in any of eight different directions. By pressing the Repeat key, the dots will run in lines to whichever part of the screen is selected by holding down the direction key.

The direction indicator nominates the keys which are grouped around the 'S' key. For anyone wishing to change colours in mid-stream as it were, the 'P' key will allow selection of any colour at any time. Finally, by selecting the appropriate background colour, the dot can be moved around the screen invisibly to re-appear when another colour is selected.

The biggest drawback with the program is that it does not allow any artwork to be retained or loaded onto cassette in the form of data. Sorry.

Program Listing

```
10  MODE 5
20  COLORG 8 8 0 0
30  X=XMAX/2
40  Y=YMAX/2
50  INPUT "ENTER NUMBER OF COLOUR YOU WISH TO USE";A
60  PRINT CHR$(12)
70  K=GETC
80  IF K=ASC("C") OR K=ASC("D") OR K=ASC("E")
    THEN X=X+1
90  IF K=ASC("Z") OR K=ASC("A") OR K=ASC("Q")
    THEN X=X-1
100 IF K=ASC("Q") OR K=ASC("W") OR K=ASC("E")
    THEN Y=Y+1
110 IF K=ASC("Z") OR K=ASC("X") OR K=ASC("C")
    THEN Y=Y-1
120 IF K=ASC("P") GOTO 50
130 DOT X,Y A
140 IF X>=XMAX-1 THEN X=XMAX-1
150 IF X<=0 THEN X=1
160 IF Y>=YMAX-1 THEN Y=YMAX-1
170 IF Y<=0 THEN Y=1
180 GOTO 70
```

Peter Tootill

CASE CONVERTER

Remove those confusions on your TRS-80 system.

Having modified my TRS-80 to display lower case letters, I found that some of my programs using menus or 'Y' and 'N' answers to questions didn't work any more. The problem was that the program was expecting an upper case response and it was getting lower case instead.

One answer is to simply alter the case of the match statement in the program. However, I don't always have the lower case driver program running, and even if it is, the computer may be in capitals-only mode, so my responses may be in either upper or lower case. One way to handle the problem would be to use a statement such as:

```
IF A$="Y" OR A$="y" THEN...
```

However, this can get a bit unwieldy if there's a menu with several options to check. So I decided to write a subroutine to convert lower case input to upper case. At the same time, I provided some error trapping by limiting input to letters and numbers only, these being the responses I normally use in programs with menus or other similar features. The routine should be fairly self explanatory.

Program Listing

```
1000  A$=INKEY$:IF A$="" THEN 1000
1010  IF ASC(A$)>95 THEN A$=CHR$(ASC(A$)-32)
1020  A=ASC(A$):IF A<65 THEN 1130 ELSE IF A>90 THEN
      GOSUB 1050:GOTO 1000 ELSE RETURN
1030  IF A<48 OR A>57 THEN GOSUB 1050:GOTO 1000
1040  RETURN
1050  PRINT "INPUT ERROR; PLEASE CHECK WHICH KEY YOU
      PRESSED. USE LETTERS AND NUMBERS ONLY"
1060  RETURN
```

Line	Function
1000	Gets a character from the keyboard
1010	Converts lower case input to upper case
1020-	Determines the range of characters which can
1030	be accepted by the routine

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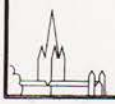

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CT STANDARDS

Our regular page explaining the meaning of the various symbols we use to make programs portable.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

Controlling That Cursor

Our original standards have now grown with the times. Machines such as the Commodore VIC which have a dual Shift capability can now be incorporated, as can those systems which use Control key functions.

The recently introduced BBC system offers pre-programmed function keys which, we are glad to say, can also be handled by our original coding system. It's nice to see just how well adapted the original standards have become over the last two years! (Indeed, a whole series of books is using them as its *de-facto* standard.) The standards for the cursor controls are given in Fig. 1.

[CLS]	CLear Screen
[HOM]	HOMe cursor
[CL]	Cursor Left
[CR]	Cursor Right
[CU]	Cursor Up
[CD]	Cursor Down
[REV]	REVerse video on
[OFF]	Turn it OFF
[SPC]	SPaCe
[CTL]	ConTroL key
[fn]	Function key (BBC)
[G<]	Graphic left (VIC/MZ-80A)
[G>]	Graphic right (VIC/MZ-80A)

Fig. 1. Our extended set of cursor control standards includes four new functions.

To indicate more than one of the above, an optional number can be placed within the brackets; [4CL], etc.

The use of square brackets has raised one or two queries. The reason for this choice is that *most* of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a Syntax Error if they are found, a useful check in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in the gap in the printout. The other common variant of the code for spaces is used by the ZX people. Their choice was '_' and this crops up in the various newsletters they publish.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy! Don't forget, you may have to look up and alter the values used elsewhere in the program.

The Graphic Solution

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphics symbols. The following standard is now in general use in programs published in Computing Today.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR$( ) codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

Making REMarks

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place: the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT
4000 INPUT "THE NUMBER OF ENTRIES ";A$
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when renumbering after removing the REMs.

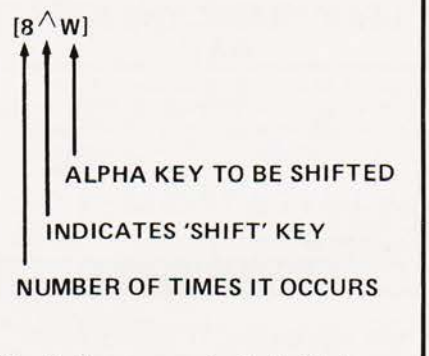

Fig. 2. The way we indicate block graphics on machines like the PET and Sharp. The VIC system of Shift Left and Shift Right is shown in Fig. 1.

1	2
4	8
16	32
64	128

Fig. 4. To converts a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

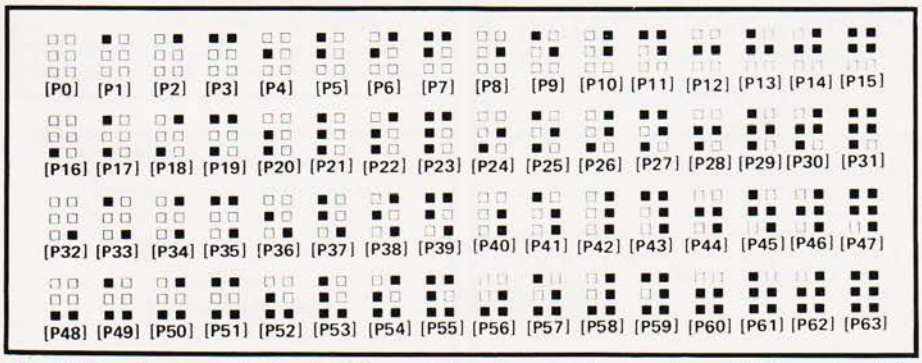

Fig. 3. The standard pixel codes; they will work on most computers which employ this technique as well as for Teletext and Prestel.

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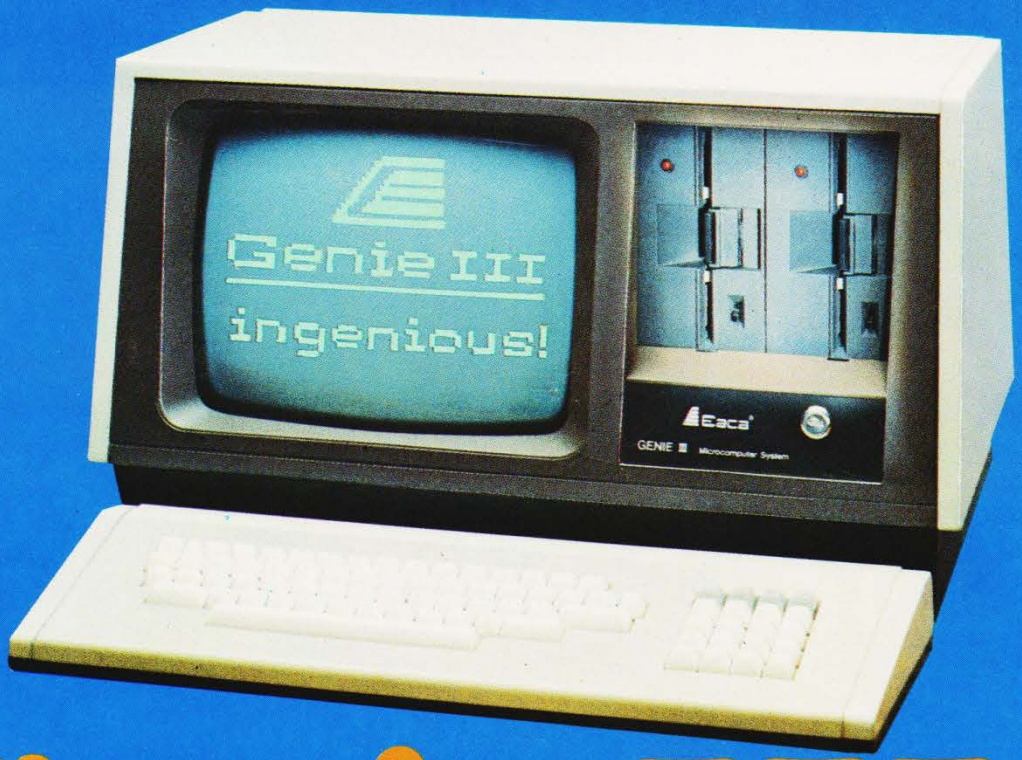

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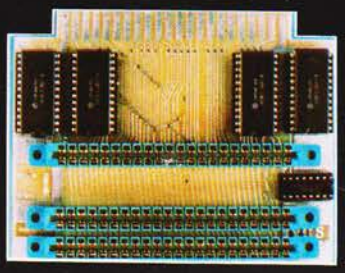

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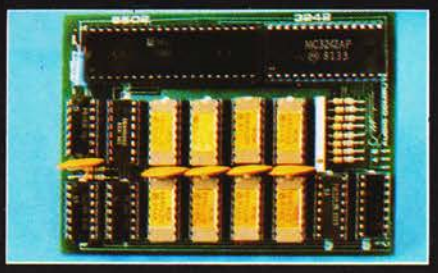

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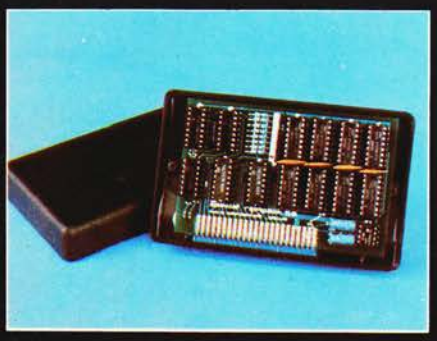

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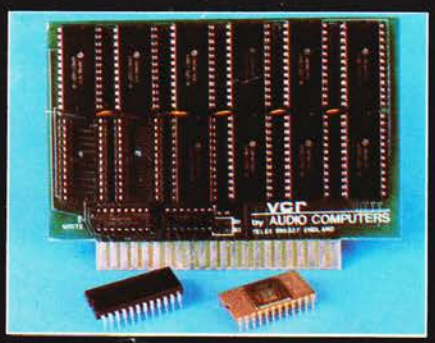

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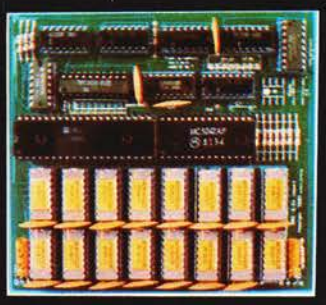

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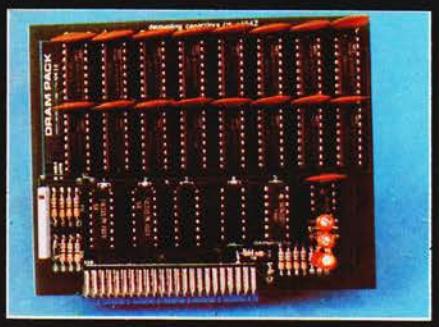

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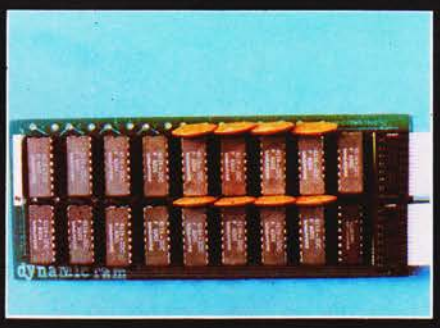

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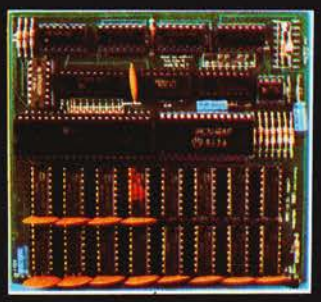

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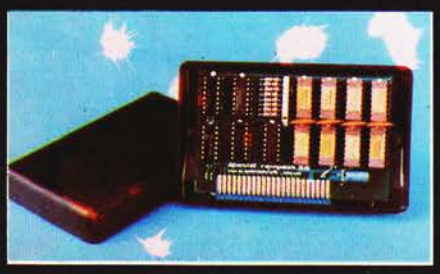

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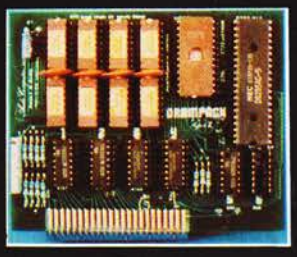

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