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OCTOBER 1984

# A&B

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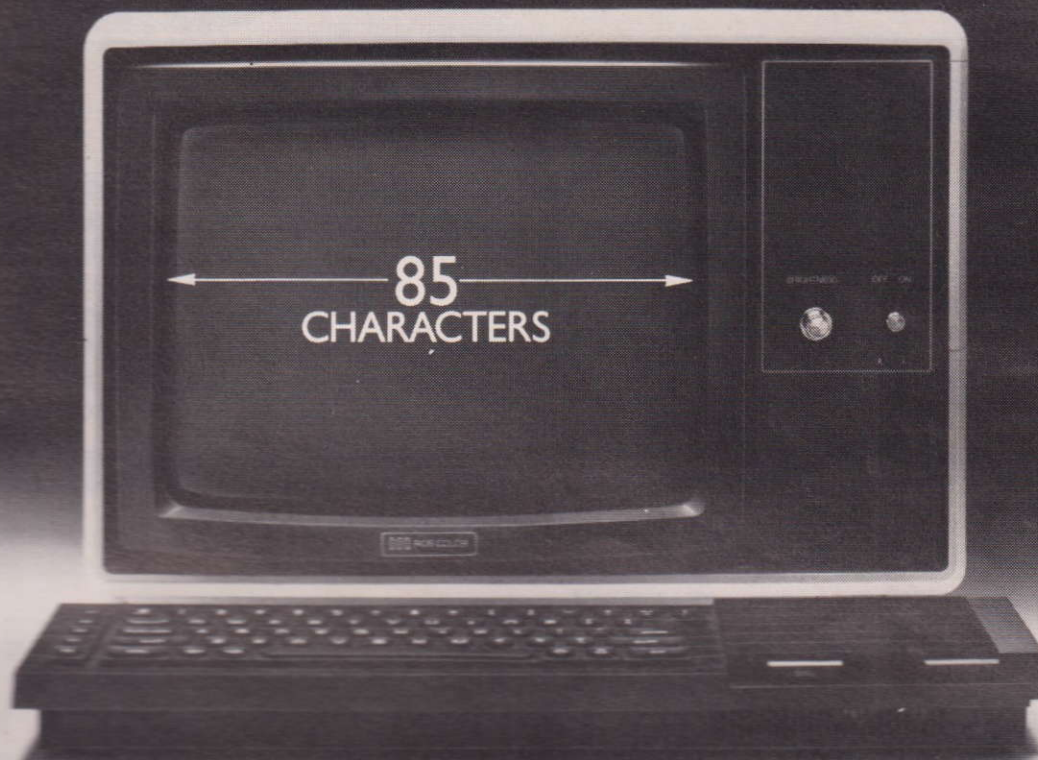
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## Volume One Number

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A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration for publication.

All submitted material should be printed or typed, double spaced. Any programs submitted should be listed (55 character width emphasised if possible). A cassette of the program alone will not be considered. All programs must come complete with a full explanation of the operation, and where relevant, the structure. We also require the program in machine readable form (cassette, 40 track 5¼", or 3" disc) plus any suitable screen photographs, printer dumps and so on.

All submissions will be acknowledged and the copyright in such works which will pass to Argus Specialist Publications Limited will be paid for at competitive rates. All work for consideration should be sent to the Editor at our Golden Square address.



## Nine October 1984

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All work for consideration should be sent to the Editor of A&B Computing at our Golden Square address.

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# Menu

So, the Acorn BBC Microcomputer continues in its role of micro flagship of the British Broadcasting Corporation's computer awareness campaign.

The Model B ('A' production has been officially abandoned) has been granted a further four years as the core of the BBC Microcomputer system.

How could it have been otherwise? A large user-base has been established, further enhancements are in the pipeline and original application ideas continue to pour forth.

It is an auspicious moment for *A&B Computing* to further increase its coverage and software support for both the model B and the Acorn Electron, a precocious and rapidly growing one year old.

Acorn's open-ended approach to the design of the BBC has created a powerful computing tool for the users themselves to exploit individually and uniquely. No software or hardware designer can take for granted what a BBC or Electron is being used for, and nor can any magazine. *A&B* tries to cover as wide a range of uses as possible.

This issue has good examples of just how far you can take the basic model B or Electron. Both Torch and Control Universal are part of a band of Cambridge based firms supporting advanced applications of the BBC. The Plus One Electron add-on is just the first step in a cascade of additions for Christmas, from both Acorn and independent suppliers, like

## ACORNSOFT GAMES

### Gateway to Karos

for the BBC Microcomputer Model B

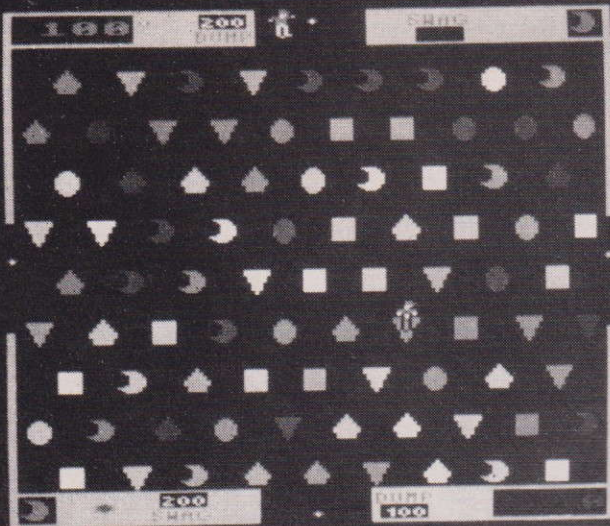


## ACORNSOFT GAMES



### Drogna

for the BBC Microcomputer Model B



Mushroom with their ROM board and Sir with the teletext board and printer/joystick adaptor.

Acorn themselves promise the obvious additions plus their long awaited home-control device. Acorn are not content with taking over the classroom, office and study; they want to get into the kitchen as well! Then of course there is the business system to look forward to. If rumour is correct, it could be with us by the time this issue is in the shops. How different from a standard BBC system will it be? A lot, if it is to justify some of the price tags which have been suggested.

On a lighter note, the run in to Christmas should see the launch of some great new games.

Acornsoft have already started with the thought provoking Drogna (from the television adventure), the brilliant, highly original Tetrapod and Gateway to Karos, an adventure in which you have to keep your head.

Acornsoft are also being very cagey about an interplanetary trading game called Elite, which by all accounts has a stunning 3D display.

Lots to look forward to then, not least typing in some of the great games and profitable programs in this *A&B*. If any of you punters do win a fortune through using Pools Prediction, please don't forget the needy staff of *A&B Computing*.

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## PRICE BREAKTHROUGH

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# Cheetah

## Marketing



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# News

## BBC RENEWS CONTRACT WITH ACORN

All speculation was laid to rest on Wednesday 11 July when a contract was signed to extend the agreement between the British Broadcasting Corporation and Acorn Computers. This gives Acorn the rights to manufacture and distribute the BBC Microcomputer for a further four year period from September 1 1984. In the past few months the challenge of Sinclair has fallen by the wayside and the deal comes as little surprise.

The BBC is already the heart of an expanding hardware system and the software support is excellent, especially in the success area of education. Chris Curry, MD of Acorn, has said that the BBC will maintain its "core of compatibility" while ensuring that owners can take advantage of future technology. As well as expanding the system, further efforts will be made to market the computer overseas.

The BBC intends to produce new books and software and to create a new television series. Of the BBC/Acorn partnership Chris Curry said "Over the next four years we intend to work out natural extensions to this unique relationship which will take it into new areas of technology."

## STOP OFF AT GCS BUS SHOP

Lion Micro now have an over the counter maintenance and repairs service incorporated into their Tottenham Court Road store. The General Computers Systems Bus shop is aimed both at Lion customers and anyone in the London area who has a micro and is without satisfactory service.

Customers hand their micros over the counter and an engineer will, wherever possible, identify and rectify minor faults there and then or advise as to the likely time of repair together with an estimate.

## MEGABYTES

Wall's Ice Cream did their best to brighten up the summer months for BBC and Electron users, both with a new ice lolly called Megabytes and with a competition run in conjunction with Acorn to give away 25 BBCs and 50 Electrons to schools and individuals. The competition involved writing a computer game featuring, of course, ice lollies. Enough to make the mouth water.

## SIMONSOFT SPRITES HOTLINE

Users of the Simonsoft Sprites package can take advantage of a new hotline, open for programming enquiries between 2pm and 3pm every week day. All queries will be answered and the line may also be used to ask permission to use the sprite routines in commercial programs. This is always granted but Simonsoft would like to know beforehand.

## BATTLE IT OUT ON STARNET

The Galactic strategy game Starnet is now well under way on Miconet 800. The game can involve up to 1000 players simultaneously. These Star Captains have to fend for themselves in a hostile universe, trying to command their fleet of ships towards some success or perhaps merely survival.

Each player makes his/her way round the Galaxy using the co-ordinates of the star sector into which they have been thrown. The Galaxy is made up of 343 maps which can at all times be studied free of charge. By sending Diplomatic Electronic messages to prospective allies and performing tactical manoeuvres, each player can travel, capture ships and stars and extort tax from other players. It is of course possible to form alliances with other players on the system so the wires should be alive with intrigue and wheeler-dealing.

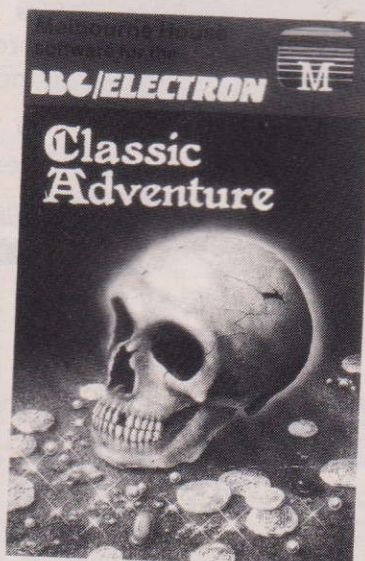


The object of the game is to build up enough power and influence to seize the Imperial Throne Ship and to become Emperor. A cash prize of £150 will be awarded to the first contestant to achieve this. There ought really to be a prize for anyone who can understand all the rules. Starnet has to be one of the biggest computer games ever played.

## ADVENTURE CLASSIC FOR BBC AND ELECTRON

The original Classic Adventure, first written in Fortran in the 1970s, very much laid down the ground rules for all Adventures that followed. You can now play it on your BBC Micro or Electron thanks to Melbourne House.

The computer acts as the player's eyes and hands, describing the immediate location and surroundings. Using this information the adventurer must find the many valuable treasures hidden, and often guarded, in the Colossal Caves. Many objects picked up along the way are not what they may seem and have strange side effects. Unfriendly characters lurk in the dark, including dragons and trolls. This is the original text-only adventure now available on your micro.



## MAGIC ROUNDABOUT FOR CRL

CRL will endear themselves to the millions of fans of the Magic Roundabout when they bring out their game based on the

# NEWS News

characters from the favourite tea time television programme. CRL have now signed the rights to the title and the characters of Florence, Brian, Dylan and other famous names. Development work has been going on for some time and it should be a late summer release. One certainty is that Zebedee will spring up somewhere in the program.

## VIDEO GAME NASTY

Drilla Killa is the name of Vampire Software's latest controversial game. Demented Duncan (perhaps he had a bad experience at the dentist when he was young!) has the drill fixation. You, the player, control Duncan as he goes on the rampage taking revenge on little old ladies and joggers. That's Monday. Tuesday finds him at the supermarket. Wednesday it's the golf-course, Thursday the House of Commons and Friday (help!) Duncan helps Andy the Axeman to reduce the population of the press.

Drilla Killa is a Mode 2 horror with all the arcade features. Available from Vampire Software, P.O. Box MT15, Shadwell, Leeds, LS17 8DW.

## CONTROL WITH PORTCOM

W.D. Interfaces have just released PortCom, a user port control module for the BBC. PortCom with cassette based software costs £99.95 and provides a host of routes to the outside world for your Beeb.

It contains four single pole changeover relays, two mains outputs, two uncommitted DC outputs, 5V and 12V outputs from the mains derived power supply, the user port still available on the front panel, two 8 LED displays showing the status of each output device and each data line of the user port, and a port indicator showing whether the output devices within PortCom have been selected.

The rest of the package in-

cludes a programming manual for PortCom and the user port and 12 way plugs and crimp terminals.

The software contains an introductory teaching program demonstrating how easily PortCom can be controlled together with many programs ranging from a simple loop alarm through to a multipurpose time clock and a laboratory experiment safety monitor. A variety of input and output models are available as well as a full range of connecting leads and plugs.

## APOLOGIES TO TOAD

Toad Educational Computing have written to A&B explaining that their ROM extension socket, which appeared as part of our Peripherals Roundup in March/April, is based around a zero insertion force socket. Our reviewer was under the impression that an ordinary ROM socket had been implemented. A zero force insertion socket allows the user to simply drop the ROM feet first into the row of female sockets. A small lever then activates the gripping device. The device is available from Toad Education Computing, 8 Westbourne Grove, Sale, Cheshire M33 1RP. Tel. 061 969 4740.

## DOING BUSINESS WITH CYB

C.Y.B. Design Services continue to come up with interesting business software for the BBC and now the BBC with Torch Z80.

The Payroll program for the BBC with dual disc drive is capable of handling 150 employees (£49.95) and the new Torch Z80 version 600 employees (£74.95). The CYB Mailing List program, once again disc based, costing £19.95 has been joined by a Torch Z80 version with extended storage. Mailing List provides facilities to add, delete and modify a database to

names and addresses and to print them out to the chosen medium, including labels and envelopes.

Mail Merge allows the much more useful option of merging the database of name and address information with the well-known wordprocessors Merlin Scribe and Wordwise. A standard letter can be personalised from a list of appropriate names and addresses on Mail Merge. What more could a business ask for? Price is £39.95. A more powerful version with Torch Z80 costs £59.95.

## SYSCON 6 EQUALS COMMODORE COMPATIBILITY

Intelligent Interfaces, who designed the Acorn IEEE interface have turned their expertise towards a highly useful product for BBC users who already have Commodore peripherals. This applies to many Commodore users in industry and education.

Syscon 6 allows the BBC to use disc drives and printers from the Commodore stable without having to divert from the normal BBC commands. This is achieved through software routines which are supplied on a ROM for insertion into the BBC. This method allows the use of Commodore peripherals from programs like Acornsoft VIEW.

\*CDISK calls up the filing

system which offers commands equivalent to all the Acorn DFS commands and contains additional bonus features like \*FORMAT and \*BLOCK. You can also take advantage of 14 character file names and up to 151 or 224 files per disc (depending on the peripheral used).

\*CPRINTER and \*APRINTER set up the necessary routines to give Commodore printers the appearance of conventional operation. In addition to printing an upper and lower case ASCII character set, special features such as line spacing, user defined character etc, are provided.

The Syscon 6 connects to the BBC via the 1MHz bus and to Commodore peripherals via an IEEE488 connector. A comprehensive guide is included. Users of Commodore disc drives need not have an Acorn DFS fitted. Information from Intelligent Interfaces. Tel. 0789 296879.

## GAMES FROM TALENT

Talent Computer Systems, until now a Commodore orientated company, have a couple of games out for the BBC and Electron. Talent's interests span higher education, industry and the home computer market. They have just put the finishing touches to books for the BBC and Electron as well as the new games. Dr John Malone, Pro-



CONTINUED OVER

# Me

Professor Andrew Colin and Mrs Veronica Colin are the team behind Talent products. The fourth partner in the company is the University of Strathclyde itself, where Professor Colin and Dr Malone are members of the Computer Science Department.

The two games are called West and Laser Reflex. The first is a challenging adventure set in a Wild West ghost town. The player must flush out a gang of robbers and collect their loot, while avoiding 'real-time' events such as attacks by Indians! There is an extensive vocabulary of 200 words and as many phrases, and 130 locations to search.

Laser Reflex involves the player defending his asteroid base from mutating star-ships with a laser beam deflected against a giant mirror. Graphics for the games are by a freelance artist Mike Masters. All Talent games are written in a language designed by Professor Colin, STAB-1. This combines the advantages of high and low level languages by identifying the need for either within a program.

## BBC AT GRANADA!

Granada TV Rental are to retail home computers including the BBC through their high street outlets. Granada will also sell a wide range of computer games, educational software and peripherals with more products being introduced throughout the year.

## BUSY BROADWAY

Broadway Electronics are keeping busy with a wide range of BBC applications. Now part of the newly formed Mushroom group, they have supplied prizes of BBC Micros to local Bedfordshire schools which took part in a schools technology project. Redbourne school, the winning exhibitor, impressed managing director Paul Vaughan so much so that he thought projects like



the electronic speedometer for cycles, computer controlled music synthesiser and graphic plotter could well become marketable products.

Meanwhile BBC equipment supplied by Broadway is being used to develop underwater weapons for the Royal Navy. Marconi Underwater Systems Limited use the BBC to collect data from a specially built data logger to record the position and velocity of the weapon. The data is retrieved using an ordinary commercial interface. Analysis is done on the BBC and subsequently can be transferred to a mainframe.

## TOP TURTLE

Valiant Designs Ltd., a young group of electronic and software engineers based in Battersea saw the culmination of nearly three years work on 16 July with the launch of the Valiant turtle. The House of Commons played host to the first remote-controlled turtle, and the first which actually looks like a turtle.

The need for the robot to look like the turtle, which is closely associated with the educational language LOGO, was the first decision the company made. Since then it has been a battle to get funds and support to keep the project going. The company took on any work it could get but kept working on the turtle.

The Valiant turtle has been on trial in schools in Bradford and London for some time and fears raised at the launch about the vulnerability of the robot in the hands of children were put to rest by teachers who have worked closely with it in the classroom.

The turtle concept is not a new one but the remote control feature of the Valiant turtle somehow breaks new ground. The fact that the unit moves

without apparent connection to the computer may have something to do with it but the clever design, support software and documentation give the package a professional feel appreciated by the educationalists at the launch.

The turtle's own batteries are rechargeable using a supplied power supply, with a quick or long charge both possible. Control from the BBC is via an infrared transmitter which sends signals which are converted by the turtle's logic control into moves, turns and pen action. The turtle's two illuminated eyes serve as power indicators, going out before any functions fail and allowing fair warning that recharging is necessary.

The turtle is capable of very accurate drawing with precise stepper motors allowing movements in units of 1mm. The software deals in centimetres but is easily converted to any measurement. The package includes Valiant's own LOGO, a

technical manual and a book for parents, teachers and children on LOGO and the turtle.

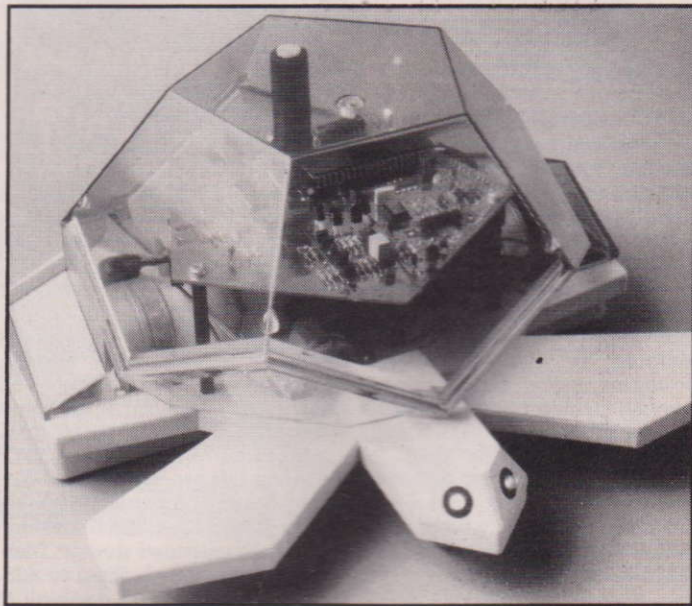
Professor Tom Stonier who holds the founding chair of the school of Science and Society at the University of Bradford, was at the launch to explain the importance of LOGO, a language designed by an educationalist not a programmer and one which is demonstrated so well by the concrete actions of the turtle, originally on screen but much better in the flesh, so to speak.

As well as Valiant's own software there are interface programs to allow popular versions of LOGO to make use of the turtle. Acornsoft have worked with Valiant to ensure that their version will be able to control the turtle when it becomes available.

## ADVANCED MEMORY MOUSE

Advanced Memory Systems plan to emulate the huge success of "Mouse" technology available on Apple's Lisa and Macintosh computers with their own BBC rodent.

The AMS mouse will come complete with an interface which will make it completely compatible with existing software and should cost considerably less than



# NEWS News

£100. Although a mouse is an excellent way of moving a cursor about the screen, it is essentially a simple device and relies on software. AMS are working with major software houses to ensure that new software can take full advantage of the AMS mouse. In the meantime it should make word-processing activities and even games easier to handle.

AMS emphasise the current computer practice of using Icons on screen to represent different functions. Once again this is a software implementation and will take considerable resources both human and computer. However now that a mouse is available, the excuse is there for software houses to have a go.

## MODEL A DISCONTINUED

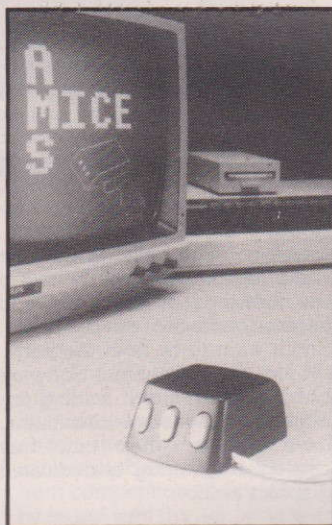
Not surprisingly Acorn have decided to drop the Model A and concentrate production on the more popular B. The Model A's lower specification does not take full advantage of the BBC facilities and many owners have upgraded to the Model B in the course of time. Presumably the Electron too has taken a chunk of the lower price market. All orders up to 31 August 1984 will be honoured.

## MORE MOSAIC BOOKWARE

Mosaic Publishing have a number of very interesting projects in the pipeline for release during the autumn. Terry Jones' (of Monty Python fame) book *Eric the Viking* is being turned into software by the adventure masters Level 9 Computing. Meanwhile Shards are working on the programs to accompany a Michael Moorcock trilogy. It will be interesting to see what these works inspire in the BBC programmers concerned. A challenge indeed.

## THE ISRAELI CONNECTION

The BBC Micro, which is used throughout ORT schools in



Israel, featured during the marathon election night coverage of Israel's election on Monday 23 July. The chief news editor decided to make use of computer graphics to help sort out the 27 parties on the ballot paper.

The producer, Rafi Ginat, who is also a leading consumer journalist, travelled Europe and the USA looking for the most appropriate system and after approaches from Aschola, the Israeli importers of the BBC, chose the BBC Micro.

A deciding factor in Mr. Ginat's choice was the fact that BBC Television engineers had already developed the necessary device to connect the BBC to video equipment used in television studios. The BBC Micros were used in the election coverage to analyse the results of Israel Television's sample poll and to predict the likely outcome of the election. As the results came into the studio from the Interior Ministry's central computer, the BBCs translated the statistics into graphical form for broadcast to the public.

The BBC is already a very popular micro in Israel. They are used for Instructional Television in conjunction with its Teletext service — based on Ceefax and Oracle. It was recently chosen by the prestigious Hebrew University of Jerusalem, after stiff competition with Apple and Commodore.

A considerable body of educational software has already been produced in Hebrew and several Jewish schools in the UK are using the Hebrew that has been developed for the BBC. Jewish schools in the USA and Australia have also expressed great interest in developments done in the biblical language.

The BBC has also found its way into business in Israel through its use in electronic communications. Companies communicate with associates in both the USA and Britain.

## WIND TUNNEL TESTS WITH BBC MICRO

They certainly take their motor racing seriously at Acorn these days. Following the Acorn race day at Silverstone back in June, comes the news that the BBC itself is being used as part of the test gear in a Southampton University wind tunnel.

The Acorn Formula 3 racing car is among others being put through its paces. Engineers can measure the aerodynamic forces operating on the car. Air is blown over a detailed one third scale model of the car and a moving belt simulates ground effects.

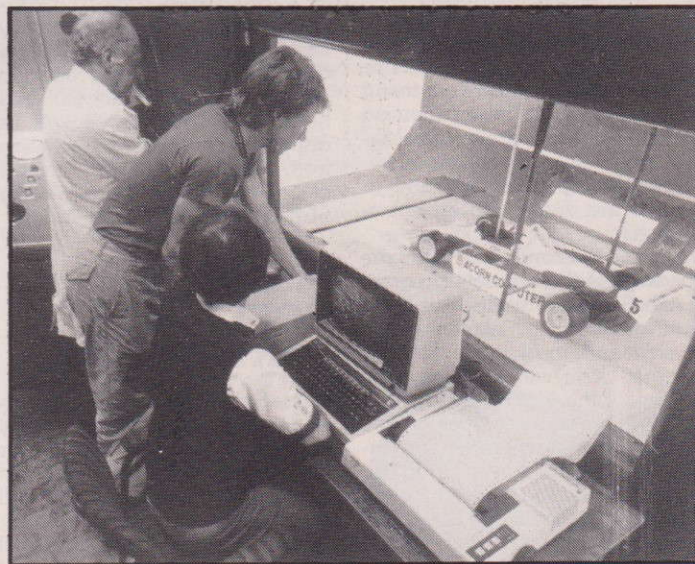
The BBC Micro scales up the data gained from the tests to direct loads that the real car would encounter. The racing team can study the effects of design changes, and further software on the BBC works out the affect on lap times. Acorn expect to achieve a 40% improvement in the aerodynamic design of the car.

## LION'S DEN

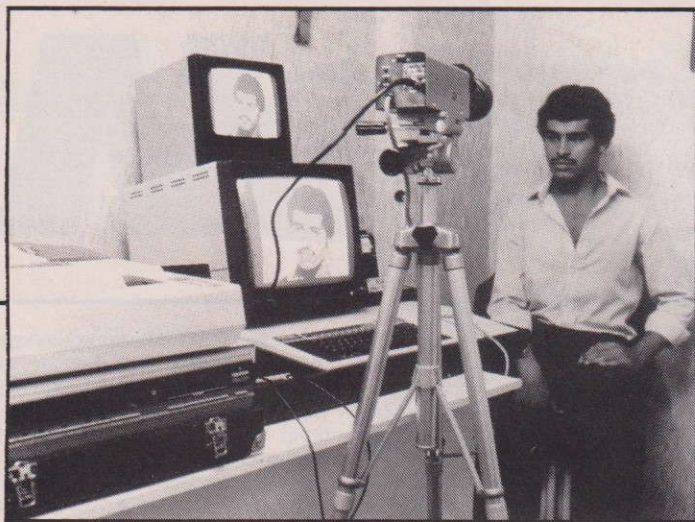
There was a lot to see at the recent Acorn/Mirrorsoft week at Lion Micros on Tottenham Court Road. The Acorn exhibition unit was there with all the hardware. The Bit Stik was especially popular as waves of school children descended into the basement of Lion House.

Mirrorsoft previewed their latest games for the BBC, including *Caesar the Cat*, *Hi Bouncer* and *Star Seeker*. *Caesar the Cat* is a very colourful game featuring the loveable cat. He has to search the crowded shelves for mice and remove them from the room when he has caught them. Like many of the Mirrorsoft games for youngsters, *Caesar* features cheerful sound effects. Don't knock the crockery down!

*Hi-Bouncer* proved most popular with visiting children. It's



CONTINUED OVER



a highly original arcade game featuring the Mr. Men familiar from the First Steps program. Mr. Bounce, who else! moves around town helping his friends. On the first screen he has to jump up and down trying to recover a scarf. When he gets it he jumps for joy and ends up on top of a lamp post. Even more sensational is what happens if he doesn't get it right. The arcade version has two levels of speed and reactions have to be equalled by correct tactical thinking for each screen.

Also included is a practice program to enable a younger, or older player to enjoy the game. This has seven levels of speed. Both programs cost £6.95.

Star Seeker is one of the "home discovery" programs from Mirrorsoft. Written by Dr Paul Phillips FRAS, it is published in association with the London Planetarium. If your second favourite hobby is watching the stars then this is the best BBC program for doing just that.

Star Seeker accurately plots the most prominent stars seen in the night sky from any position on Earth; at any time in this or the next century. There are menu options to obtain information on individual stars, draw constellations, simulate the rotation of the Earth through the night and to output the displays to an Epson printer.

The second part of the package is the separate program Solar System. This displays information about the planets of the system and, most timely, Halley's Comet. You can also draw the phase of the Moon. Star Seeker is available on two tapes or one disc with a comprehensive instruction manual. At £9.95 for the cassettes and £12.95 for the disc, this has to be one of the best value programs around.

There were also queues to

get a digitised picture from the R.H. Electronics team. Examples of capturing screens from video tape and from camera abounded, including a gentleman looking not unlike a certain sales manager at Lion.

## INTEC HARD AND FAST

Hard disc manufacturers INTEC have launched a range of Winchester add-ons for the BBC.

The range offers mass storage in 5, 10 and 20 Mbyte units for commercial and educational users who require the capacity and reliability which Winchesters can bring to a system — at a price. INTEC hard disc drives start at £1399 for 5 Mbytes. There are fixed and removable cartridge configurations and software features such as logon, passwords and directory sub-volumes, and on-board diagnostics.

John Richardson Computers, who supply the pharmacy trade with an all-in BBC system now uses INTEC hard discs to supply medical centres and hospital dispensaries as well as dispensing chemists. Information from INTEC, 41a-45 Knight's Hill, West Norwood, London SE27 0HS. Tel. 01 761 5999.

## SMITHS IN SOFTEAM PARTNERSHIP

W.H. Smiths have joined up with Softeam to market and supply software through computer dealers. The software is confined to the business area and will cover a number of machines. Acorn however, have given full co-operation to make sure that

business software is available in the Acorn format for the BBC Micro and Z80 second processor.

The team supply a software catalogue from which dealers order but if the software happens not to be in stock, there is guaranteed next day delivery, free of charge. The deal also includes full after sales service, as well as. The belief is that the computer industry will follow in the footsteps of the USA and become software driven. W.H. Smith want to be in at the start.

In the meantime Software Ltd., the country's leading independent software distributor, have released their new free catalogue featuring a dedicated graphics section.

## MORE CONTROL FROM SAAB

Saab Industrial Systems (from Woolmer Green not Gothenberg) have designed a software package to allow a standard BBC cassette or disc based system to program the Saab Supervisor Programmable Controller System.

The package is to be made available in French, German and Swedish (naturally). The programmable controller is a low cost industrial system which

could find its way into colleges via the BBC link.

There are two prime operational modes, command, in which the user develops his program. There are 30 user commands such as TURN-ON and WAIT-FOR. The BBC is linked to the controller via the serial port and programs are transferred from the BBC memory to the controller RAM or permanently fixed into the non-volatile EPROM memory system.

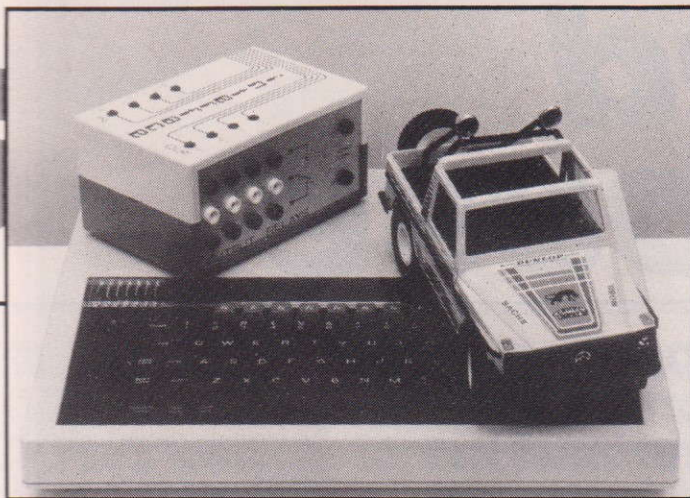
The BBC can use the Supervisor system to extend into areas where basic control and automation techniques are being taught. Further information from Saab Industrial Systems Ltd, 61 London Road, Woolmer Green, Herts SG3 6HU. Telephone: (0483) 814777.

## PILOTING INTO CONTROL

Pilot One Ltd. have launched what they hope is the first part of an expanding range of software and hardware which will inexpensively introduce BBC owners into the world of Control Technology.

The digital Interface, IN/521/E (such catchy names these devices have) plugs into the user port of the Beeb and forms





the basis of a number of control projects provided by Pilot such as alarm systems, mains controllers and adaptors for motorised models.

The interface provides four input and four output channels for response to 5V/0V signals and for switching external devices via relays. Eight LEDs indicate the current state of the relays and inputs allowing software to be tested before use.

Since we are not all up to programming the user port direct, Pilot supply a set of BASIC procedures, menu driven, to cover the interface. The programs are explained and options given to introduce the procedures into the user's own work.

The interface was designed to introduce the principles of control technology but has proved flexible enough to accommodate the advanced programmer. Prices start at £70 and there are a whole host of accessories from simple motor leads to a three motor crane with software. Further information from: Pilot One Ltd., Victoria House, 46 St. Augustine's Road, Bedford MK40 2ND. Tel. 0234 781938.

## HAIR RAISING

In 1979 a book was written called "Masquerade" which started a treasure hunt that was followed



by people all over the world. The prize, a jewelled hare made with gold and set with precious stones, was valued at £20,000 when it was won by the man who solved all the clues in the book and dug it up in 1982.

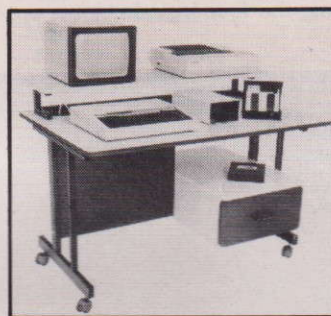
The "Jewelled Hare of Masquerade" has now been bought by a company called Haresoft Ltd and is the prize on offer to the winner of their computer treasure hunt competition. Its location can be found with the aid of clues and graphics and the game is said to appeal to an inquisitive rather than an intellectual mind.

The puzzle has been programmed in two stages and is issued on two cassettes for use with the BBC Micro, linked so that both are necessary to find the treasure. The first, Hareraiser-Prelude, is available now and the second, Hareraiser-Finale, will come out in late October, each priced £8.95. The cassettes are specially coded so there is no possibility of duplication and each one must correspond to a special code from the originator. Also each tape has its own registration card. The winner is the first person to crack the location of the hidden treasure, and must produce both tapes corresponding to the registration numbers (for authenticity) before picking up the Golden Hare or a £30,000 cash alternative.

## DRIVE CRAZY

Advanced Memory Systems, pioneers of the 3" disc drive, are offering a better value package to anyone now buying their 3" drives. A copy of Clares Replica program is now provided for tape users to transfer their programs to the newly acquired disc system. Replica itself is uncopyable and so can not be used as a means of piracy. A single drive with cables, manual, utility disc and Replica is now £199. Double drives cost £385.

Meanwhile Opus Supplies have come up with the first double sided "Microdrive" — what will Sir Clive say! The Super 3 Microdrive comes in single and dual drive formats with all leads, manual, one year's guarantee and a free cartridge. The 200K single costs £229.95, the dual drive £399 plus VAT. The units can be daisy-chained with other 3" drives or standard 5 1/4" drives. Track to track access time is 3 milliseconds and the single and double density models offer 125K and 250K Bits Per Second rate of transfer respectively.



The robust and lightweight design possible with 3" drives certainly seems to be catching on but as yet no more news of software publishers following the trend.

Opus themselves offer full support for 5 1/4" disc drives, now including a double density controller. Opus claim complete compatibility with the BBC and the result is 80% more storage on every disc.

The double density controller supports up to 248 files per side of disc and operates 80% faster than single density systems. The controller comes with all leads and manual and can be installed without any changes being made to the host BBC. The board sits above the main board and is designed to leave room for ROM boards — it sure is getting crowded under the bonnet these days. The controller also offers the ability to switch between 40 and 80 tracks and selection between single and double density is automatic. Also featured are utility programs such as Format, Verify, and Tape to Disc Transfer.

If you want something to

take the weight of all this hardware Opus are marketing their "Elite" workstations. They look nice and are obviously purpose built, but carry the heavy price tag of £239.21 including delivery and VAT. However, you shouldn't run out of space, even with disc drives and a second processor. Elite furniture for an elite bunch of Beeb bashers.

Cumana have now launched their dual drives into the high street stores alongside the single slimlines. The two types are "side by side" and switchable 40/80.

## COMPUTER NASTIES

Coming soon for the BBC Micro will be a computer game developed from the horror film "The Evil Dead". Released by new company Palace Software, it is the first of a series of games based on successful feature films.

The film tells the story of a group of naive teenagers trapped in an isolated cabin by ancient spirits of the undead. One by one they become possessed and turn in to demonic monsters intent on destroying the living. The game closely follows the film's plot, beginning with the player attempting to prevent the evil spirit from entering the house and increasing in pace as the inhabitants are transformed into ghouls, with the player having to outwit and outspeed them as they chase the hero around. The game features a musical soundtrack written especially for it.

Although Palace Software's main releases will be film tie-ins, it is also looking for original games brought in by freelance programmers. In the meantime, look forward to the possibilities of "Basket Case", "Halloween" and "Texas Chainsaw Massacre".

Unfortunately all back issues of A&B Computing have now sold out. Looking to the future there is at least the consolation that A&B will be with you twice as often as was previously the case.

# Haunted House

Jane and Jonathan Evans

Ever wanted to play the role of Frankenstein's servant Igor, stumbling around a haunted house in the dark? All the things are possible with a BBC Micro. In this game you have to run around the house switching off lights left on by mischievous ghosts. The snag is that you can only see where you are when you pass a lighted window, though the noise of your heartbeat gives you some clue to your whereabouts. When you do succeed in switching all the lights off the ghosts switch them on again in new random locations, leaving you less time than before to

## An heart-stopping sortie into the home of Dr. Frankenstein and his servant Igor.

achieve your task and avoid your evil master's wrath.

### TECHNIQUES USED

The program runs in Mode 1 using the four logical colours pro-

vided but only three actual colours on screen. This is necessary to make Igor invisible when moving around the black area of the house, though visible whenever part of his body crosses a lighted window. Igor is printed using GCOL3 which EOR's (exclusive

OR's) his colour number (3) with the background that he is printed on. When combined with the lighted window yellow (colour 2) this produces colour 1 which has been redefined as blue by the VDU19 command in line 260. Hence a blue Igor is visible when he passes a window.

The house is printed in colour 0 set to its default black. EORing Igor's colour 3 with 0 produces logical colour number 3 which has been defined as a second black at line 260. Hence we print one black on another to produce our invisible man. The other point to bear in mind is that



## PROGRAM LISTING

```

10REM HAUNTED HOUSE
20REM BY JANE AND JONATHAN EVANS
30REM FEBRUARY 1984
40REM
50MODE7:PROCInstructions
60 K=12:HISCORE%=0
70ENVELOPE1,1,1,-1,1,1,2,1,30,0,0,-30,126,126
80ENVELOPE2,1,0,0,0,0,0,0,126,-1,-1,-1,126,0
90 DIM WX(42),WY(42)
100 VDU 23, 224,24,25,17,126,188,164,36,54
110 VDU 23,225,7,63,127,255,255,255,243,225
120 VDU 23,226,192,252,254,255,255,255,207,135
130 VDU 23,227,225,243,126,62,30,2,3,3
140 VDU 23,228,135,207,126,124,120,64,192,192
150 VDU 23,254,0,126,126,126,126,126,126,0
160 VDU 23,255,255,255,255,255,255,255,255,255
170 VDU 23, 253,0,0,0,8,28,8,0,0
180PROCposwin
190 WINDOW$=CHR$254+CHR$254+CHR$10+CHR$8+CHR$8+CHR$25
4+CHR$254
200SKULL$=CHR$225+CHR$226+CHR$10+CHR$8+CHR$8+CHR$227+
CHR$228
210REM
220REM MAIN PROGRAM LOOP
230REM
240REPEAT:LEVEL%=0:SCREEN%=0:SCORE%=0
250MODE1: COLOUR 129:CLS :VDU 23;8202;0;0;0;
260 VDU 19,1,4,0,0,0,19,3,0,0,0,0
270VDU4:PRINT TAB(0,30)"SCREEN=";TAB(15,30)"SCORE=";
TAB(30,30)"TIME="
280 PROCstars
290 PROCfence(0,132)
300 PROCfence(1080,132)
310 PROChouse
320REM
330REM PLAY LOOP
340REM
350 REPEAT:SCREEN%=SCREEN%+1
360VDU4:PRINT TAB(8,30);SCREEN% TAB(22,30);SCORE%
370 VDU5:HIT=0
380 PROCrandom
390X%=168:Y%=132:MOVEX%,Y%;PROCx:*FX15,1
400T1=TIME
410REPEAT
420REPEAT:PROCmove:UNTIL test OR FNtime
430 IF test THEN PROCTest
440 UNTIL HIT=6 OR FNtime
450IF HIT=6 THEN PROCclear
460IF HIT=6 AND LEVEL%<7 THEN LEVEL%=LEVEL%+1
470UNTIL FNtime AND HIT<6
480MODE7:PROCscore
490UNTIL G$="N" OR G$="n"
500MODE7:END
510:
520 DEF PROCfence(X,Y)
530 GCOL 35,3
540 MOVE X,Y
550 PLOT 0,0,300:PLOT 0,200,0
560 PLOT 81,-200,-300:PLOT 81,200,0
570 ENDPROC
580:
590 DEF PROChouse
600 GCOL 0,0
610 PLOT 4,200,100:PLOT 4,200,900
620 PLOT 85,1080,100:PLOT 85,1080,900
630 PLOT 4,200,900:PLOT 4,1080,650:PLOT 85,100,650
640 PLOT 4,1080,900:PLOT 4,1080,650:PLOT 85,1180,650
650 PLOT 4,300,1000:PLOT 4,400,1000:PLOT 85,300,900:P
LOT 85,400,900
660 PLOT 4,900,1000:PLOT 4,1000,1000:PLOT 85,900,900:
PLOT 85,1000,900
670 ENDPROC
680:
690 DEF PROCposwin
700 Y=700:NW=0
710 REPEAT
720 FOR X=300 TO 980 STEP 105
730 NW=NW+1:WX(NW)=X:WY(NW)=Y
740 NEXT X
750 Y=Y-100
760 UNTIL Y=100
770 ENDPROC
780:
790 DEF PROCrandom
800 FOR I=1 TO 42:W%(I)=0:NEXT I
810 W%(RND(7))=1:W%(RND(7)+7)=1:W%(RND(7)+14)=1:W%(RND

```

CONTINUED OVER

although Igor is stored and printed as text these graphic effects work because the printing is done under VDU5 (printing text at the graphics cursor). Incidentally, if you have difficulty remembering or working out the effects of EOR you can always get BASIC to tell you by typing PRINT 1 EOR 2 etc in command mode.

The rest of the program involves fairly straightforward, though hopefully well structured BBC BASIC programming.

## PROGRAM STRUCTURE

Lines 60 to 200 initialise user defined graphic characters and sound envelopes before entering the main program loop. The repeat loop from lines 240 to 490 handles repeated plays of the entire game. It is terminated by the decision of a player not to have another game. Lines 240 to 310 initialise flag variables for score, screen level etc and call procedures to draw the general scenery.

The repeat loop from lines 350 to 470 then handles the play on each individual game, terminating when a player fails to clear a screen within the time limit. After printing the current score and screen, the randomised windows and the starting position for Igor, a third nested repeat loop from lines 410 to 470 deals with the play on each screen, terminating either when the screen is cleared (flag variable HIT reaches the required total of six windows) or when the time limit for the level has been exceeded (checked by the function FNtime). The function of the main procedures, in order of calling rather than listing is as follows:

**PROCInstructions** (lines 1530 to 1710): Presents optional instruction sequence.

**PROCposwin** (lines 690 to 770): Computes co-ordinates (top left hand corners) for printing windows in 42 possible positions (only six actually used in a given play).

**PROCstars** (lines 1080 to 1160), **PROCfence** (lines 520 to

570). **PROChouse** (590 to 670): These draw the general scenery, though not Igor or the windows.

**PROCrandom** (lines 790 to 850): There are 42 possible window positions composed of six rows of seven. One window from each row is chosen randomly for printing and its position recorded by placing a 1 rather than 0 in appropriate position of the flag array W%. The windows are then printed using the co-ordinates in the arrays WX and WY which were computed by PROCposwin.

**PROCmove** (lines 870 to 1010): A fairly standard procedure for moving the cursor position by key presses except that the parameters ensure that Igor can only be moved into the house from his starting position. The repeat loop with INKEY (0) is necessary to permit continuous updating of the time remaining (line 970) and checking for time limit expired (FNtime).

**PROCsound** (lines 1030 to 1060): This procedure performs two functions. It gives a little beep to let the player know that Igor has moved and also places the value TRUE in the logical variable "sound" so that PROCmove knows that a move has been made.

**FNtime** (lines 1390 to 1400): Returns a value TRUE if the time limit is exceeded, otherwise FALSE.

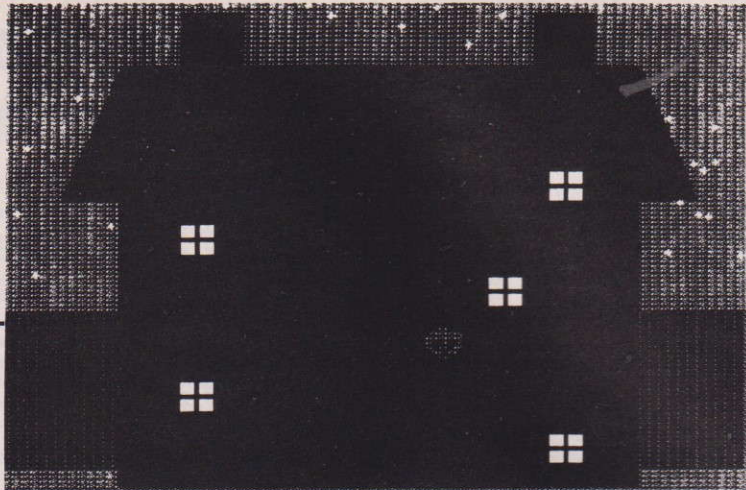
**PROCTest**, **PROCTestw** (lines 1180 to 1280): These procedures check whether a window has been 'hit' when the player presses the light switch (space bar).

**PROChit** (lines 1300 to 1350): If a window is hit, this procedure deletes it and provides a fleeting creepy apparition.

**PROCx** (line 1370): Prints Igor who was originally a cross when we were developing the program. Purists and romantics should rename this procedure PROCigor.

**PROCclear** (lines 1420-1470): Provides a fanfare to celebrate clearing a screen.

**PROCscore** (lines 1730-1830): Prints an appropriate message on completing a game.



```

D(7)+21)=1:WX(RND(7)+28)=1:WY(RND(7)+35)=1
820 FOR I=1 TO 42
830 IF WX(I)=1 THEN MOVE WX(I),WY(I):GCOL 0,2:PRINT W
INDOW$
840 NEXT I
850 ENDPROC
860:
870DEF PROCmove
880 sound=FALSE:test=FALSE
890 REPEAT
900C1=INKEY(0)
910IF C1=32 THEN test=TRUE
920IF C1=90 AND X%>212 THEN MOVE X%,Y%:PROCx:X%=X%-K:
PROCsound
930IF C1=88 AND X%<1036 THEN MOVE X%,Y%:PROCx:X%=X%+K
:PROCsound
940IF X%<200 THEN 970
950IF C1=47 AND Y%>132 THEN MOVE X%,Y%:PROCx: Y%=Y%-K
:PROCsound
960 IF C1=58 AND Y%<750 THEN MOVE X%,Y%:PROCx:Y%=Y%+K
:PROCsound
970VDU4:PRINT TAB(37,30):(60-LEVEL%*6)-INT((TIME-T1)/
100):" ":VDU5
980 UNTIL test OR sound OR Fntime
990 IF test OR Fntime THEN ENDPROC
1000MOVEX%,Y%:PROCx
1010ENDPROC
1020:
1030DEF PROCsound
1040SOUND1,-10,100,1
1050 sound=TRUE
1060ENDPROC
1070:
1080DEF PROCstars
1090 VDU 5
1100LOCAL X%,Y%
1110FOR I=1 TO 50
1120X%=RND(1279):Y%=RND(623)+500
1130 GCOL0,2
1140MOVE X%,Y%:VDU 253
1150NEXT I
1160ENDPROC
1170:
1180DEF PROCtest
1190 I=0: winhit=FALSE
1200 REPEAT:I=I+1
1210IF WX(I)=1 THEN PROCTestw
1220UNTIL winhit OR I=42
1230IF winhit PROChit ELSE VDU7
1240ENDPROC
1250:
1260DEF PROCtestw
1270IF X%>WX(I)-16 AND X%<WX(I)+48 AND Y%<WY(I)+16
AND Y%>WY(I)-48 THEN winhit=TRUE
1280ENDPROC
1290:
1300DEF PROChit
1310MOVE WX(I),WY(I):GCOL0,3:PRINT WINDOW$:WX(I)=0
1320MOVE WX(I),WY(I):GCOL0,1:PRINT SKULL$:MOVE WX(I),W
Y(I):FOR I=1 TO 500:NEXT I:GCOL 0,0:PRINT SKULL$
1330REM:SOUND
1340HIT=HIT+1:SCORE%=SCORE%+10:VDU4:PRINT TAB(22,30):S
CORE%:VDU5
1350ENDPROC

```

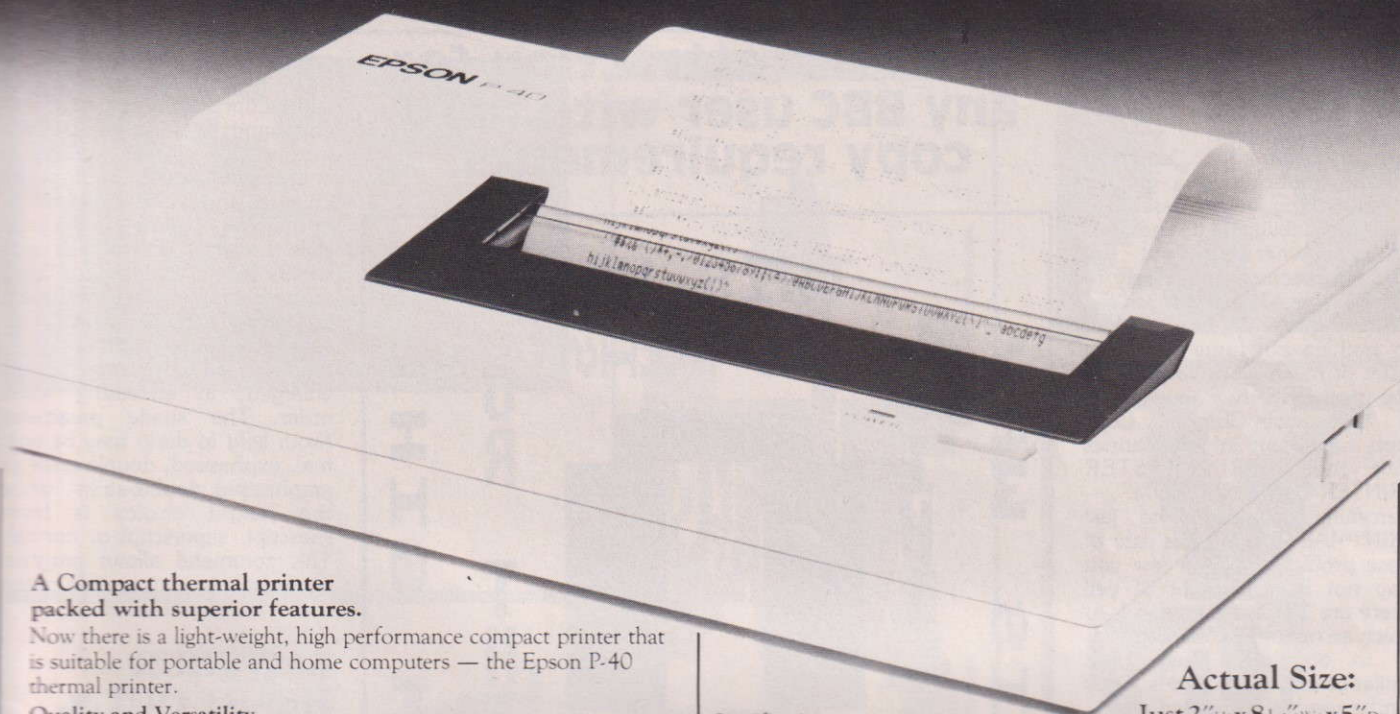
```

1360:
1370DEF PROCx:GCOL3,3:VDU224:ENDPROC
1380:
1390DEF Fntime
1400IF TIME-T1>6000-LEVEL%*600 THEN =TRUE ELSE =FALSE
1410:
1420DEF PROCclear
1430FOR I=100 TO 180 STEP 4
1440 SOUND1,1,I,2
1450SOUND1,0,0,0
1460NEXT I
1470ENDPROC
1480:
1490DEF PROCheader
1500CLS: PRINT:FOR I=1 TO 2:VDU141,131,157,132:PRINTSP
C10:"HAUNTED HOUSE":NEXT I
1510ENDPROC
1520:
1530DEF PROCinstructions
1540PROCheader
1550PRINT TAB(0,10)"Do you want instructions (Y/N) ?":
*FX15,1
1560REPEAT:G$=GET$:UNTIL INSTR("YNyn",G$)>0
1570IF G$="N" OR G$="n" ENDPROC
1580PROCheader
1590 PRINT""You are Frankenstein's servant Igor,""and
your master has sent you to turn""off all the lights
in the Haunted""House before dawn breaks. After you ""
enter the house you won't be able to ""see where you
are until you pass"
1600PRINT"a window. Then you can switch off the ""lig
ht in that room and go searching""for the next. The on
ly sound you hear""is the beating of your heart and if
you""bump against a wall your heart will""stop....."
1610 PRINT""Press <SPACE> to continue"
1620*FX15,1
1630REPEAT UNTIL GET=32
1640PROCheader
1650PRINT""One problem... as soon as the house is""da
rk the mischevous ghosts will light""up another lot of
windows and you have""even less time to reach them al
l. "
1660PRINT"Don't get lost in the dark or you may""neve
r get out again... and don't""let the ghosts scare you
to death."
1670PRINT""Your controls are:""TAB(10)"Z - LEFT""TAB(
10)"X - RIGHT""TAB(10)": - UP""TAB(10)"/ - DOWN""TAB(6)"
SPACE - LIGHT SWITCH"
1680PRINT""Press <SPACE> to start"
1690*FX15,1
1700REPEAT UNTIL GET=32
1710ENDPROC
1720:
1730DEF PROCscore
1740PROCheader
1750FOR I=53 TO 113 STEP 4:SOUND1,2,I,1:NEXT I
1760PRINT""Dawn has broken!! What will ""Frankenstei
n do to you now?"
1770IF SCORE%>=HISCORE% THEN HISCORE%=SCORE%:GOTO 1800
1780PRINT"The most successful servant""scored ";HISCO
RE%:". You scored""only a miserable ";SCORE%," points.
"
1790GOTO 1810
1800PRINT""You are the most successful servant to ""da
te. You scored ";SCORE%," points."
1810PRINT""Do you want another game (Y/N) ?"
1820REPEAT:G$=GET$:UNTIL INSTR("YyNn",G$)>0
1830ENDPROC

```

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Now there is a light-weight, high performance compact printer that is suitable for portable and home computers — the Epson P-40 thermal printer.

### Quality and Versatility

The Epson P-40 is part of the new 'P range', which offers a micro printer with print quality identical to that found in the Epson range of superior printers. The P-40 is the first low cost printer that can print 480 dots per line which means it can reproduce graphs, and pictures beautifully. The P-40 can offer three kinds of column capacities: 20 columns, 40 columns and 80 columns (condensed) — no other compact printer offers such a selection.

### Light, Quiet and Cost Efficient.

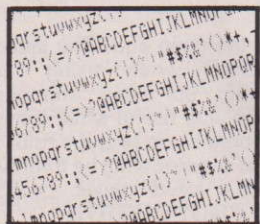
Since the P-40 is a thermal printer, operation is particularly quiet and there's no ink ribbon to change. Maintenance is simple. In addition the P-40 portable battery-driven printer has four rechargeable NiCad batteries built into the printer which can be recharged in 6 hours. It's simple, economic and easy to use.

### Top Quality Image and High Speed Printing.

The quality of printing in all Epson printers is unequalled and the P-40 is no exception. A superior Epson head design featuring nine dots together with its ability to express small letters ensures superior legibility. The compact P-40 also provides high speed printing with 45cps.

### Self Test Function

The P-40 compact thermal printer has a useful self test function.



High Resolution Print - Actual Size

**Actual Size:**  
Just 2"(H) x 8 1/2"(W) x 5 1/2"(D)

### Specifications

Print Method	Thermal Dot Matrix
Print Speed	45 Characters per second (For 40 and 80 column setting)
Print Direction	Unidirectional (Left to Right)
Character Set	96 ASCII character, (Featuring English Capital Letters, English Lower Case Letters, figures, signs and graphics)
Character Size (mm)	2.4 (H) x 1.7 (W) Normal 2.4 (H) x .85 (W) Condensed 2.4 (H) x 3.4 (W) Enlarged
Paper	Epson Thermal roll paper P-40 TRP
Paper Feed	Friction Feed
Paper Width	112mm
Power Supply	NiCad Batteries, Internal

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# Printmaster

Trevor Attewell

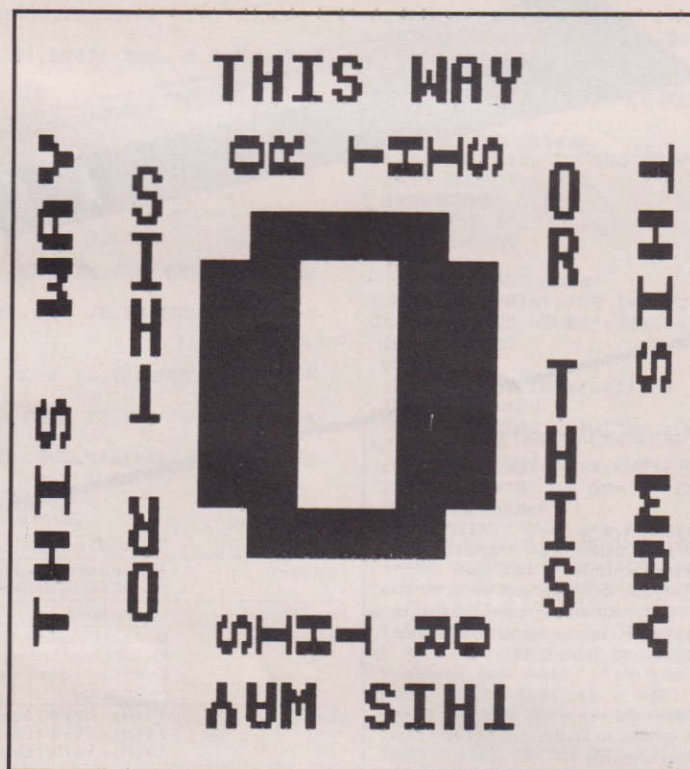
If you own a printer you will doubtless have spent many happy(?) hours sorting out the totally unmemorable strings of code required to utilise it fully. You may also have also tried a graphic dump, typing in an assembler program, debugging it, and finding somewhere to put the resulting machine code, only to discover that when it is called the machine hangs up, and you can do nothing but fume while the result of much work vanishes as you press BREAK.

Once again Computer Concepts have sent in the Marines with their "PRINTMASTER PRINTER TOOLKIT ROM" — mercifully abbreviated to just PRINTMASTER. It takes care of these problems, plus a few you may not have thought of yet! There are 23 'star' commands to which an optional 'C' can be added to distinguish them from similar ones in other ROMs. They can be used in command mode, in BASIC (or other languages) and in service ROMs, including the edit mode on the latest WORDWISE-B20 upgrade, which is a real boon. Integer variables may be used for any numerical argument, greatly increasing the power and flexibility of the ROM. This version is designed for the ubiquitous Epson — not every command applied to every model, but variations are noted where appropriate, and there is a complete control code summary at the end with applicable model numbers. It will also work with any printer that shares Epson codes. Future versions will provide for alternative printers.

## AVOIDING CODES IN THE HEAD

The effects of the 14 control code commands are fairly obvious from their names. \*FONT changes the international character set, of which there can be up to 10. The MX80 is omitted from the command availability list (though not the summary) — certainly a Mk.III accepts the first 7. Non-English letters do not appear on the Beeb keyboard,

**The 'star' attraction for any BBC user with hard copy requirements.**



so, if you habitually write in strange tongues you'll still need a good memory — or stickers on your keys! \*INITIALISE is a particularly useful command, resetting the printer to its default settings after you have forgotten which ones you altered, accidentally or otherwise.

\*LINCH and \*LINE-SPACE are related commands, the former setting the number of lines per inch and the latter the space between lines in 216ths. of an inch. Both default to the standard 6 lines/inch (36/216ths. of an inch spacing). \*MARGIN sets the left and/or right margin positions, while \*PAGE determines the page length, either in inches or in numbers of lines, and the number of lines to be skipped

at the page end. The latter is required when using fan-fold paper, but these commands are also very useful when listing long programs on teletype rolls, which can subsequently be trimmed into equal sized pages. \*ITALIC, \*PROPORTION and \*UNDERLINE turn italics, proportional spacing and underlining on or off respectively, where available, while \*TAB sets the horizontal tab positions.

\*PCODE is a cover-all command for use with the less common control codes that you might need only occasionally. It accepts ASCII or decimal codes of any length.

\*STYLE and \*TEXT are also related commands. The former sets the type of text, ie.

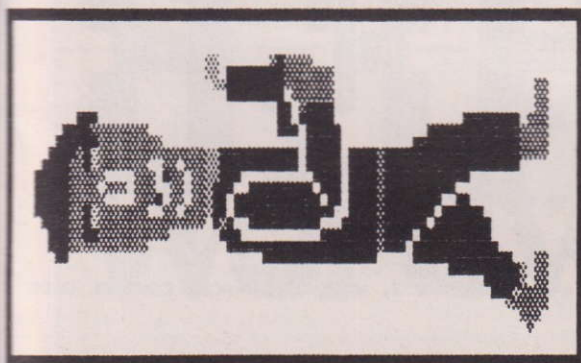
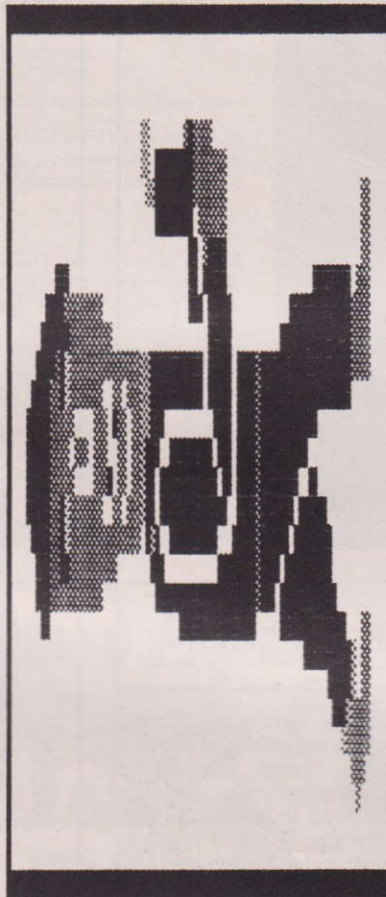
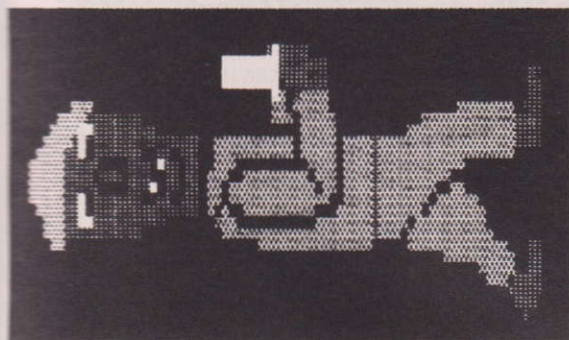
enlarged, condensed, emphasised, double strike, elite, superscript or subscript. Strings of commands are accepted, for example to cancel subscript characters before setting on enlarged and double strike mode. In the case of \*TEXT, the print style is selected on the basis of its width, height and shade, using numerical parameters. The width parameter includes condensed, elite, normal, enlarged condensed, elite enlarged and normal enlarged, in increasing width order. The 'shade' parameter (from light to dark) may be normal, emphasised, double strike or emphasised double-strike, while the height choice is from subscript, superscript or normal. This command allows program control of text output style by the use of integer variables.

## EAT YOUR HEART OUT, CAXTON?

Apart from the text styles available from the Epson itself, \*GPRINT prints normal Beeb characters (not teletext) in an astonishing range of sizes, shades and orientations. The smallest size is elite, but this can be multiplied by an integer up to 255, both horizontally and/or vertically! Moreover, the letters can be oriented in eight different ways — normal (across the page), downwards on the right, upside down, and upwards on the left, plus similar orientations with the individual letters in line ahead rather than side by side. The shading is by dot density, with seven shades from light to solid black, and the string can be indented from the left margin by a specified number of 20ths. of an inch. A character can thus occupy anything up to 600mm long along the length of the paper! It will take some time to print, but

ESCAPE works if it was an accident or you chicken out. Naturally, the width (or length if you print it sideways) will be limited by the paper itself.

\*TPRINT is a variant on \*GPRINT in which one of the printer's own character set is repeated to form the pattern of



the text to be printed, rather than using a graphics dot matrix. This makes it very much quicker than \*GPRINT, and some shading effect is still possible by choosing a suitable character. The text appears on the screen, where it is made up from the normal character set appropriate to the mode in use, and there is no printout unless the printer is enabled. The printer character font, size, density and line spacing can be selected by any of the appropriate commands (see above), the particular character required being specified by its ASCII code. A control code (less than 32) will cause each large character to be made up from printed versions of itself. The string to be printed may contain user defined characters, which can be self-replicated on screen in graphics modes if required, but will not appear on the paper

(though a substitute character may be printed in certain circumstances).

The smallest print size is 8 times the width of the current printer characters by 8 linespaces high, and the largest (theoretically) is 255 times that size — limited in practice by screen or printer wrap-around. The text can be oriented in eight ways (as with \*GPRINT), and can be printed normally or inversely (blank against a character background) — see examples. There is no indent argument, but spaces can be inserted, and text windows can be defined for the screen version.

## WINDOW ON THE WORLD

Ever tried defining a graphics window to fit exactly round part

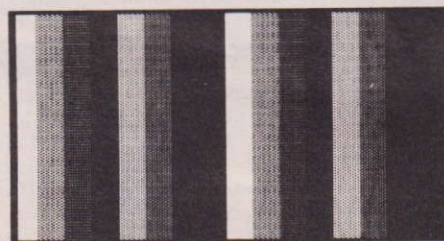
of an existing screen display? PRINTMASTER makes it a doddle! \*WINDOW produces a flashing line rectangular window, initially around the screen edges. The cursor keys (or their games equivalents) control movements of two opposite corners, interchanged by the TAB key, while SHIFT gives faster movement. Having positioned the rectangle where required, pressing 'V' displays the BBC window coordinates on the top line of the screen — these vanish on the next key press. 'RETURN' sets the graphics window as displayed, while 'ESCAPE' aborts the attempt and restores the previous window, if any. If the top of the screen is already occupied the values displayed by 'V' may not be very readable, but the coordinates are stored, and are printed normally on typing \*WVALS. This is a valuable

facility which greatly simplifies finding the coordinates of any point or area in any graphics applications, particularly computer-aided design.

## DOWN IN THE DUMPS?

Why put up with single-format, easily corrupted machine-code dumps! \*GDUMP will produce a high resolution screen dump in any graphic Mode, including Mode 8, in any of four orientations on the paper, in any size or proportions and at any inset from the margin. It dumps whatever is in the graphics window or, if one is not set, the whole screen. It also works in Mode 7, though you are then limited to a whole-

CONTINUED OVER

[illegible]

**THE**

A&amp;B COMPUTING OCTOBER 1984

# ROM SOFTWARE

for the BBC Micro



## Printmaster

£33.35  
incl.

PRINTMASTER is a printer utility ROM, offering powerful screendumps, text dumps, file dumps and many others. PRINTMASTER offers the best possible utilities, and plenty of them, for just one type of printer per ROM.

PRINTMASTER (EPSON) supports the MX, RX and FX series of printers.

PRINTMASTER (STAR) supports the STAR GEMINI 10X and the DP510.

Versions for other printers will be produced according to the volume of requests for each type.

All PRINTMASTER commands are preceded by an asterisk and can be used in the same way as Operating System commands, i.e. they may be included within BASIC programs as well as other languages etc. In addition, BASIC 'resident integer variables' may be passed to the commands within programs.

Just some of PRINTMASTER's commands are listed below:

\*GDUMP will allow screen dumps of any mode. Mode 7 (TELETEXT) screens can be copied including double-height characters. All 16 colours are represented by graduated grey shading. The dump may be printed in any direction on the paper (horizontally or vertically) and can be magnified by any factor in length and height independently.

\*WINDOW gives an interactive means of defining a graphics window, far easier than the normal VDU command. GDUMP will copy only the area within the graphics window.

\*TDUMP copies any text currently on the screen.

\*GPRINT will print a string of characters as large as necessary (e.g. one character per page!) in any orientation, shade, etc. for headings, posters, etc.

\*FDUMP copies the contents of a file directly to the printer, whilst the machine is being used for other tasks, running programs etc.

Other commands include: \*FONT, \*UNDERLINE, \*ITALICS, \*TAB, \*PAGELEN, \*INITIALISE, \*DEFINE, and others.

```
PRINTMASTER (Epson) 1 02
DEFINE <chr>
FDUMP <fsp>
FONT <country>
GDUMP <cor,op> <X,Y> <gap>
GPRINT <str> <X,Y> <cor,op> <gap>
INITIALISE
ITALIC <con/off>
LINE <lines per inch>
LINESPACE <a> <b inches>
MARGIN <left> <right/width>
PAGELEN <inches/lines> <skip>
PCODE <codes/$ASCII>
PROPORTION <con/off>
STYLE <str>
TAB <columns>
TDUMP <udc width>
TEXT <width> <shade> <height>
TPRINT <str> <chr> <X,Y> <cor,op>
ULOAD <fsp>
UNDERLINE <con/off>
USAVE <fsp>
WINDOW
WVALS
05 1 20
```

**Now Available**  
**Printmaster (Star)**  
for the GEMINI 10X  
and the DP 510

ORDER AS : PRINTMASTER (EPSON) £33.35 incl.  
OR PRINTMASTER (STAR) £33.35 incl.

# Wordwise

The Most Popular Word Processing ROM for the BBC Micro

£46.00 incl.

WORDWISE is ideal as an introduction to word processing for the beginner, but is a powerful enough tool to be used seriously by professional authors (at least two of the most popular BBC Micro magazines are prepared entirely with WORDWISE). Being entirely ROM based it occupies none of the memory which is used to store text. It will operate fully on cassette, disc or ECONET (level II). It is not specific to any particular printer, nor does it require a special printer-driver (an expensive extra on some word processors). WORDWISE allows any codes to be sent to any printer, at any point within the text, by using a simple 'embedded command'.

For the beginner, text can be typed straight into WORDWISE and saved, loaded, previewed or printed immediately. Once experience is gained, commands may be added to control the final layout on paper. Some of the layout or 'formatting' commands are described later. At any time whilst the text is being entered or edited a word count is displayed continuously on the top line. Labelled function keys provide the user with simple controls to mark any section of text and then delete, move or copy it to any other position. Characters can be quickly converted between upper and lower case; changing case of entire paragraphs is equally simple.

### WORDWISE

(C) Computer Concepts 1982

- 1) Save entire text
- 2) Load new text
- 3) Save marked text
- 4) Load text to cursor
- 5) Search and Replace
- 6) Print text
- 7) Preview text
- 8) Spool text

#### ESC Edit Mode

Please enter choice\_

Moving around the text is simple. Cursor keys alone move one position in any direction; CTRL and cursor keys together move in larger steps, a word left/right, a page up/down; SHIFT and cursor keys move as far as possible to the right/left of the line or to the start/end of the entire text. These movements are so easy to use that many other programs have adopted exactly the same method.

Formatting commands include the ability to split the document into pages of any length, with or without headings or footings. Page numbers may be printed automatically within the text, including within headings and footings. Commands are provided to set (at any point in the text) line length, left margin, tabulation positions, line spacing etc. Text can be centred on a line, indents and temporary indents can be set and cancelled. Output can be made to automatically pause at the end of a page, e.g. for a single sheet feed. Right justification of text can be turned on and off at any points in the text.

User-defined keys may hold any required string as normal and used within WORDWISE, including the codes required to induce key-operations such as cursor movement.

#### ARIES compatible WORDWISE

A new version of WORDWISE is available upon request at the standard price which is fully compatible with the ARIES B20 RAM board. When fitted alongside the compatible WORDWISE, the ARIES board allows text to be previewed in 80 columns even with the normal RAM full of text. An upgrade from the standard version of WORDWISE is available. Please ask for details.



# Moneywatch

Moneywatch is a file-handling program designed on a BBC Model B OS 1.2, to enable the user to keep records of all his bank/building society accounts on tape and when necessary, extract and input information to and from them.

The program allows each bank and building society account to have up to eight sub-headings (for such uses as rates, insurance, housekeeping etc.). The user is allowed to add to and take away from each of these sub-accounts, with the computer recording such information as to the amount, the date of the transaction and the title of the sub-account itself, so as to provide a detailed analysis of all of the transactions that have taken place at the end of each session. At the end of a session, the file is re-saved, with the new balances for each of the sub-accounts.

Up to five Standing Orders are allowed when dealing with individual bank accounts, with the computer keeping on file such information as the concern to whom the standing order is payable to, the amount and from which sub-account the Standing Order is to be debited.

At any point in a session there is an option for all of the transactions which have taken place so far, to be printed out on hard-copy.

Up to twenty-five individual transactions are allowed in any session before the data-file has to be re-saved. The reason for this relatively low figure, is due to the fact that the program itself occupies nearly 9K and to enable the program to utilise MODE 3 for its transaction print-out, care has to be exercised to ensure that the amount of data in the computer's memory, does not exceed the 3.75K which is left when the computer is running in that mode.

## HOW TO USE THE PROGRAM

When the program is run, after the opening titles have been displayed, the operations menu appears on the screen. This menu give you the options to raise new bank and building

## Keep a tight reign on the household accounts with this efficient and friendly program.



society accounts and to access existing bank and building society accounts. The last option is for the program to end. Pressing escape during the execution of any of the first four options will return you to this menu. However, this procedure is not recommended unless in the event of an emergency, since all of the data so far processed will be lost when the user returns to the option he/she escaped from.

It should not be necessary for the escape button to be used at all, since the program normally allows verification from the user for any decision he/she takes, before the existing data is affected.

Before the user can access bank and building society accounts, they have to be raised. The procedures for raising both bank and building society accounts are identical and extremely straight forward.

Firstly, a prompt appears asking the user to state the name of Bank/Building society. In the case of the bank, this would be either in the form of BARCLAYS or BARCLAYS DEPOSIT, but

for building societies it would probably need to be of the form HALIFAX SEVEN DAY etc., thus allowing the computer to differentiate between accounts from the same society.

Next, the user is asked to supply the date which the account was opened, (i.e. the date of the first transaction). This should be entered in the form 08/05/81 etc. The user is then required to enter the number of sub-account headings he/she would like to have. A maximum of eight is allowed, with each sub-heading having a maximum of ten letters. These could range from routines available for the correction of mistakes made in the inputting of these account titles. If the user notices that he/she has mis-spelt the last title then XXX should be entered. The computer will then allow the last title to be re-entered. When all of the titles have been input, the computer prompts "ARE YOU SURE (Y/N)\*". A reply of "N", will allow all of the titles to be typed in again.

After the account titles have been entered, it is the turn of the

initial amounts in each account to be input. The computer individually displays the name of the accounts previously entered, asking for the relevant amount. If the account is to start with nothing in it, it is not necessary to type in 0.00 but press RETURN instead, the program will then go on to the next heading. The program displays amounts to two decimal places. Half-pences should not be entered!

Once all of the amounts have been entered and the user has agreed that everything is as it should be, the account is ready to be saved on cassette/disc. This is carried out in the normal way.

## PROGRAM IN USE

It is now necessary to cover the way that accounts are accessed. When either building society or bank accounts are accessed, the relevant file must be loaded first. The way the program runs is self-explanatory in this nature. Once the relevant account is loaded into the computer the operation menu for building societies or Banks is displayed. Both menus carry the functions Pay in/Draw out, print out of transactions and transactions over, the latter only being used when the file is ready to be re-saved on cassette. The Bank menu also contains the function Set Up/Carry out standing order. The choosing of this option produces a further menu on the screen offering the user the choice of setting up standing orders, the execution of standing orders, the deletion of an existing order from the computer's memory and an option to return to the original banking menu. A maximum of five standing orders is allowed for each Bank account. When the user sets up a standing order, he/she must supply the computer with the information of who the standing order is payable to, the amount of the standing order and from which heading in the Bank account it should be debited to.

When the user asks for the standing order to be executed, all the standing orders are displayed and the person asked to choose which order is to be carried out.

The date of the transaction also has to be entered. The computer then displays the new total for the sub-account the S/O was debited to. If the user does not wish to execute any more standing orders, the program returns to the Standing Order menu.

If the user wishes to delete an existing order, all the current orders are displayed and the user asked to make his/her choice for the deletion. The remaining orders are then displayed together with an option to delete another. If this is declined, the program once again returns to the S/O menu.

## TRANSACTIONS

If the user wishes to pay in/draw out then option (1) is chosen from the Banking/Building society operation menus. The computer then asks whether money is to be paid in or paid out. The date of the transaction then has to be entered. After the first transaction, a prompt appears asking whether the next transaction is to be recorded for the same date. If not, a new date has to be input. Next, all the existing sub-accounts are displayed and the user asked which file he/she wishes to pay in/draw out of. Once this choice has been made the file and the amount in it are shown on the screen. The amount to be added/taken away has to be input. After the user has verified that this is the correct amount, the computer credits/debits the sub-account and displays the new total. The user is then asked whether another transaction is required.

Up to twenty-five transactions are allowed in any one session. If another transaction is attempted, the computer replies with the message "No more transactions" and returns the program to the relevant operations menu. The user then has the choice of viewing a printout of all of the transactions carried out so far and of saving the file on cassette.

At any stage in the program when an account is being accessed, the user can call a print-out of transactions. This is done in the MODE 3 80 column mode. All the details of the transactions so

far carried out are displayed, together with an up to date set of balances for all the sub-accounts. An option for a hard-copy is also given.

The final choice offered in the Banking/Building society menus, is that of transactions over. This is used to save the account with all the new totals for the various sub-accounts on tape/disk. In the interest of time, only the most recent set of figures (plus of course in the case of the bank, details of standing orders), are saved. After this has been carried out, the program returns to the master menu. If the program was to run on a disc-based system, the program could be easily modified so that the last twenty or so transactions were saved for future reference. For this to happen on a cassette based system, the amount of time taken to load and save each file would take far too long for the program to offer a time-saving facility in the home. With only the most recent set of figures on tape, each file can be loaded into the computer in under two seconds.

## HOW THE PROGRAM WORKS

MODE 7: The teletext mode of the BBC micro, using only 1K of user available memory and offering a text-only format of 40x25. In this mode, CHR\$(141) creates double height characters, CHR\$(136) causes the following line to flash on and off, while CHR\$(129) TO CHR\$(135) produces text of different colours. Mode 6 can be utilised for the Electron.

MODE 4: Uses 10K of available memory, offering text format of 40x32 and a graphics resolution of 320x256.

MODE 3: Text only format using 16K of available memory, supporting a text format of 80x25.

OPENIN XXX: Open cassette/dis.

VDU 20, a,b,c,d: Creates text window allowing text to be transmitted to a certain portion of the screen only.

VDU 26: Destroy any ex-

isting text window.

@%=&20209: Makes all numbers be displayed to two decimal places in a field nine characters wide.

@%=10: Returns output of numbers back to normal.

STRING\$(A, "B"): Create a string A characters long of character "B".

VDU 2: Send output to

printer.

VDU 3: Return output to normal.

VDU 21: Disable screen (Prevent text being printed on the screen).

VDU 6: Return output to screen back to normal.

TAB (X, Y): Print at a point X characters from left hand margin and Y lines down.

Lines 20-70

Dimension variables and set up user defined characters.

Lines 90-120

Display titles.

Lines 130-280

Display master menu. Carry out appropriate routines from user's choice.

Lines 290-400

details entered of new Bank Account. These are then saved on file.

Lines 410-550

ACCESS BANK ACCOUNT: User enters the name of the Bank account to be accessed, the computer then loads the relevant file into its memory.

Lines 560-740

Banking Operations menu displayed. Choice entered by user and the relevant routines executed.

Lines 750-870

Details entered of new Building society account. These are then saved on file.

Lines 880-1000

ACCESS BUILDING SOCIETY ACCOUNT: User enters the name of the Building society account to be accessed. The computer then loads this file into its memory.

Lines 1010-1160

Building Society operations menu displayed. Choice of operation chosen by user and the relevant procedures executed.

Lines 1170-1330

Routine for printing out the transactions carried out so far. This is done in Mode 3 and presented to the user in a tabular form. Lines 1280 to 1320 concern the hard-copy option. A major routine used for setting up Bank and Building Society Accounts. Lines 1430 to 1470 concern the raising of the User's choice of sub-accounts (maximum of eight). Line 1460 allows the user to correct a mistake made in the entry of the name of the last sub-account. Lines 1510 to 1570 are for the assignment of the initial balances to these sub-accounts. Line 1600 allows all the amounts to be re-entered if the User discovers a mistake he/she made in the inputting.

Lines 1620-1990

Probably the most used set of lines in the entire program. These lines contain the procedures for paying into and out of an account. Line 1650 updates the transaction number. If this is greater than 25 (166), then no more transactions will be allowed in that session. Lines 1670 to 1690 adjust the variables dependant on whether an amount is being paid in or drawn out.

Between 1700 and 1740, the date of the transaction is entered by the user.

Lines 1760 to 1830 display all the sub-accounts. The user then enters which file

CONTINUED OVER

	he/she wishes to be debited/credited.
	Lines 1850 to 1900 lets the user enter the amount he/she wishes to pay in/draw out. The relevant variables are then either adjusted or updated which ever is necessary.
Line 1910	displays the sub-account and the new balance for it.
Lines 1920 to 1950	ask the user whether another transaction is wanted. The appropriate action is then taken depending on the answer.
Lines 1960-2010	Routine used to update the balances held in the sub-accounts which are not involved in a transaction.
Lines 2020-2250	Major routine allowing the setting-up of and execution of standing orders.
	Lines 2030 to 2130 prints out on the screen an operations menu for the user to choose from. The choice is then entered and the relevant routines carried out.
	Line 2150 prints out all the standing orders which exist at the present time.
	Line 2170 to 2210 asks the user for the date of the standing order. The standing order is then carried out, with all the necessary variables being adjusted.
	Line 2220 displays the new balance for the sub-account which the standing order was debited to.
	Line 2240 gives the User the chance to carry out another standing order without having to return to the standing order operations menu.
Lines 2260-2320	Procedure used for displaying all the existing Standing Orders together with all the relevant information for each one. This data consists of the amount of the standing order, to whom it is payable and the sub-account it is to be debited to.
Lines 2330-2450	Procedure used for setting up a new standing order. The User has to enter various items of information (see previous page). This is then stored ready to be saved when the account is next stored on cassette/disk.
	N.B. A maximum of five Standing Orders per Bank account is allowed. To increase this, the relevant variables will need to be re-dimensioned.
Lines 2330-2450	Procedure used for setting up a new standing order. The User has to enter various items of information (see previous page). The user then enters the S/O to be deleted.
	Lines 2500 to 2530 re-adjusts all the data regarding the other standing orders. The remaining S/Os' are then displayed and the option given to delete another.
Lines 2540-2670	Procedure to display all the sub-accounts and their balances.
Lines 2680-2710	Draw a horizontal line across the screen.
Lines 2720-2770	Draw a vertical line Z characters from the left hand margin down the screen.
Lines 2780-2900	Save on cassette/disk all the data concerning the relevant Bank account. All data concerning Standing Orders, together with the most recent

Lines 2910-3000	balances of the sub-accounts are saved. Save on cassette/disk all the data concerning the relevant Building Society account. All data concerning the most recent balances of the various sub-accounts is saved.
Lines 3010-3050	Adjust all the most recent balances, so that they became the first balance on record, in order to make the saving of the account easier to carry out.

## VARIABLES USED IN MONEYWATCH

### Specialised Strings and Variables

M\$(N)	= File name in account.
M(X, Y)	= Balance of each file after every transaction.
B\$(N)	= Date of each transaction.
T(N)	= Balance of account after each transaction.
SIGN(N)	= Add/take away from file.
F\$(N)	= File used for transaction.
AM(N)	= Amount taken/added in each transaction.
P(N)	= The file number used in each transaction.
SO\$(N)	= The name of concern Standing Order is payable to.
S1\$(N)	= The amount payable for each Standing Order is to debited to.
M1(N)	= The amount payable for each Standing Order.
A1\$	= The title of the account.
CNT	= The Transaction number.

### General Strings

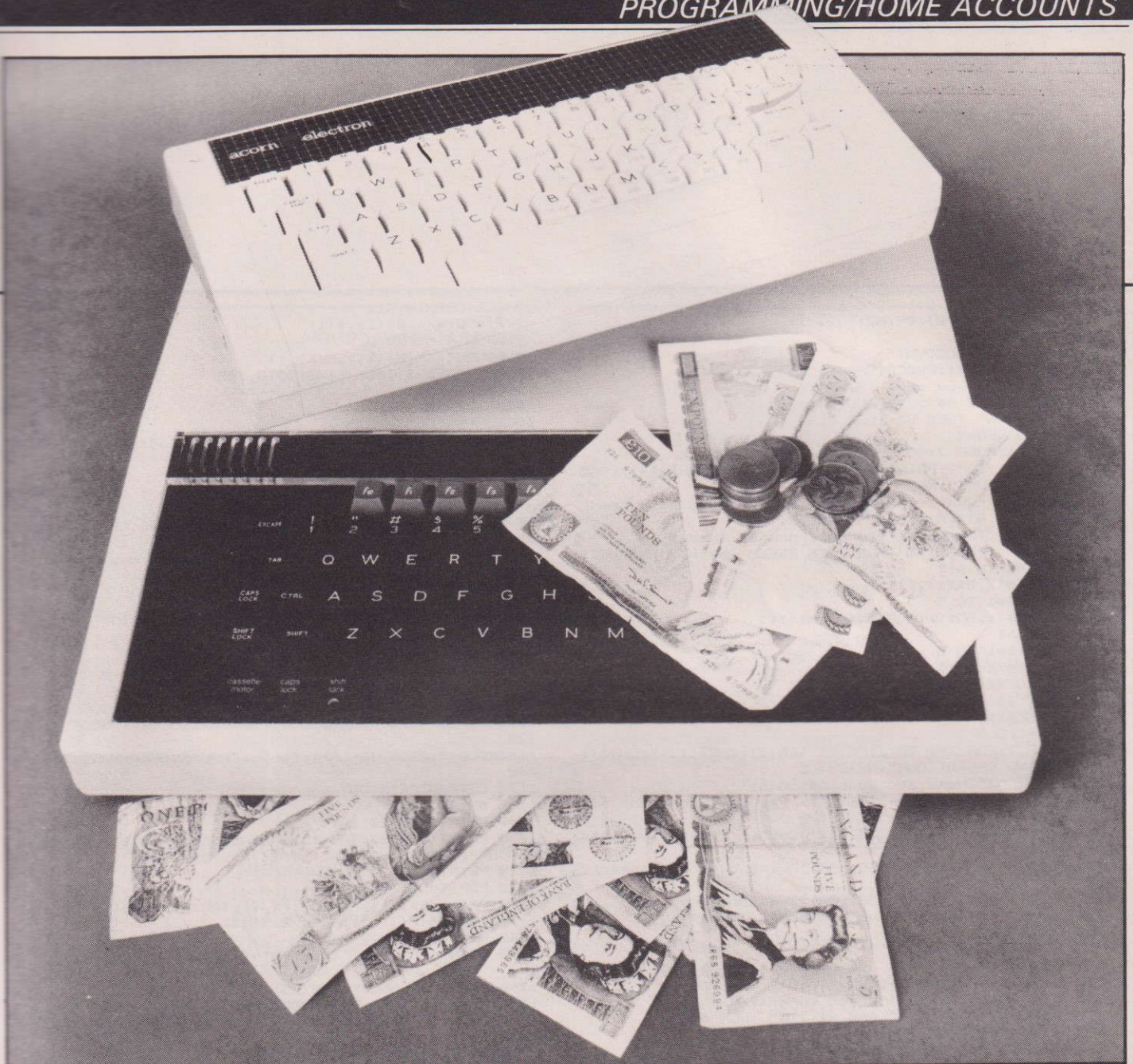
A\$, J\$, P\$, KK\$, L\$, a\$, G\$

### General Variables

AA, A, QQ, FF, WW, W, DD, Z, X1, GG

## PROCEDURES USED IN MONEYWATCH

PROCACCOUNT	Set up a new account with upto eight sub-headings. The first values of these headings are entered.
PROCDISPLAY	Displays in tabular form, the current status of the sub-headings in the account.
POCSAVEBANK	Saves on cassette/disk, the latest balance of each sub-heading and overall balance of the account. In addition, all data concerning standing orders is saved.
PROCORDER	Major routine dealing with the setting up, execution of and deletion of Standing Orders.
PROCPRINTOUT	Prints out in tabular form, the details of all the transactions (max 257), carried out on an account in the current session, together with an up to date set of balances of the account of its sub-headings. An option of a hard-copy is given.
PROCPAYDRAW	Major routine dealing with paying in and drawing out of bank and building society accounts.
PROCADJUST	Only used before an account is saved on tape ensuring that only the most up to date set of balances is saved.
PROCSAVESOCIETY	Saves on cassette/disk, the final balances of the account and all the sub-headings.
PROCAMEND	Updates at the end of each transaction, all the sub-accounts not used in that transaction.

**PROCDELETE**

Deletes a Standing Order from the computer's memory.

**PROCSETUP**

Routine for setting up a new Standing Order.

**PROCSO**

Prints out on the screen the details of all the existing Standing Orders.

**PROCHORIZLINE**

Draws a Horizontal line across the screen.

**PROCVERTICLINE**

Draws a vertical line down the screen.

## PROGRAM LISTING

```

10 ON ERROR MODE 7:GOTO 130
20 CLEAR
30 DIM M$(10),M(8,25),B$(25),T(25),SIGN(25),F$(25),A
M(25),F(25)
40 DIM SO$(6),S1$(6),M1(6)
50 VDU 23,224,0,0,0,255,0,0,0,0
60 VDU 23,225,128,128,128,128,128,128,128,128
70 VDU 23,226,128,128,128,255,128,128,128,128
80 MODE 7
90 FOR N=1 TO 2:PRINT TAB(9);CHR$(133);CHR$(141);"MO
NEYWATCH":NEXT
100 PRINT TAB(7,10);"A P.J.K. PRODUCTION"
110 PRINT TAB(2);CHR$(136);CHR$(130);"PRESS ANY
KEY TO CONTINUE":A$=GET$
120 CLS

```

```

130 FOR N=1 TO 2:PRINT TAB(7);CHR$(134);CHR$(141);"OP
ERATIONS MENU":NEXT
140 PRINT TAB(7);"THESE ARE YOUR OPTIONS:--":PRINT
150 PRINT TAB(3);CHR$(130);"1) Raise new Bank Account
"
160 PRINT TAB(3);CHR$(130);"2) Access an existing Ban
k Account"
170 PRINT TAB(3);CHR$(130);"3) Raise a Building socie
ty account"
180 PRINT TAB(3);CHR$(130);"4) Access a Building Soci
ety Account";
190 PRINT TAB(3);CHR$(130);"5) End Program"
200 PRINT TAB(3);CHR$(134);"TYPE IN YOUR CHOICE (1-5)";
210 A$=GET$:AA=VALA$
220 IF AA<1 OR AA>5 THEN 210
230 PRINT TAB(0,5+AA*2);CHR$(136)
240 PRINT TAB(0,24);"Are you sure (Y/N) ";
250 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 250
260 IF A$="N" THEN 120 ELSE CLS
270 IF AA=5 THEN GOTO 10:END
280 ON AA GOTO 290,410,750,880
290 FOR N=1 TO 2:PRINT TAB(5);CHR$(130);CHR$(141);"NE
W BANK ACCOUNT":NEXT
300 PRINT TAB(5);"What is the name of the Bank ";:INPUT A1
$

```

**CONTINUED OVER**

```

310 PRINT""What date was the account opened on"
320 INPUT"(e.g. 07/09/82)",B$(1)
330 PROCACCOUNT
340 A1$=A1$+" ACCOUNT"
350 MODE 4:CNT=1:PROCDISPLAY:CLS
360 PRINT"Are you sure (Y/N)";
370 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 370
380 IF A$="N" THEN 80 ELSE CLS
390 PROCSAVEBANK
400 VDU 26:MODE 7:GOTO 130
410 FOR X=1 TO 2:PRINT TAB(4);CHR$(130);CHR$(141);"AC
CESS BANK ACCOUNT":NEXT
420 PRINT""What Bank Account do you wish to access"
430 INPUT",A1$:A1$=A1$+" ACCOUNT"
440 PRINT""The data-file will now be loaded"
450 PRINT""POSITION TAPE THEN PRESS ANY KEY":A$=GET$
460 XX=OPENIN A1$
470 INPUT#XX,B$(1),T(1)
480 FOR X1=1 TO 5
490 INPUT#XX,S0$(X1),S1$(X1),M1(X1)
500 NEXT X1
510 FOR X1=1 TO 8
520 INPUT#XX,M$(X1),M(X1,1)
530 IF EOF#XX THEN X1=8:GOTO 540
540 NEXT X1
550 CLOSE#XX
560 CNT=1:CLS
570 MODE 7:FOR X=1 TO 2:PRINT TAB(5);CHR$(134);CHR$(1
41);"BANKING OPERATIONS":NEXT
580 PRINT""These are your options:-"
590 PRINT'TAB(3);CHR$(130);"1) Pay in / draw out of
the account"
600 PRINT'TAB(3);CHR$(130);"2) Set up / carry out sta
nding order";
610 PRINT'TAB(3);CHR$(130);"3) Print out of transacti
ons"
620 PRINT'TAB(3);CHR$(130);"4) Transactions over"
630 PRINT""Type in your choice"
640 @%=%20209
650 J$=GET$:A=VALJ$
660 IF A<1 OR A>4 THEN 650
670 PRINT TAB(0,6+A*2);CHR$(136)
680 PRINT TAB(0,22);"Are you sure (Y/N)"
690 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 690
700 IF A$="N" THEN 570
710 IF A=2 THEN PROCORDER:GOTO 570
720 IF A=3 THEN MODE 3:PROCPRINTOUT:MODE 7:GOTO 570
730 IF A=4 THEN PROCADJUST:PROCSAVEBANK:MODE 7:GOTO 1
20
740 MODE 4:PROCDISPLAY:VDU 26:PROCPAYDRAW:MODE 7:GOTO
570
750 FOR N=1 TO 2:PRINT CHR$(130);CHR$(141);"NEW BUILD
ING SOCIETY ACCOUNT":NEXT
760 PRINT""What is the name of the Society/Account"
770 PRINT TAB(5);"e.g. HALIFAX CURRENT":INPUT A1$
780 PRINT""What date was the account opened on"
790 INPUT"(e.g. 07/09/82)",B$(1)
800 PROCACCOUNT
810 A1$=A1$+" ACCOUNT"
820 MODE 4:CNT=1:PROCDISPLAY:CLS
830 PRINT"Are you sure (Y/N)";
840 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 840
850 IF A$="N" THEN 80 ELSE CLS
860 PROCSAVESOCIETY
870 VDU 26:MODE 7:GOTO 130
880 FOR N=1 TO 2:PRINT CHR$(130);CHR$(141);"ACCESS BU
ILDING SOCIETY ACCOUNT":NEXT
890 PRINT""What Building society Account do you w
ish to access"
900 INPUT",A1$:A1$=A1$+" ACCOUNT"
910 PRINT""The data-file will now be loaded"
920 PRINT""POSITION TAPE THEN PRESS ANY KEY":A$=GET$
930 XX=OPENIN A1$
940 INPUT#XX,B$(1),T(1)
950 FOR X1=1 TO 8
960 INPUT#XX,M$(X1),M(X1,1)
970 IF EOF#XX THEN X1=8:GOTO 980
980 NEXT X1
990 CLOSE#XX
1000 CNT=1:CLS
1010 MODE 7:FOR X=1 TO 2:PRINT CHR$(134);CHR$(141);"BU
ILDING SOCIETY OPERATIONS":NEXT
1020 PRINT""These are your options:-"
1030 PRINT'TAB(3);CHR$(130);"1) Pay in / draw out of t
he account"
1040 PRINT'TAB(3);CHR$(130);"2) Print out of transactio
ns"
1050 PRINT'TAB(3);CHR$(130);"3) Transactions over"
1060 PRINT""Type in your choice"
1070 @%=%20209
1080 J$=GET$:A=VALJ$
1090 IF A<1 OR A>3 THEN 1080
1100 PRINT TAB(0,6+A*2);CHR$(136)
1110 PRINT TAB(0,22);"Are you sure (Y/N)"
1120 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 1110
1130 IF A$="N" THEN 1010
1140 IF A=2 THEN MODE 3:PROCPRINTOUT:MODE 7:GOTO 1010
1150 IF A=3 THEN PROCADJUST:PROCSAVESOCIETY:MODE 7:GOTO
120
1160 MODE 4:PROCDISPLAY:VDU 26:PROCPAYDRAW:MODE 7:GOTO
1010
1170 DEFPROCPRINTOUT
1180 QQ=0
1190 PRINT TAB(20);A1$
1200 PRINT"DATE";TAB(15);"HEADING";TAB(35);"IN";TAB(4
5);"OUT";TAB(55);"TOTAL";TAB(70);"BALANCE"
1210 PRINT
1220 FOR T= 2 TO CNT
1230 PRINT B$(T);TAB(15);F$(T);TAB(40-(5*SIGN(T)));AM(
T);TAB(55);M(P(T),T);TAB(70);T(T)
1240 NEXT T
1250 PRINT:FOR H=1 TO 8:PRINT M$(H);TAB(25);M(H,CNT):
NEXT
1260 PRINT"BALANCE";TAB(25);T(CNT)
1270 IF QQ=1 THEN VDU6:VDU3:GOTO 1330
1280 PRINT""Do you want a print-out of these figures
(Y/N)"
1290 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 1290
1300 IF A$="N" THEN 1330
1310 PRINT"WHEN PRINTER IS READY PRESS ANY KEY":P$=GE
T$
1320 IF A$="Y" THEN VDU 2:VDU 21:QQ=1:GOTO 1190
1330 ENDPROC
1340 DEFPROCACCOUNT
1350 PRINT""How many account headings do you wish to
have (upto 8) ";
1360 A$=GET$:N=VALA$
1370 IF N<0 OR N>8 THEN 1360
1380 PRINT""Each heading can have upto ten letters"
1390 PRINT'TAB(4);CHR$(136);CHR$(131);"PRESS ANY KEY
TO CONTINUE":A$=GET$:CLS
1400 PRINT "Now type in your ";N;" headings"
1410 PRINT""If a mistake is made type XXX"
1420 PRINT""
1430 FOR A=1 TO N
1440 INPUT M$(A)
1450 IF LEN(M$(A))>10 THEN 1440
1460 IF M$(A)="XXX" THEN A=A-1:GOTO 1440
1470 NEXT A
1480 PRINT""Are you sure (Y/N)"
1490 A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 1490
1500 IF A$="N" THEN 1400 ELSE CLS
1510 PRINT "For your ";N;" headings type in the RELEVAN
T amounts"
1520 PRINT""
1530 FOR A=1 TO N
1540 PRINT M$(A)+" ";TAB(15);:INPUT M(A,1)

```

## YOUR BANK ACCOUNT

DATE	HEADING	IN	OUT	TOTAL	BALANCE
14/04/81	INSURANCES		43.00	42.00	1377.40
14/04/81	SAVINGS		248.00	517.00	1129.40
29/04/81	RATES/RENT	245.00		288.50	1374.40
29/04/81	SAVINGS	120.00		637.00	1494.40
29/04/81	ELEC/GAS	74.00		108.90	1568.40
29/04/81	CAR	23.00		133.00	1591.40
29/04/81	INSURANCES	32.00		74.00	1623.40
29/04/81	H-PURCHASE	147.80		147.80	1771.20
05/05/81	DRAWINGS		136.95	100.05	1634.25
14/05/81	ELEC/GAS		85.00	23.90	1549.25
14/05/81	H-PURCHASE		64.00	83.80	1485.25
14/05/81	RATES/RENT	15.63		304.13	1500.88
27/05/81	SAVINGS		49.00	588.00	1451.88
30/05/81	RATES/RENT	23.00		327.13	1474.88
30/05/81	HOLIDAY	45.00		190.00	1519.88
30/05/81	ELEC/GAS	74.00		97.90	1593.88
30/05/81	CAR	22.00		155.00	1615.88
30/05/81	INSURANCES	72.00		146.00	1687.88
30/05/81	H-PURCHASE	69.00		152.80	1756.88
07/06/81	H-PURCHASE		107.00	45.80	1649.88
07/06/81	RATES/RENT		308.00	19.13	1341.88
07/06/81	ELEC/GAS		84.00	13.90	1257.88

RATES/RENT	19.13
SAVINGS	588.00
HOLIDAY	190.00
ELEC/GAS	13.90
CAR	155.00
INSURANCES	146.00
DRAWINGS	100.05
H-PURCHASE	45.80
BALANCE	1257.88

An example of a printout using the printout of transactions option.

```

1550T(1)=T(1)+M(A,1)
1560NEXT
1570PRINT "TOTAL=";T(1)
1580PRINT "ARE YOU SURE (Y/N)"
1590A$=GET$:IF A$<>"Y" AND A$<>"N" THEN 1590
1600IF A$="N" THEN CLS:GOTO 1510
1610 ENDPROC
1620 DEFPROC PAYDRAW
1630CLS:PRINT TAB(8);"PAY IN / DRAW OUT"
1640PRINT "Do you wish to pay in or out (I/O)"
1650 CNT=CN+1
1660 IF CNT>25 THEN PRINT "No more transactions":CNT=CN
T-1:PRINT TAB(7)"PRESS ANY KEY TO CONTINUE":A$=GET$:EN
DPROC

```

```

1670A$=GET$:IF A$<>"I" AND A$<>"O" THEN 1670
1680IF A$="I" THEN SIGN(CNT)=1 ELSE SIGN(CNT)=-1
1690IF A$="O" THEN KK$="Withdrawn" ELSE KK$="Paid in"
1700 IF CNT=2 THEN 1730
1710 PRINT "Same Date ?":L$=GET$
1720 IF L$="Y" THEN B$(CNT)=B$(CNT-1):GOTO 1750
1730PRINT "Date of transaction (e.g. 07/09/83)"
1740INPUT B$(CNT)
1750GG=1:0% = 10:PRINT
1760REPEAT
1770PRINT GG;" " ;M$(GG):GG=GG+1

```

CONTINUED OVER

```

1780 UNTIL LEFT$(M$(GG),1)=""
1790 PRINT "Enter file number"
1800 @%=&20209
1810 K$=GET$:KK=VALK$
1820 IF KK<1 OR KK>GG-1 THEN 1810
1830 FF=0:FF=KK:F$(CNT)=M$(FF)
1840 PRINT "M$(FF);TAB(23);"";M$(FF,(CNT-1))
1850 PRINT "Amount to be ";KK$:INPUT AM(CNT)
1860 PRINT "ARE YOU SURE (Y/N)":A$=GET$:IF A$="N" THEN
1850
1870 M$(FF,CNT)=M$(FF,(CNT-1))+(AM(CNT)*SIGN(CNT))
1880 IF M$(FF,CNT)<0.01 THEN M$(FF,CNT)=0
1890 T(CNT)=T(CNT-1)+(AM(CNT)*SIGN(CNT)):P(CNT)=FF
1900 PROCAMEND
1910 PRINT "NEW TOTAL FOR ";M$(FF);" = ";M$(FF,CNT)
1920 PRINT "PAY IN / OUT AGAIN ? (Y/N)"
1930 A$=GET$:IF A$<>"N" AND A$<>"Y" THEN 1930
1940 IF A$="N" THEN CLS:PROCDISPLAY:ENDPROC
1950 CLS:GOTO 1640
1960 DEFPROCAMEND
1970 FOR N=1 TO 8
1980 IF N=FF THEN 2000
1990 M(N,CNT)=M(N,(CNT-1))
2000 NEXT
2010 ENDPROC
2020 DEFPROCORDER
2030 CLS:FOR N=1 TO 2:PRINT TAB(8);CHR$(130);CHR$(141)
;"STANDING ORDERS":NEXT
2040 PRINT "Do you wish to :-"
2050 PRINT TAB(7);"1) Set up a standing order"
2060 PRINT TAB(7);"2) Carry out a standing order"
2070 PRINT TAB(7);"3) Delete existing S/O"
2080 PRINT TAB(7);"4) Return to main program"
2090 PRINT "Enter choice (1-4)"
2100 W$=GET$:WW=VALW$:IF WW<1 OR WW>4 THEN 2100
2110 IF WW=3 THEN PROCDELETE:GOTO 2030
2120 IF WW=4 THEN ENDPROC
2130 IF WW=1 THEN PROCSETUP:GOTO 2030
2140 CNT=CNT+1:IF CNT>25 THEN PRINT "No more transactio
ns":CNT=CNT-1:PRINT TAB(7)"PRESS ANY KEY TO CONTINUE":
A$=GET$:ENDPROC
2150 PROCSD
2160 PRINT "Enter S/O number":W$=GET$:W=VALW$:IF W<1 O
R W>5 THEN 2160
2170 SIGN(CNT)=-1:FF=0
2180 FOR N=1 TO 8:IF M$(N)=S1$(W) THEN FF=N
2190 NEXT
2200 PRINT "Date of transaction (e.g. 07/09/75)":INPU
T B$(CNT)
2210 M$(FF,CNT)=M$(FF,CNT-1)-M1(W):AM(CNT)=M1(W):P(CNT)=
FF:F$(CNT)=M$(FF)+ " S/O ":T(CNT)=T(CNT-1)-M1(W)
2220 PRINT "NEW TOTAL FOR ";M$(FF);" = ";M$(FF,CNT)
2230 PROCAMEND
2240 PRINT "Another S/O (Y/N)":A$=GET$:IF A$="Y" THEN
2140
2250 GOTO 2030
2260 DEFPROCSD
2270 @%=10:CLS:N=1:REPEAT
2280 PRINT "(:N;)" "S0$(N);" from "S1$(N);" for "
M1(N)
2290 N=N+1
2300 UNTIL LEFT$(S0$(N),1)=""
2310 @%=&20209
2320 ENDPROC
2330 DEFPROCSETUP
2340 CLS:FOR N=1 TO 2:PRINT TAB(5);CHR$(130);CHR$(141)
;"NEW STANDING ORDER":NEXT
2350 GG=0:REPEAT:GG=GG+1
2360 UNTIL LEFT$(S0$(GG),1)=""
2370 PRINT "Name of concern S/O being paid to":INPUT
S0$(GG)
2380 @%=10:PRINT
2390 FOR N=1 TO 8:PRINT N;"";TAB(15);M$(N):NEXT
2400 @%=&20209
2410 PRINT "File to be debited (e.g. Insurance)":WW$=G
ET$:WW=VALW$:IF WW<1 OR WW>8 THEN 2410
2420 S1$(GG)=M$(WW):PRINT "AMOUNT TO BE DEBITED"
2430 INPUT M1(GG):PRINT "Are you sure (Y/N)":A$=GET$:
IF A$="N" THEN 2380
2440 PRINT "Another new S/O (Y/N)":A$=GET$:IF A$="Y" T
HEN GG=GG+1:CLS:GOTO 2370
2450 ENDPROC
2460 DEFPROCDELETE
2470 PROCSD:PRINT "Which Order is to be deleted"
2480 A$=GET$:DD=VALA$:IF DD<1 OR DD>5 THEN 2480
2490 FOR X=DD TO 5
2500 S0$(X)=S0$(X+1):S1$(X)=S1$(X+1):M1(X)=M1(X+1)
2510 NEXT
2520 CLS:PROCSD:PRINT "Any more orders to be deleted"
A$=GET$
2530 IF A$="Y" THEN 2470 ELSE ENDPROC
2540 DEFPROCDISPLAY
2550 PRINT A1$
2560 PROCHORIZLINE
2570 PRINT "DATE";TAB(12);B$(CNT)
2580 PROCHORIZLINE
2590 FOR A=1 TO 8
2600 PRINT M$(A);TAB(12);"";M(A,CNT)
2610 PROCHORIZLINE
2620 NEXT
2630 PRINT "TOTAL";TAB(12);"";T(CNT):PROCHORIZLINE
2640 PROCVERTICLINE(11):PROCVERTICLINE(22)
2650 PRINT TAB(5,31);"PRESS ANY KEY TO CONTINUE":G$=G
ET$
2660 VDU 28,21,30,39,1
2670 ENDPROC
2680 DEFPROCCHORIZLINE
2690 COLOUR 1
2700 PRINT STRING$(39,CHR$224)
2710 ENDPROC
2720 DEFPROCVERTICLINE(Z)
2730 FOR X=1 TO 30
2740 IF X=1 OR X DIV 3=X/3 AND X<8*4 THEN PRINT TAB(Z,
X);CHR$226:NEXT:COLOUR 3:ENDPROC
2750 PRINT TAB(Z,X);CHR$225
2760 NEXT
2770 ENDPROC
2780 DEFPROCSAVEBANK
2790 CLS:PRINT "POSITION TAPE READY FOR SAVING OF":P
RINTA1$
2800 PRINT "PRESS ANY KEY TO CONTINUE":A$=GET$
2810 XX=OPENOUT A1$
2820 PRINT#XX,B$(1),T(1)
2830 FOR X1=1 TO 5
2840 PRINT#XX,S0$(X1),S1$(X1),M1(X1)
2850 NEXT X1
2860 FOR X1=1 TO 8
2870 PRINT#XX,M$(X1),M(X1,1)
2880 NEXT X1
2890 CLOSE#XX
2900 CLS:ENDPROC
2910 DEFPROCSAVESOCIETY
2920 CLS:PRINT "POSITION TAPE READY FOR SAVING OF":P
RINTA1$
2930 PRINT "PRESS ANY KEY TO CONTINUE":A$=GET$
2940 XX=OPENOUT A1$
2950 PRINT#XX,B$(1),T(1)
2960 FOR X1=1 TO 8
2970 PRINT#XX,M$(X1),M(X1,1)
2980 NEXT X1
2990 CLOSE#XX
3000 CLS:ENDPROC
3010 DEFPROCADJUST
3020 FOR A=1 TO 8
3030 B$(1)=B$(CNT):M(A,1)=M(A,CNT):T(1)=T(CNT)
3040 NEXT A
3050 ENDPROC

```

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# Spriten Up

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This series of programs will enable you to define your own multicoloured characters (sprites) and use them easily from BASIC, in MODE 2.

Each sprite is 8×8 pixels (i.e. normal character size), and any combination of the 16 colours may be used in each character. Up to 32 sprites may be present on the screen at any one time, to each of which may be assigned any one of eight designs, created previously. There is no restriction on the use of the normal user-defined VDU characters, or of graphics PLOT actions. Sprite colours are independent of COLOUR and GCOL, but will be affected by appropriate VDU 19 changes. It is advisable when using sprites to make sure that the screen is not hard-scrolled. The program assumes that the start address of the screen memory is &3000, but hard-scrolling the screen will cause this address to change, and may result in some confusion.

## SPRITE #1

This first program enables you to design a set of up to eight sprite designs using an 8×8 grid, and save then onto tape for future use. A previously-defined set may be loaded from tape for alterations. After calling PROC-setup, the program repeatedly calls PROC-menu and takes appropriate action according to the option chosen. The procedures are as follows:

### PROC-setup

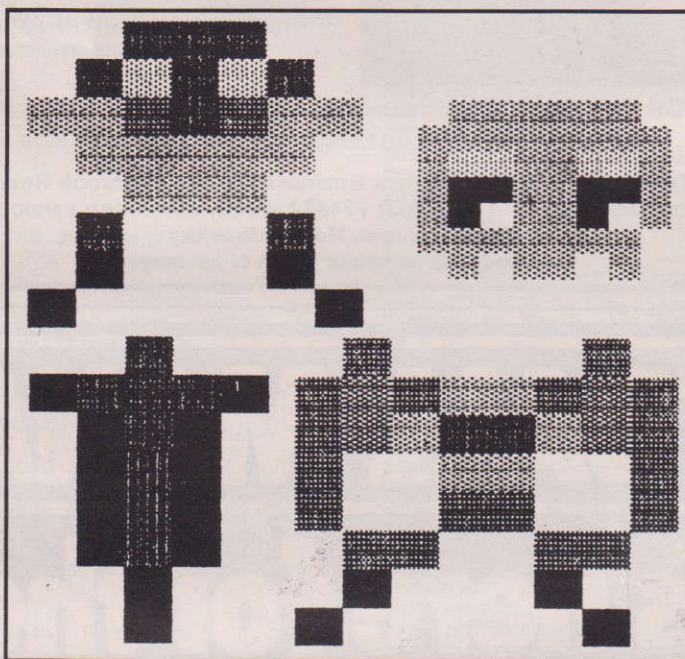
(lines 150-260) sets up variables, restores default logical colours, sets up the cursor keys to return ASCII codes, clears the sprite locations, and reads from DATA the 16 elements of the byte array 'mask', each of which is a byte mask required to set the right pixel of a byte to one of the logical colours, 0-15.

### PROC-menu

(lines 280-540) asks you to select one of 5 options, using the cursor keys to select and the COPY key to enter. The options are:

- 1) DEFINE SPRITE — allows a sprite to be designed on an 8×8 grid.
- 2) SHOW SPRITES — shows the current designs, 0-7.

## Design and animate multicoloured graphic sprites. Manipulate machine code routines from within your own BASIC programs.



3) CLEAR SPRITES — clears all sprite locations.

4) SAVE SPRITES — saves current sprites onto tape.

5) LOAD SPRITES — loads a set of sprites from tape.

### (PROC-define)

(lines 560-920) asks for sprite number, then displays the current contents of the selected sprite on the grid. The assembly language routine in this procedure is to determine the colour of each of the two pixels produced by a byte. The bits of each pixel are arranged within the byte as shown in figure 1. The routine shifts the bits left, the most significant bit

being shifted into the carry flag. the bits are rotated left into locations &70 and &71 alternately, and the routine returns with the left pixel colour in &70 and the right pixel colour in &71. PROC-alter is then called.

### (PROC-show)

(lines 940-1060) prints the numbers 0-7 down the screen, then displays alongside them the associated sprite designs 0-7. Pressing space-bar will return to the menu.

### PROC-clear

(lines 1080-1120) clears all sprite locations.

### (PROC-tape)

(lines 1140-1230) asks for

filename, then either \*LOADs or \*SAVEs the named file, according to the parameter F\$ passed to the procedure. OSCLI, the command line interpreter, is used to achieve this. The sprite designs are held in locations &2F00-&2FFF.

### PROC-grid

(lines 1250-1350) draws the 8×8 grid.

### PROC-fill

(lines 1370-1470) fills square (X,Y) of the grid with the colour passed to the procedure, by plotting two triangles of that colour. Also, the relevant byte in the sprite location is updated, using the appropriate colour mask byte (multiplied by two for the left pixel).

### (PROC-alter)

(lines 1490-1760) allows the sprite to be altered. The crosshair is moved using the cursor keys, and squares are filled by pressing the appropriate number key for colours 0-7. Flashing colours 8-15 are obtained by pressing SHIFT with the appropriate number key 0-7. The sprite design is displayed actual size to the right of the grid. Pressing C will clear the sprite. When the design is complete, press E to return to the menu.

### (PROC-xhair)

(lines 1780-1840) displays the crosshair cursor in the logical inverse colour to that of the square it is in.

### PROC-showsprite

(lines 1860-1900) displays a sprite on the screen.

### PROC-clearsprite

(lines 1920-2030) clears the current sprite.

## SPRITE #2

This is a very short BASIC program which sets up USERV and programs the BREAK key to reset USERV each time a soft reset is carried out. It then \*LOADs SPRITE #3 before deleting itself by writing &OD into ?PAGE and &FF into PAGE?1. (It may be recovered by typing OLD if required). Before using sprites you will need to CHAIN SPRITE #2, so SAVE it at the beginning of a tape, where it can be found easily.

## SPRITE #3

SPRITE #3 is the machine code routine responsible for sprite handling. The third listing given is the source code which produces this routine. Type in this listing and SAVE it just after SPRITE #1. Run it to assemble the machine code, and test it. To do this, you will need to have created some sprite designs previously, using SPRITE #1. See below, 'USING SPRITES IN BASIC'. When it is working, save the machine code immediately following SPRITE #2 (which will \*LOAD it) by typing:

```
*SAVE SPRITE#3 2900 2B00
```

number. This is multiplied by 2 by shifting left, and ANDed with 62, giving an even number in the range 0-62. This is used as an offset from jumtab to fetch the address of the first byte to the sprite. The address is then stored in addrlo and addrhi.

If the carry flag is set, X was  $\geq 128$ , and the sprite is to be displayed on the screen (see below). If the carry is clear, then Y contains the number of the sprite design (0-7) to be assigned to sprite X (0-31). In this case, the number in the Y register is ANDed with 7 to mask out any higher order bits, and multiplied by 32 by shifting left 5 times, to give the offset from &2F00 of the

The variables used in the source code program are:

sprite	- start address of sprite designs (&2F00)
screentab	- 640 x table
jumtab	- table of addresses of the first byte of each sprite
jumpadr	- address of first byte of sprite
oldv	- original contents of USERV
xlo, ylo	- x and y co-ordinates (in pixels)
addrlo	- address of sprite required
addrhi	
screnlo	
screenhi	- addresses of screen locations
scrnlo	
scrnhi	
temp	- temporary storage locations
temp2	
sub, line	- used to calculate offset from screen address
xhigh	- high byte to be added to screen address

## WORKING SPRITES

The following is a brief description of how the program works. When the machine code routine is entered, the accumulator is checked. If it contains zero, \*CODE was used to call the routine, and the program continues. Otherwise, \*LINE was used, in which case a jump is made to the message 'BAD COMMAND', to which USERV originally pointed. If the X register contains &FF (255), then the X and Y registers will be loaded from locations &80 (128) and &81 (129) respectively. The X register contains the sprite

required sprite design (each design is 32 bytes long). The sprite is then copied into the desired sprite location (starting from the address in addrlo and addrhi), and control is returned to BASIC.

To display the sprite on the screen is not very straightforward due to the non-linear way in which the screen memory is mapped. Figure 2 shows a block of four graphics cells, each of 8 bytes, from the top left corner of the unscrolled MODE 2 screen, with the hexadecimal address of each byte. If the x and y co-ordinates indicate that, say, &3004 is the location to which the first byte of the sprite should be sent, and the bytes of the

3000	3008	3010
3001	3009	3011
3002	300A	etc.
3003	300B	
3004	300C	
3005	300D	
3006	300E	
3007	300F	
3280	3288	
3281	3289	
3282	328A	
3283	328B	
3284	328C	
3285	328D	
3286	328E	
3287	328F	

sprite were transferred sequentially to the screen starting from this address, the sprite would be distorted. Instead, the address of the top of the relevant graphics cell (&3000) will be stored, and the location line, which indicates the offset from this location of the first byte, will contain 4. The location sub will be set at zero. The offset of the current byte from the stored address is given by (temp+line-sub), where temp contains the number of the current byte (0-31).

## CALCULATED MOVE

When (temp MOD 8)+line becomes equal to 8, &280 (640) is added to the stored address and 8 is stored in sub. Thus, (temp+line-sub) still gives the offset, but this time from the first byte of the next character cell down. After 8 bytes have been exchanged, the stored address is reset to its original value (&3000 in this case), and sub is reset to zero. This sequence is repeated until all 32 bytes of the sprite have been exchanged from the bytes in the screen locations to which they are transferred, after which control is returned to BASIC.

The address of the first byte of the required graphics cell is calculated from the x and y co-ordinates given. These should be in pixels and measured from the top left corner of the screen. The range for the x co-ordinate is 0-150 and that for the y co-ordinate is 0-247. Values outside

these ranges will be set to the maximum value. The x co-ordinate is ANDed with &FE to make it an even number (because each byte produces two pixels) and multiplied by 4 to give the number of bytes to be added to the screen address. The y co-ordinate is ANDed with 7. This gives the value to be stored in line.

The number of pixels is transferred back to the accumulator from the Y register, then divided by 4 and ANDed with &FE to make it even. It is now equal to twice the number of character rows from the top of the screen, and is used as an offset into screentab, which contains 32 entries of a 640 x table, stored high byte first. (There are 640 bytes per character row). The screen address is then incremented by the appropriate multiple of 640, after which it is equal to the address of the first byte of the required graphics cell.

The sprite is then transferred byte by byte into the correct screen locations as described above, and the previous contents of these locations are stored in the sprite location. Thus calling the routine again will restore the original background, and transfer the sprite back to its location.

## USING SPRITES IN BASIC

Before attempting to write or run a program which uses sprites, you should CHAIN SPRITE #2. This sets up USERV and the BREAK key as already stated, and LOADs SPRITE #3 (the machine code which you have \*SAVED after SPRITE #2). Then \*LOAD the file containing the sprites you wish to use. This all sounds very tedious, but as there are only four blocks in total to load, it does not take very long. Note that the programs will survive a soft reset, but if you perform a hard break (i.e. CTRL & BREAK pressed together), you will have to CHAIN SPRITE #2 again.

Programs using sprites

CONTINUED OVER

should select MODE 2, then set HIMEM to &2900.

Sprites are accessed from BASIC by means of the O.S. command, \*CODE x,y. This instructs the computer to load the X register with the x value given, and the Y register with the y value given (or with zero if no value is given), and then jump to the address held in (?&200 and ?&201) with the accumulator set to zero. With the default contents of USRV, this produces the message, 'BAD COMMAND', but USRV has been altered by SPRITE #2 to contain the start address of the sprite handling routine.

To assign a design (0-7) to a

sprite (0-31), use \*CODE x,y, where x is the sprite number and y is the design number. E.g. \*CODE 24,3 will assign design a sprite on the screen, use ?&70=?&71=y, to determine the position, where x is the number of pixels from the left edge of the screen (0-150) and y is the number of pixels from the top of the screen (0-247), then \*CODE x, where x is (128+ the sprite number) to display the sprite at that position. E.g., \*CODE 152 will display sprite number 24.

Using this command a second time will replace the sprite with the original background (so make sure you have specified the

position correctly; also, if the sprite has been overwritten, you will have to reassign it using \*CODE x,y before using it again.

Now it is not easily possible to pass BASIC variables to an operating system command. (In particular, you may want to pass a loop variable). To overcome this problem, you can use ?&80=x: ?&81=y: \*CODE 255.

The machine code routine checks the X register for 255 (&FF), and if it is equal, the X register will be loaded from location &80 (128) and the Y register from location &81 (129). In this way, variables can be passed to

the routine if desired.

Remember that, like any operating system command used in a BASIC program, \*CODE must be the last statement on a line. Note that \*FX136,x,y is directly equivalent to \*CODE x,y.

## CHALLENGE

Finally A&B Computing would like to lay down the challenge of the arcade to its readers. Why not design and program a game using Sprite routines listed here? A&B Computing publishes all sorts of programs, arcade and educational. Why not get in on the act? Payment is generous and consider the fame...

### PROGRAM LISTING 1 SPRITE #1

```
100NERRORGOTO110
20DIM mask 15,Title 30
30MODE7:HIMEM=&2E00:PROC_setup
40MODE7:HIMEM=&2E00:PROC_menu
50ON option GOTO60,70,80,90,100
60MODE2:HIMEM=&2E00:VDU23;8202;0;0;0;0:PROC_define:GO
TO40
70MODE2:HIMEM=&2E00:VDU23;8202;0;0;0;0:PROC_show:GOTO
40
80PROC_clear:GOTO40
90PROC_tape("SAVE"):GOTO40
100PROC_tape("LOAD"):GOTO40
110*FX4
120MODE7
130END
140:
150DEFPROC_setup
160SPRITE=&2F00
170oscli=&FFF7
180VDU20
190*FX4,1
200sprite=0:option=1
210FORI=0TO15
220READmask?I
230NEXT
240DATA0,1,4,5,16,17,20,21,64,65,68,69,80,81,84,85
250PROC_clear
260ENDPROC
270:
280DEFPROC_menu
290VDU23;8202;0;0;0;0
300FORI=2TO3
310VDU31,10,Y,131,157,129,141,83,80,82,73,84,69,35,49
,32,32,32,156
320NEXT
330PRINTTAB(1,5);CHR#132;CHR#157;CHR#131;"MULTI_COLOUR
RED CHARACTER DEFINER"
340PRINTTAB(2,6);"By G. Collins"
350FORI=8TO9
360PRINTTAB(9,I);CHR#134;CHR#141;CHR#136;"SELECT OPTI
ON"
370NEXT
380PRINTTAB(2,12);"Select using vertical cursor keys"
390PRINTTAB(4,13);"Press COPY to enter selection"
400PRINTTAB(12,15);"DEFINE SPRITE "CHR#156
410PRINTTAB(12,16);"SHOW SPRITES "CHR#156
```

```
420PRINTTAB(12,17);"CLEAR SPRITES "CHR#156
430PRINTTAB(12,18);"SAVE SPRITES "CHR#156
440PRINTTAB(12,19);"LOAD SPRITES "CHR#156
450PRINTTAB(8,21);CHR#131;CHR#157;CHR#132;"ESCAPE "CH
R#135;CHR#156;" to EXIT"
460REPEAT
470VDU31,8,option+14,135,157,130
480*FX15
490m=GET
500VDU31,8,option+14,32,32,32
510option=option-(m=138)+(m=139)
520IFoption<1option=1ELSEIFoption>5option=5
530UNTILm=135
540ENDPROC
550:
560DEFPROC_define
570COLOUR132
580CLS
590COLOUR7
600PRINTTAB(0,4);"SPRITE No. (0-7) ?"
610REPEAT
620sprite=GET-48
630UNTILsprite<8ANDsprite>=0
640CLS
650PROC_grid
660FORI=0TO31
670b=sprite*32+I
680P%=&2E00
690IDPTO
700LDA#0
710STA#70
720STA#71
730LDX#b
740LDA SPRITE,X
750LDY#4
760.nxt ASL A
770ROL#70
780ASL A
790ROL#71
800DEY
810BNE nxt
820RTS
830:
840CALL&2E00
850X=(I DIV8)*2
860Y=I MOD8
870PROC_fill(7&70)
880X=X+1
890PROC_fill(7&71)
900NEXT
910PROC_alter
920ENDPROC
```

```

930:
940DEFPROC_show
950CLS
960FORI=0TO7
970PRINTTAB(5,4+I*2);I;" ....."
980NEXT
990FORsprite=0TO7
1000screen=&3BA0+sprite*&500
1010PROC_showsprite
1020NEXT
1030PRINTTAB(0,29)"Press SPACE_BAR to"
1040PRINTTAB(2,30)"return to MENU"
1050REPEATUNTILGET=32
1060ENDPROC
1070:
1080DEFPROC_clear
1090FORI=0TO255
1100SPRITE?I=0
1110NEXT
1120ENDPROC
1130:
1140DEFPROC_tape(F%)
1150CLS:VDU28,4,8,25,5
1160INPUTTAB(4,5);"FILENAME ";T$
1170T$=LEFT$(T$,10)
1180$Title=F$+T$+" 2F00 2FFF"+CHR$13
1190IFF$="LOAD "Title!(11+LENT$)=&D
1200X%=Title MOD256
1210Y%=Title DIV256
1220CALL osc11
1230ENDPROC
1240:
1250DEFPROC_grid
1260GCOLOR,7
1270FORH=32TO896STEP108
1280MOVEH,1000
1290DRAWH,456
1300NEXT
1310FORV=456TO1000STEP68
1320MOVE32,V
1330DRAWB96,V
1340NEXT
1350ENDPROC
1360:
1370DEFPROC_fill(C)
1380GCOLOR,C
1390MOVE40+X*108,996-Y*68
1400MOVE40+X*108,936-Y*68
1410PLOT85,132+X*108,996-Y*68
1420PLOT85,132+X*108,936-Y*68
1430byte=sprite*32+Y+INT(X/2)*8
1440pixel=1-(X/2=INT(X/2))
1450Mask=(mask?C)*pixel
1460SPRITE?byte=(SPRITE?byte)AND(&AA/pixel)ORMask
1470ENDPROC
1480:
1490DEFPROC_alter
1500X=0:Y=0
1510PROC_xhair
1520COLOUR1
1530PRINTTAB(0,20);"C TO CLEAR SPRITE"
1540PRINTTAB(0,22);"CURSOR KEYS TO MOVE"
1550PRINTTAB(0,24);"KEYS 0-7 FOR COLOURS"
1560PRINTTAB(0,28);"(+ SHIFT for FLASH)"
1570PRINTTAB(3,30);"E to EXIT"
1580End=FALSE
1590REPEAT
1600screen=&4600
1610PROC_showsprite
1620*FX15
1630m=GET
1640IFINKEY(-1)ANDm=48PROC_fill(8):m=0:PROC_xhair
1650IFm>47ANDm<56PROC_fill(m-48):PROC_xhair
1660IFm>32ANDm<40PROC_fill(m-24):PROC_xhair
1670IFm=99ORm=67PROC_clearsprite

```

```

1680IFm=69ORm=101THENEnd=TRUE
1690PROC_xhair
1700X=X+(m=136)-(m=137)
1710Y=Y+(m=139)-(m=138)
1720IFX>7 X=7ELSEIFX<0 X=0
1730IFY>7 Y=7ELSEIFY<0 Y=0
1740PROC_xhair
1750UNTILEnd
1760ENDPROC
1770:
1780DEFPROC_xhair
1790GCOLOR,0
1800MOVEX*108+88,984-Y*68
1810DRAWX*108+88,952-Y*68
1820MOVEX*108+58,970-Y*68
1830DRAWX*108+116,970-Y*68
1840ENDPROC
1850:
1860DEFPROC_showsprite
1870FORloc=0TO31
1880screen?loc=SPRITE?(sprite*32+loc)
1890NEXT
1900ENDPROC
1910:
1920DEFPROC_clearsprite
1930FORI=0TO31
1940SPRITE?(sprite*32+I)=0
1950NEXT
1960FORX=0TO7
1970FORY=0TO7
1980PROC_fill(0)
1990NEXT
2000NEXT
2010X=0:Y=0
2020PROC_xhair
2030ENDPROC

```

## PROGRAM LISTING 2 SPRITE #2

```

90 page=PAGE
100 oldv=&7E
120 code=&2900
140 USERV=&200
160 ?oldv=?USERV
180 oldv?1=USERV?1
200 ?USERV=code MOD&100
220 USERV?1=code DIV&100
240 *K.10?&200=0:M?&201=&29:M
260 *L.SPRITE#3
280 MODE7
300 ?page=&D:page?1=&FF

```

## PROGRAM LISTING 3 SPRITE #3

```

10REM .... For # read the 'hash'
20REM character (SHIFT+3) throughout
30sprite=&2F00
40screentab=&2AC0
50jumptab=&2A80
60FORI=0TO62STEP2
70jumpadr=&2B00+I*10
80jumptab?I=jumpadr MOD&100
90jumptab?(I+1)=jumpadr DIV&100
100screentab?I=(I*320)DIV&100
110screentab?(I+1)=(I*320)MOD&100
120NEXT
130oldv=&7E
140xlo=&70:ylo=&71
150addrlo=&72:addrhi=&73
160screenlo=&74:screenhi=&75

```

CONTINUED OVER

```

170scrnlo=&76:scrnhi=&77
180temp=&78
190temp2=&79
200sub=&7A
210line=&7B
220xhigh=&7C
230FORI=0TO3STEP3
240PX=&2900
250[OPTI
260CMP#0          \Is it *CODE ?
270BEQ start      \Yes,goto start else
280JMP (oldv)     \print BAD COMMAND
290.start
300CPX#&FF        \If x=&FF (255)
310BNE nochange
320LDX &80        \then load X&Y from
330LDY &81        \zero page locations
340.nochange
350TXA
360ASL A          \X to be 0-62
370AND#62         \X to be even
380TAX
390LDA jumtab,X   \This gets address
400STA addrlo     \of sprite number
410INX            \X/2 and stores it
420LDA jumtab,X   \in addrlo and
430STA addrhi     \addrhi
440BCS display    \If X was <=128
450TYA            \Y contains design
460AND#7          \No., 0-7.
470ASL A
480ASL A          \*32 to give offset
490ASL A          \of sprite design Y
500ASL A          \from &2F00
510ASL A
520TAX
530LDY#0
540.nxt
550LDA sprite,X
560STA (addrlo),Y
570INX
580INY            \32 bytes of design
590CPY#32         \stored from address
600BNE nxt        \addrlo and addrhi
610RTS            \sprite now assigned
620.display
630LDA#0
640STA xhigh
650STA screenlo   \start of screen
660LDA#&30        \memory is &3000
670STA screenhi
680LDA xlo
690CMP#151        \adjust X
700BCCx_ok        \co_ordinate
710LDA#150        \if >150
720.x_ok
730AND#&FE
740ASL A          \*4 to give No. of
750ROL xhigh      \bytes
760ASL A
770ROL xhigh
780CLC            \screen address
790ADC screenlo   \adjusted according
800STA screenlo   \to X co-ordinate
810LDA screenhi
820ADC xhigh
830STA screenhi
840LDA ylo        \Y co-ordinate
850CMP#248
860BCCy_ok        \adjust Y
870LDA#247        \co_ordinate if >247
880.y_ok
890TAX
900AND#7
910STA line
920.clear
930TYA
940LSR A
950LSR A
960AND#&FE
970TAX

```

```

980INY
990CLC
1000LDA screentab,Y \These lines
1010ADC screenlo    \adjust the
1020STA screenlo    \screen address
1030DEY             \according
1040LDA screentab,Y \to the Y
1050ADC screenhi    \co-ordinate
1060STA screenhi
1070LDY#0
1080.nextbyte
1090LDA (addrlo),Y
1100TAX             \byte of sprite to X
1110TYA             \byte No. (0-31)
1120STA temp        \stored in temp
1130AND#7
1140BNE cont
1150LDA screenlo    \re-assign
1160STA scrnlo      \screen address
1170LDA screenhi    \after every
1180STA scrnhi      \8 bytes
1190LDA#0
1200STA sub
1210.cont
1220CLC
1230ADC line
1240CMP#8
1250BNE exchange
1260STA sub
1270CLC
1280LDA scrnlo
1290ADC#&80         \increment
1300STA scrnlo      \screen address
1310LDA scrnhi      \by &280 (640)
1320ADC#2
1330STA scrnhi
1340.exchange
1350CLC
1360LDA temp        \calculate offset
1370ADC line        \from screen
1380SEC            \address and
1390SBC sub         \hold in Y reg.
1400TAY
1410LDA (scrnlo),Y  \byte from screen
1420STA temp2       \to temp2
1430TXA            \byte from sprite
1440STA (scrnlo),Y  \to screen
1450LDY temp        \byte No. to Y reg
1460LDA temp2       \byte from screen
1470STA (addrlo),Y  \to sprite
1480INY            \next byte
1490CPY#32
1500BNE nextbyte    \32 bytes
1510RTS            \exchanged.
1520J
1530NEXT

```

### PROGRAM LISTING 4

```

10 MODE2:VDU23;B202;0;0;0;
20 HIMEM=&2900
30 DIMD 3,X 3,Y 3,VX 3,VY 3
40 FORI=0TO3
50 X?I=RND(100)+20:Y?I=RND(200)+20
60 VX?I=RND(3):VY?I=RND(3)
70 D?I=I
80 ?&80=I: ?&81=D?I: *CO.255
90 ?&70=X?I: ?&71=Y?I: ?&80=I+128: *CO.255
100 NEXT
110 REPEAT
120 FORI=0TO3
130 *CO.7,7
140 ?&70=X?I: ?&71=Y?I: *CO.135
150 X?I=X?I+VX?I
160 IFX?I>140 OR X?I<10 VX?I=-(VX?I)
170 Y?I=Y?I+VY?I
180 IFY?I>240 OR Y?I<10 VY?I=-(VY?I)
190 ?&70=X?I: ?&71=Y?I
200 ?&80=I: ?&81=D?I: *CO.255
210 ?&80=I+128: *CO.255
220 NEXT
230 UNTILO

```

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# Walk Before You Run

Richard Ives

Let's just make sure that everyone reading this knows how to SAVE programs on tape or disc before we go on to more difficult things. There are other filing systems apart from tape or disc; for example, files can be transferred over the local network (called ECONET on the Beeb), or they could be sent to other users' storage systems over the telephone. Electron users are not able to use discs without an interfacing device, but for BBC users the two systems, disc and tape, use a common subset of commands, so there shouldn't be too much confusion.

If we are writing BASIC programs (and if you are writing in machine code you shouldn't be reading this!) then saving a program which you have written should not present any problems. Make sure that your tape recorder or disc drive is properly connected to your computer and that you have a disc or tape in the equipment to which you want to SAVE. (O.K., O.K., I know this is obvious, I bet you have forgotten to do this on more than one occasion!). Then you just type:

SAVE "program"

press the RETURN key and sit back and wait for the computer's arrow-head prompt to come back. Tape users will have to wait much longer than disc users of course, but at least they have the advantage of being able to use file names of up to ten characters — on the standard disc system the maximum is seven, which I find an irksome limitation.

## CHECKING IF YOUR PROGRAM HAS SAVED

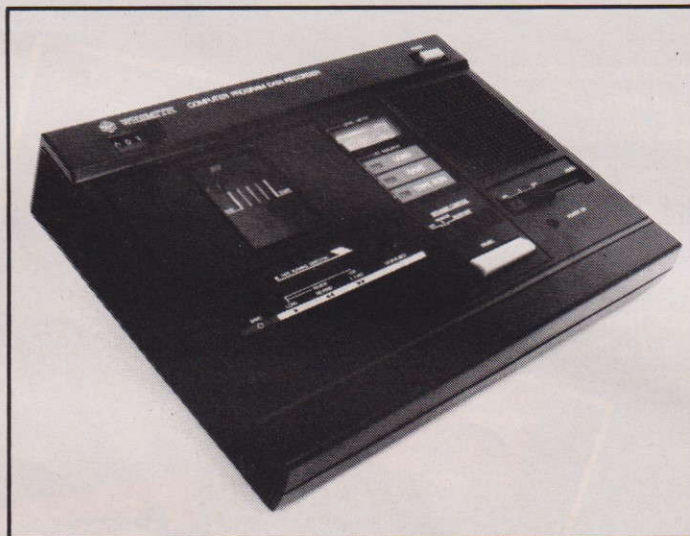
You can check if your program has got onto the disc or tape by typing

\*CAT

(Short for "catalogue")

This will give a list of all the files on the disc (or tape, if you rewind it first!). Press the escape key to stop CATaloging. Unfortunately, it will not VERIFY the saved pro-

## An introduction to file handling of all kinds.



grams, that is, it will not check that they can be reLOAded. Although neither the Beeb nor the Electron are provided with a VERIFY command it is possible to check that a program will reLOAD by rewinding the tape to the start of the program you have just saved and typing

\*LOAD "" 8000

This is just a trick which fools the computer's cassette operating system into thinking that it is LOAding a program when actually it isn't. The '8000' represents a part of memory which can't be LOAded to (you may be familiar with this as "ROM") so the program you have in memory will not be affected. However, the normal messages will be printed as the computer apparently LOADs (or fails to LOAD) the program, so you will be able to tell if everything is O.K. Personally, whether I'm using tape or disc, I SAVE two copies of everything, each one on a different disc or tape, and if the stuff is really valuable I store the two copies in separate rooms in my house (I've learnt from bitter experience of losing stuff to be ultra-careful; but real pro's keep three copies - this

is (in a patriarchal way) referred to as the "Grandfather, Father, Son" system.

## LOADING IT BACK

If you have been careful with your saving you shouldn't have any problem getting your program back in the next time you want to use it... but you probably will, anyway. My advice here is fairly limited, but try different tape recorders, even the music centre. I always use my personal stereo, which seems to playback anything successfully (but I can't record programs with it). Try a new lead, try disconnecting the "record" socket when playing back, make sure you have a series one operating system. Make sure you are using good quality tapes. I've stopped using so-called "computer" tapes as many of them seem to be of low quality, and I now use a good quality Hi-Fi tape. Make sure that your tape heads are clean. Borrow a de-Gaussing device from a friendly Hi-Fi freak (they are expensive to buy). If all else fails, buy a utility ROM with a procedure to help you load in dud programs.

## SAVING DATA

All this, then, applies to BASIC programs. It is also possible, and very useful, to be able to save information other than computer programs after the computer is switched off. Thus, an address file could be stored in electronic form. Also, we sometimes need access to more information than the computer can hold at any one time. Furthermore, data outside a program is easier to update than if it was concealed in DATA statements inside the program. This other information is generally called "data", to distinguish it from programs.

The most obvious example of saving data is when saving text while using a word-processing chip, but this is not the only use. In a program called "Animal", for example, you teach the computer to classify animals. When you want to stop you have the option of saving a data file of the animals you have taught it so far, so that you can carry on teaching the computer more animals at a later date. Another example is in Adventure programs, where you can save your position in the game and go back to it later. Some Adventure games (e.g. Acornsoft Quest) hold the data separately from the main program, thus allowing the latter to be longer, since more memory is released for the main program as it is not cluttered up with data statements.

## THE OFFICE ANALOGY

BBC BASIC provides commands which make it possible to handle data files fairly simply. Before going on to describe these, it is helpful to think of how a human office would handle data storage. The boss might instruct a minion to open a file with a certain name; the boss might then give some information to be put in the file, and finally ask for the file to be closed and put away. On some other occasion, when the information in that file was required, it would first have to be located, then opened, then the information read from it, then it

ought to be closed and put away again. The boss doesn't care how the files are ordered and arranged, as long as the information is available when it is wanted.

Suppose we want to keep a record of the user's answers to our capital city quiz (which we developed earlier in this series), perhaps so we can look at them later on. For example, a teacher might want to take home a tape of his/her class's answers to a computerised test to see what mistakes they had made. (No doubt it would be possible for the computer to analyse the data as well as record it, but let's assume that our teacher is following this course, and is unable to do that, yet! At least she doesn't have to mark the work, since we could make the computer do that easily.) For convenience, I'll refer to the tape filing system only from now on, since there are some differences between the two systems.

## CREATING A DATAFILE

So, having made sure that our computer is connected to a cassette recorder, preferably one with motor control (that is, the computer will switch it on and off as it needs to) we can begin. First, we need to tell the computer that we want to open a file in order to write some information to the tape. We can call this file what we like (subject to the ten character limit), but 'ANSWER' would be a sensible title. We do this by giving a channel for the computer to use. It needs this because if we have several files open at once, the computer needs to keep them separate.

The line of BASIC to do the job is:

```
100 C = OPENOUT "ANSWER"
```

The computer will open a file called ANSWER and store the channel number it is using for the file in the variable we have called C (we could have called it anything, and, like the boss not caring how things are filed so long as it's efficient, we don't care



what channel number the computer uses, but it has to have somewhere to keep this value). Notice we say OPENOUT because we want to open a file for OUTPUT. Now, once the user has given us the answers to our quiz, we want to store them on tape. Let's assume that there are ten answers stored in the array ANSWER\$, in elements one to ten of that array. We need a loop to refer to each of these ten elements, and first we must DIMension the array:

```
10DIM ANSWER$(10)
110 FOR I=1 TO 10
130 NEXT I
```

and in the loop we want to store each value in our ANSWER file. So each time round the loop, we'll send the array element ANSWER\$(I) to be put on tape:

```
120 PRINT # C, ANSWER$(I)
```

This line means: output the information stored in ANSWER\$(I) to the filing system, on the channel which has previously been given the value stored in C (at line 100). Since we linked the filename ANSWER to the channel number C the data will be stored under this name. Having put all the data on tape, we must close the file:

```
140 CLOSE # C
```

Let's try this out, then, simply and crudely by INPUTting an answer from the keyboard in

response to a prompt. I'll leave you to make this more sophisticated; there is enough here for us to see how the thing works.

```
112 PRINT "Type in your response"
114 INPUT ANSWER$(I)
```

If the tape is rewound a little, and the instruction:

```
* CAT
```

is typed, the computer will CATALOG the tape for us; that is, it will print on the screen a list of both the files and programs it finds on the tape. With any luck you should see that our very small file called ANSWER has actually been created. Press the escape key to stop CATALOGing.

## READING A DATAFILE

But now what? How can we read it back in? Let's treat this as a separate program, so type:

```
NEW (RETURN)
```

First we must OPEN the correctly named file for INPUT, allocating a channel number as we do so.

```
10 C = OPENIN "ANSWER"
```

Then we can read in the pieces of data, printing them on the screen as we go along, and storing them, if we wish. We'll use an ar-

ray with a different name for this, so let's DIMension it, and since we might not be sure how many items there are in the file ANSWER, we'll allow plenty of space:

```
1 DIM JOHNResults$(100)
```

Since we don't necessarily know the length of the file we want to read, we need some way of detecting when the End Of File is reached. Fortunately, BBC BASIC provides us with a function to do this. The function EOF# returns the value 'false' until the End of File is reached, when it returns the value 'true'. (Note: if you are using a very old Beeb you may find that EOF# is not implemented — get an operating system upgrade!) So a REPEAT...UNTIL loop will be appropriate here:

```
15 I=1
20 REPEAT
30 INPUT # C, JOHNResults$(I)
40 PRINT JOHNResults$(I)
50 I=I+1
60 UNTIL EOF# C
70 CLOSE # C
```

This program segment will read on channel C the data stored on tape in the file ANSWER, and put it into successive elements of the array we've called JOHNResults\$. Line 40 will PRINT John's results on the screen. The variable called I will be increased each time around the loop, so that each of John's answers are stored in a different element of the array. When the computer detects the end of the file it will exit from the loop and, at line 70, it will close the file.

**EXERCISES:** (1) Reconstruct our capital city quiz so that the correct answers are read from tape before the quiz starts and, at the end, the user's answers are written out to tape.

(2) Write a database program to store your friends' names and phone numbers, but assume you are a very popular person, and have so many friends that you need to store the data in a file, rather than simply putting it in data statements in your program.

# Rebalance this sheet

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# Sheet in one second.

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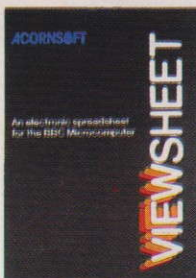
you too can have figures like this.

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key card and reference card, it'll soon have you juggling figures at lightning speed.

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ViewSheet's operations and functions in brief.

The operations supported by ViewSheet are: addition, subtraction, multiplication, division, exponentiation and bracketed operations.

And the functions supported are: ABS, ACS, ASN, SIN, SGN, RAD, ATN, COS, DEG, EXP, INT, LN, LOG, PL, SQR, TAN, MIN, AVERAGE, MAX, CHOOSE, LOOKUP, COL, IF, READ, ROW and WRITE.

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# Edudot

Freda Perrow

The PLOT command on the Electron and the B.B.C. Micro has often been called unfriendly — even by John Coll who wrote the BEEB's User Guide. You will see why if you turn to page 319 of the guide (Page 99 for the Electron Guide). There are so many variations of the PLOT command that it is a little confusing at first. However once you have got the command mastered there are some superb graphics that can be drawn.

EDU-DOT is based on the careful manipulation of the PLOT statement, but before we go onto that program let's try a little experimenting. Type in listing 1 and we'll go through and explain it.

## FOCUS ON PLOT

If we wish to mark out the corners of a triangle we use the PLOT 69 command — this puts a dot on the screen at the position given by X and Y. To draw a line we use PLOT5 and to fill a triangle we use PLOT85. All these are fully documented in the user guide.

Now going through listing 1 — which simply draws two triangles — one within the other. Line 30 puts us in graphics MODE 2 and line 40 sets the data pointer to read the data at line 140. We started with PLOT69 at line 20 so the loop formed by lines 50 to 110 reads the X and Y positions and places a dot on the screen. This continues until X is read as zero.

PLOT is then changed to 5 and the process repeated but this

## An educational quiz for the children lets you fill in the dots on the PLOT command.

time the dots are joined by lines. This process is used in the main program. Before we move on to this however let's look at line 80. This line is just a crafty way of obtaining a move instead of a plot. What we are actually doing is adding 1 to the X position in the data statement. This is then detected by line 80 and the move command is implemented instead of the PLOT.

Perhaps you would like to see what happens if we alter the fifth data statement from 650 to 652 and then add line 85 as follows.

```
85 IF X MOD 10=2 THEN
PLOT85,X-2,Y: GOTO 100
```

## THE GAME

From the basic idea above we move on to EDU-DOT. Based on the children's paper game of joining dots to form a picture, the graphics screen is first filled with a number of dots. The player is then presented with a simple question. If this is answered correctly two dots are joined up. This continues until all the dots are joined up and hopefully a picture is recognisable.

The program is presented

with a limited number of pictures and questions but it is quite easy to extend.

Ensure that you keep within the limits of the graphics window. Also try to keep the number of plotted points to below 25 because each point will require an answer and too many questions would become too boring for the children.

Keep all your plotted points in units of 10. After you have the outline of your drawing store the X and Y positions in a DATA statement at the end of the program. See line 1450 as an example. Note that the title of the picture is the first item in the data statement and is inside quotes.

If you want to move between two points without a connecting line then add 1 to the X position i.e. 500 would become 501. The DATA statement must end with 0,0.

Adding pictures will also require these lines amending....  
360 SHAPE=RND(6) .... Alter 6 to the number of pictures.  
1320 Add the line number used below.

1381-1399 for each picture added type in line 1380 but alter 1470/0 to the line where you have stored your data.

If you study the format of the program carefully you should clearly see how to add your own selection of questions, however it is advisable to have the program as listed up and running before you try any alterations.

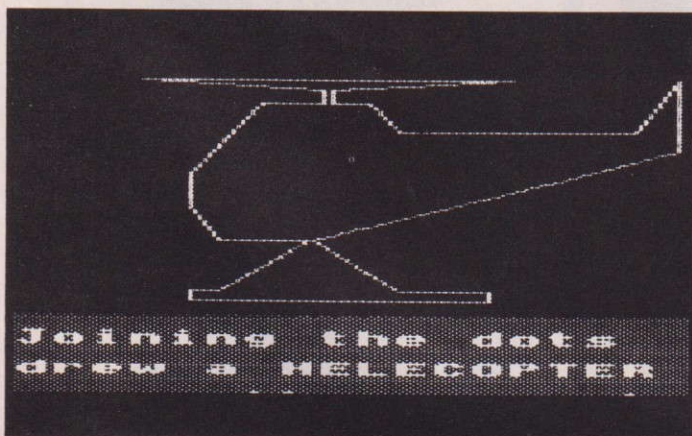
The picture 'Tunnel' at line 1470 is really only included as a demonstration to illustrate how you can move without drawing lines. I am sure you can improve on this one (and the rest too probably because I'm no artist).

## HOW IT WORKS

50-310	Main Body of the program.
50	Turns off the auto repeat of the keys.
60	Dimensions the arrays.
70	Variable 'C' determines the type of plot function.
90	Turns the cursor off.
120	Reads the name of the picture.
140-280	Drawing loop.
140-150	X and Y position of the DOT.
160	If drawing complete, goes to the end.
190	Detects if a MOVE rather than a PLOT required.
200-240	Directs the program to the type of question selected.
250	Plays jingle to acknowledge correct answer.
270	Joins dots if C=5.
290	Finishing caption.
330-550	DEFPROCINIT
340-350	Sets up envelope commands.
360	Selects the picture to be drawn.
370	Sets up text window.
380	Clears text window to blue.
400-470	Collects the data for various questions.
570-1180	Procedures — self explanatory.
1270-1290	DEFPROC TUNE plays either correct or fail jingle.
1320	DEFPROC PIC — restores pointer to read correct data for picture required.
1420-END	Data for the various pictures.

## PROGRAM LISTING

```
10REM *****EDU-DOT*****
20REM *****FRED PERROW*****
40REM *COPYRIGHT JAN 1984**
50*FX11,0
```



```

1000 MONTH$(12),N$(12),OPS$(13),OP$(13)
1100 DEF PROCINIT
1200 PROC PIC
1300 READ SHAPE$
1400 REPEAT
1500 READ X
1600 IF X=0 GOTO 280
1700 IF C<>69:IF colour=132 colour=129 ELSE colour=132
1800 COLOUR colour:CLS
1900 IF X MOD 10=1 MOVE X-1,Y:PLOTS,X-1,Y:GOTO 280
2000 IF C=5 AND CHOICE=49 PROCTABLES
2100 IF C=5 AND CHOICE=50 PROCCALENDER
2200 IF C=5 AND CHOICE=51 PROCCALPHA
2300 IF C=5 AND CHOICE=52 PROCOPS
2400 IF C=5 AND CHOICE=53 PROC MIX
2500 PROC TUNE(1)
2600 INKEY(25)
2700 PLOT C,X,Y
2800 UNTIL X=0
2900 IF C<>69 CLS:PRINT "Joining the dots" "drew a ";S
3000 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
3100 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
3200 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
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7400 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
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8200 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
8300 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
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9000 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
9100 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
9200 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
9300 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
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9700 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
9800 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD
9900 IF C<>69 CLS:PRINT "press the space bar" "for another drawing":VD

```

```

8700 LX=RND(26)+96
8800 7602=&30
8900 BX=RND(2)-1
9000 PRINTTAB(0,2)"What letter comes"
9100 IF LX=97 OR BX AND LX <>122 PRINT "after "; ELSE P
RINT "before ";
9200 PRINTCHR$(LX)
9300 IF LX=97 OR BX AND LX <>122 REPEAT:7602=&30:UNTIL
GET=(LX+1) ELSE REPEAT:7602=&30:UNTIL GET=(LX-1)
9400 7602=&20
9500 ENDPROC
9600:
9700 DEF PROC OPS
9800 LX=RND(13)
9900 7602=&30
1000 PRINTTAB(0,1)"What is the opposite" "of ";COLOUR3
:PRINTOPS$(IX);"?
1010 INPUTTAB(11,3)ANS:COLOUR7
1020 7602=&20
1030 IF ANS <> OPS$(IX) THEN PRINTTAB(0,5)"Sorry I was l
ooking" "for ";OPS$(IX); "PRESS THE SPACE-BAR":PROCTUN
E(2):REPEAT:UNTIL GET=32:CLS:GOTO 980 ELSE PRINTTAB(4,9)
"CORRECT!!":ENDPROC
1040 ENDPROC
1050:
1060 DEF PROC SELECT
1070 PRINT "Please select 1 - 5"
1080 PRINT "1. Tables"
1090 PRINT "2. Calendar"
1100 PRINT "3. Alphabet"
1110 PRINT "4. Opposites"
1120 PRINT "5. Mixture"
1130 ENDPROC
1140:
1150 DEF PROC MIX
1160 LX=RND(4)
1170 IF LX=1 PROCTABLES ELSE IF LX=2 PROCCALENDER ELSE
IF LX=3 PROCCALPHA ELSE PROCOPS
1180 ENDPROC
1190:
1200 DEF PROC TEST
1210 COLOUR3
1220 PRINTTAB(4,7)STRING$(12,".")
1230 INPUTTAB(6,7)ANS
1240 COLOUR7
1250 ENDPROC
1260:
1270 DEF PROC TUNE(E)
1280 SOUND 11,E,250/E*3,25/E
1290 ENDPROC
1300:
1310 DEF PROC PIC
1320 ON SHAPE GOTO 1330,1340,1350,1360,1370,1380
1330 RESTORE 1420:ENDPROC
1340 RESTORE 1430:ENDPROC
1350 RESTORE 1440:ENDPROC
1360 RESTORE 1450:ENDPROC
1370 RESTORE 1460:ENDPROC
1380 RESTORE 1470:ENDPROC
1390:
1400 DATA JANUARY,FIRST,FEBRUARY,SECOND,MARCH,THIRD,APR
IL,FORTH,MAY,FIFTH,JUNE,SIXTH,JULY,SEVENTH,AUGUST,EIGHT
H,SEPTEMBER,NINTH,OCTOBER,TENTH,NOVEMBER,ELEVENTH,DECEM
BER,TWELTH
1410 DATA in,out,left,right,up,down,hot,cold,big,small,h
igh,low,thick,thin,fast,slow,little,large,sweet,sour,sh
allow,deep,hard,soft,loud,quiet,yes,no,old,young,dark,l
ight,wet,dry
1420 DATA "TANK",611,600,610,620,420,620,460,660,100,68
0,100,700,480,680,500,720,800,720,860,620,660,620,660,6
00,1000,600,1100,550,1000,500,300,500,200,550,300,600,6
10,600,0,0
1430 DATA "TANKER",1121,580,1100,500,200,500,160,600,26
0,600,280,580,1120,580,1100,640,1100,840,940,900,940,64
0,400,640,400,590,360,590,360,900,340,900,340,580,0,0
1440 DATA "CHURCH",701,400,600,500,200,500,200,850,300,
1000,400,850,400,800,900,800,1000,700,1000,500,600,500,
600,600,650,650,700,600,700,500,800,400,0,0
1450 DATA "HELICOPTER",1121,850,1050,740,650,740,600,80
0,540,800,540,830,840,850,220,850,520,830,520,800,420,8
00,300,650,300,580,350,510,500,510,350,400,300,400,300,
380,800,380,800,400,650,400,510,510,1120,700,1120,850,0
,0
1460 DATA "YACHT",621,1000,620,500,300,500,400,400,900,
400,1000,500,680,500,680,1000,1000,600,300,600,620,1000
,680,1000,0,0
1470 DATA "TUNNEL",601,400,600,500,650,560,700,500,700,4
00,801,400,800,600,650,810,500,600,500,400,401,400,400,
620,650,930,900,620,900,400,1001,400,1000,660,650,1020,
300,660,300,400,0,0

```

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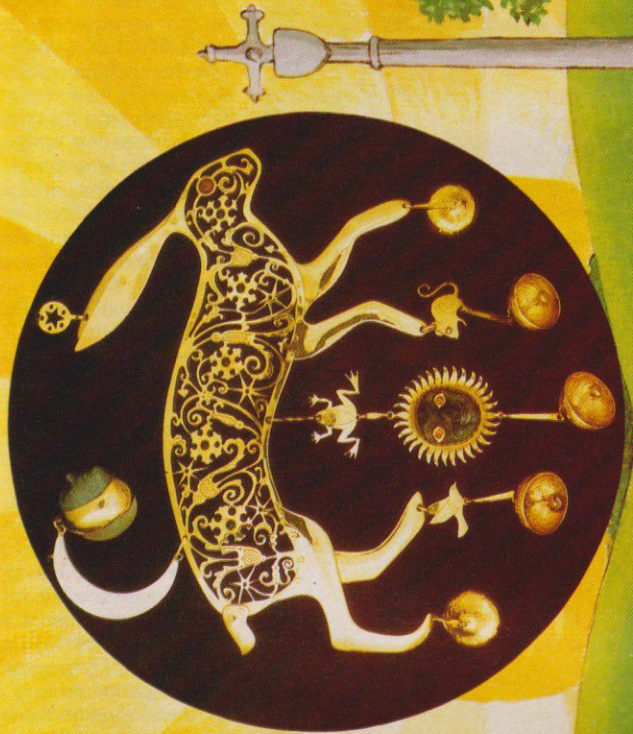
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# Ultradrive

Jonathan Evans

Everyone knows that cassette tape storage is slow and unreliable. Anyone who uses their micro for the more serious applications such as program development, wordprocessing or database management will find the use of domestic tape recorders particularly frustrating. The problem in all such applications is the need for frequent resaving of revised files. To achieve this on cassette tape requires extremely careful and tedious management and logging of tape space to avoid accidental overwriting of important files. If, like me, you use the disc system at work, the comparison is truly painful.

The problem of course is cost. Although prices have fallen substantially over the past year or so, upgrading to discs is still a pretty expensive business. It's hard to get the disc drive interface fitted for under £100 nowadays — and that's if you can find a dealer with the necessary chips. I was nevertheless steeling myself for the £300 odd total outlay for an interface plus single drive when I received a letter from Ikon Computer Products, offering a new product, the Ultradrive at a price of £79.95 including VAT and carriage. This was almost half the price of their well known Hobbit, though offering, the letter claimed, the same facilities with a much faster data transfer rate (12,000 baud) and taking no user memory in its standard configuration.

## IRRESISTABLE

At only about twice the price of a decent tape recorder this seemed irresistible, so I sent in my money and waited, with growing impatience. When, it finally arrived — the Post Office having thrown Ikon into chaos by losing several of their sacks — I was not disappointed. It is excellent value for money, although it shows some signs of being rushed out. The documentation — as it freely admits — is rather poor, and will be followed by a proper user's manual. There are also some shortcomings in the utilities software support, described below,

## This successor to the Hobbit strikes another blow for fast tape storage systems.

which again Ikon promise to rectify in the near future.

The Ultradrive is a high speed tape drive which comes complete with a filing system ROM, which may be fitted into any of the sideways ROM sockets, a ribbon cable which connects to the user port, and a connector to the Beeb's power supply unit. The tapes used are micro-cassettes, of the same general design as those used in dictaphones — only more expensive. The Phillips' data certified digital cassettes cost around £20 for a box of six. Apparently the Hobbit used to work quite well with the cheaper Phillips audio cassettes, but as I discovered to my cost the Ultradrive does not — probably due to the increased data transfer rate.

One advantage over both cassette tape and disc systems is the sheer compactness of the system. The drive itself is approximately a four inch cube and a box holding six micro-cassettes measures about three by two by two and a half — not bad for around 750K of storage. Minor irritations with the physical design are that the user port connector is not correctly sized to be held in good contact by the clips on the machine — mine is currently held in place by a piece of Blu-Tac! — and a tendency for the 'write enable' plugs on the tapes to become loose. I have often had annoying 'write protected' error messages when attempting to save on to theoretically enabled tapes.

In the several brief mentions of the Ultradrive I have seen in magazines, the storage is claimed to be 100K per side, which is actually quite an exaggeration. When a tape is formatted, using a program provided on a utility tape, it defaults to two 'loops' per side. What this actually means is that there is one catalogue on the

beginning of the tape and a second in the middle, each controlling the section of tape which follows. Changing loops is achieved by a \*SWAP command. When formatted in this way I found that Loop 1 reserves 125 blocks of storage and Loop 2 106. Since four blocks equal one K, I make that around 58 per side. You can, if you wish, format one side as a single loop with a maximum single file size for maximum random access file space of 64K.

## COMMANDING

The usual commands for saving and loading files work in the normal way (SAVE, LOAD, \*SAVE, \*LOAD, \*SPOOL and \*EXEC). Unlike domestic cassette, however, the process is entirely automatic since the system keeps a copy of the catalogue in memory (at 'page' 9 if you're interested). The catalogue is re-read if the tape is changed in the drive or if memory is cleared by a Control-Break. When a file is saved the tape will rewind to the catalogue position so that the updated catalogue may be written on to the tape — hence saving is normally twice as slow as loading.

If a file is saved under the same name, an 'OK TO REPLACE' warning is given (now why didn't Acorn think of that when they designed their DFS?). Replacing files may result in a 'can't extend' message if another file has been recorded afterwards. However, the system provides a simple way of reserving space for expansion. If at the time of saving a file you append a colon followed by a number (eg SAVE "PROG:40), it will reserve the specified number of blocks of contiguous space on the tape for that filename.

The \* commands provided

are shown in Table 1. One compromise in cutting the price of the Hobbit, has been in squeezing the filing system into an 8K ROM. This means that some of the commands — most annoyingly \*DELETE — have been placed on to a separate utility tape. \*COPY has temporarily gone missing altogether, although I am assured by telephone conversations with Ikon that this utility will follow, together with a \*COMPACT and a \*INFO. The latter will tell you the parameters needed for \*SAVING files, ie file length, load address and execution address. In the absence of \*COPY, I think it rather poor that this was not provided with the package initially, especially since it is trivial to write. I have discovered by experiment that the parameters can be obtained by opening a file by the OPENIN command and the PRINTING (in hex) EXT# for length, and !900 and !904 respectively for load and execution addresses. I have written a short BASIC utility to do the job for me. Having done so you can then alleviate the irritation of the absence of \*DELETE from the ROM by copying the (tiny) DELETE program from the utility tape on to any loop used for development work. Another consequence of the small ROM is that error messages are expressed as single character codes which have to be looked up in a table. Personally, I would have been willing to pay extra for a 16K ROM containing all the present and promised \* commands currently placed on a utility tape. I hope that Ikon will consider offering such an upgrade in due course.

Despite these niggles, the filing system operates similarly to disc and indeed is friendlier in some respects, eg with the warning on replacing files. Unlike disc, its catalogue displays the number of blocks occupied by (or reserved for) each file and also functions as a menu, which is a mixed blessing. Following \*CAT one is in 'menu mode' which can only be released by pressing Return. Each file is shown with a capital letter. If one of these letters is pressed the system will attempt to load and run the file as a BASIC

program. This is great for offering young children a menu of games, but can lead to problems. For example, if you forget to type Return and type SAVE it will pick up the A and chain the first program over whatever you have in memory.

While the system works well with Wordwise, accidental triggering from the Menu can likewise destroy your text. On balance I regard this as the lesser evil when compared with using the Acorn DFS with Wordwise. How often does one destroy a file by accidentally entering a name for saving instead of loading (options 1 and 2 on the Wordwise menu), with no OK to replace warning? Unlike the DFS, the Ultradrive also provides a \*RECOUP utility to recover an accidentally deleted file.

## FASTER FILING

How fast is the Ultradrive? Considerably faster than normal tape, but considerably slower than disc. To \*REWIND an entire tape takes about 90 seconds, and a \*SWAP 45 seconds. Since the tape runs at maximum speed when loading and saving program files, the maximum loading time within a loop is 45 seconds, and the maximum saving time 90 seconds. (Data files are slower due to switching on and off between blocks, but this is a feature of the micro — the cassette and disc systems do the same thing.) Because file access is serial, rather than parallel as on discs, a 20K program at the start of the loop will load faster than a 2K program recorded at the end (assuming one is starting from the catalogue). Hence one needs to give some thought as to how files are saved. For example, a multipart program will load much faster if the sections are saved in the right order. Whilst not instantaneous, the gain over normal tape is enormous. For example, I recently transferred a full size commercial adventure game, which now loads in about 40 seconds as compared with the usual six and a half minutes.

This brings me on to one of the drawbacks of the Ultradrive. At present no-one is selling com-

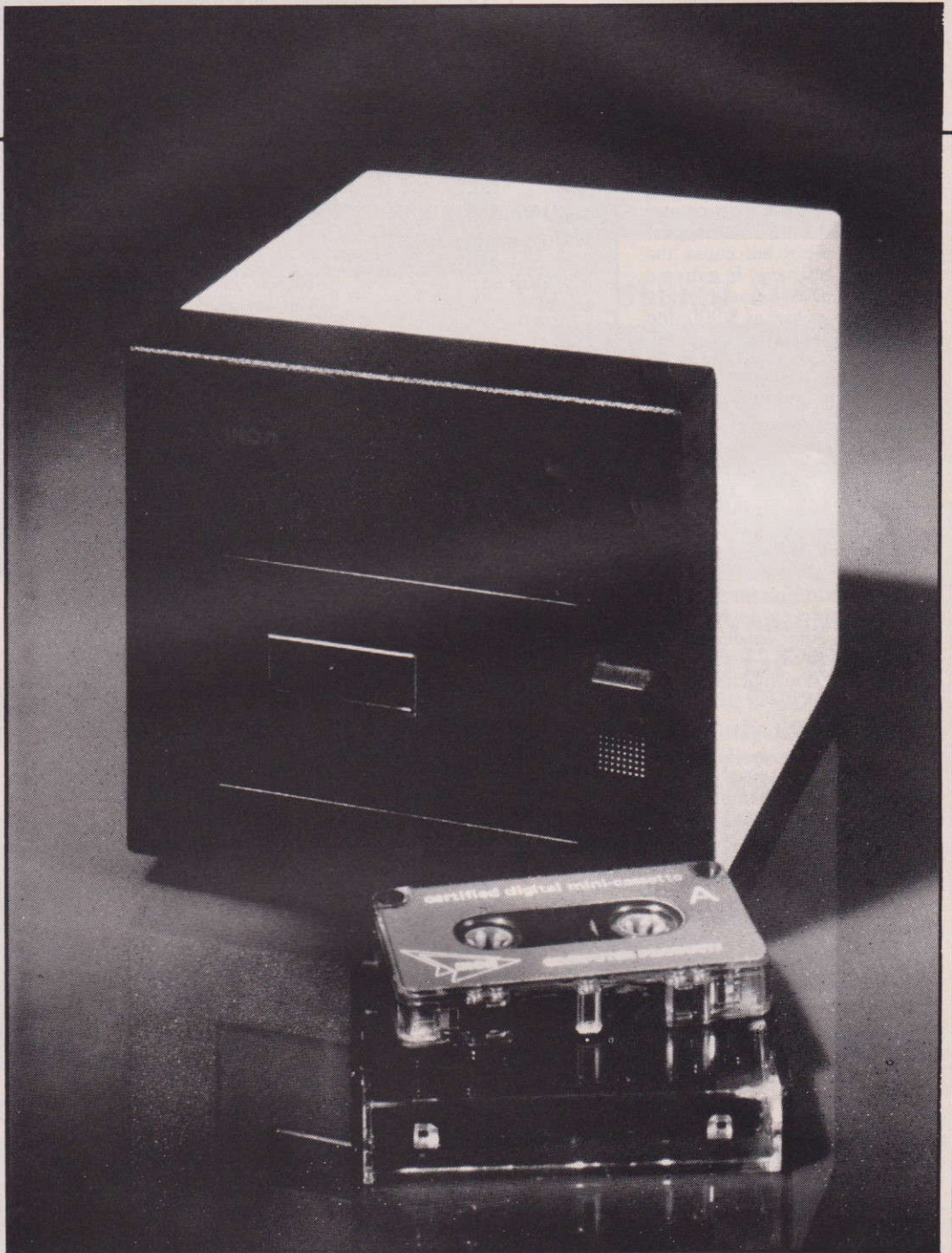
mercial software on this medium, so one has to buy programs on ordinary cassette. Transferring these on to the Ultradrive presents less problems than for disc drive owners, in that PAGE is normally left set to the same address (&E00). Whilst I was pleasantly surprised to discover that a number of my commercial tapes were not, in fact, protected

as such, transfer is not necessarily straightforward. The problems arise from the facts that (i) the Ultradrive is much less tolerant than the tape system of uses of memory space below &E00 and (ii) the Ultradrive disables interrupts when running.

When transferring machine code programs it is advisable to force them to \*LOAD to &E00

before \*SAVEing them on to the Ultradrive. Many commercial games steal extra RAM by loading below the 'official' start of user memory (at &E00). If these are then \*RUN from the Ultradrive they may work correctly but will overwrite some of the filing system workspace in the

**CONTINUED OVER**



process. I strongly recommend a Control-Break after using such a program since I have discovered that a normal Break may appear to regain control but cause the system to misbehave. In extreme cases, such as one game I have that loads in as low as &900, the Ultradrive system may be disabled during loading and crash. In this event the problem may be overcome by \*LOADing into a safe area of RAM and programming a red key to (a) download the program to the correct address after loading (in an analogous manner to that recommended for running tape programs from disc) and (b) CALL the execution address of the program. I found it convenient to write a short BASIC loader program to do the job for me. After loading it announces 'Press f3' — and a few seconds later the machine code program runs.

The second problem arises from the fact that the Ultradrive disables interrupts while loading a file, which the cassette tape system does not. A number of commercial programs use interrupt programming to 'poke' data into memory in parallel with the loading of the BASIC program. For example, some adventure games 'poke' the text high in memory during loading which is 'peeked' out by the BASIC program when it runs. When copying from tape to tape this affords minimal protection — a straight LOAD and SAVE will fail, but a \*LOAD and \*SAVE will generally work. Unfortunately the Ultradrive will ignore the interrupt part of the program which has been \*SAVED, so you just end up with the BASIC and not the data it needs. This can be overcome by loading the program from tape and then (1) SAVEing the BASIC and (2) \*SAVEing the data which must be \*LOADED back before the BASIC program runs. However, this requires some sophistication on the part of the user. You have to know enough on examining the listing of the BASIC to work out where the data has been loaded — eg from a lowered

**Table 1**  
**\* COMMANDS FOR ULTRADRIIVE**

(1) Commands in ROM

* DRIVE	n	Selects drive in a dual system
* CAT		Catalogues current loop
* SWAP		As *CAT but swaps loops first
* KILL		Deletes all files on one loop in one go
* REWIND		Rewinds tape
* ULTRA (U)		Selects ultradrive filing system

Plus — \*SAVE, \*LOAD, \*SPOOL, \*EXEC

(2) Commands on utility tape

* FORM	name ( no )	Formats one side of a tape (both loops)
* DELETE	( name )	Deletes a named file, or group of files specified by wildcard. If no name given, offers each file on the catalogue in turn for deletion.
* ACCESS	name (L)	Locks and unlocks files as on disc system
* RENAME	name1 name2	Renames an existing file
* RECOUP	NAME	Attempts to recover deleted files

value of HIMEM or the use of indirection operators such as ? and !. I should emphasise that the methods I describe are for the perfectly legal purpose of transferring one's own software to a superior filing system, and will not work on tapes which have been deliberately protected. You will soon discover which software companies prevent you doing this by treating everyone as a pirate. You must then decide whether their software is so superior to other companies' that it is worthwhile \*TAPEing it in the old-fashioned way.

## RANDOM ACCESS

The Ultradrive fully supports random access files, and responds to the BASIC commands intended for disc use like EXT# and PTR#. You can even create auto-boot files. It also has several suffix control codes on filenames other than the one I have mentioned for reserving blocks of memory. One option allows you to create protected BASIC or machine code programs which

disable Escape and clear memory when Break is hit. I have mentioned that the Ultradrive has some advantages over the disc system, other than its much lower price.

One of these is the use of the tape PAGE &E00 leaving 2.8K more user memory. In this configuration a 'simple' system operates with only one drive and only one file permitted to be open at a time. By holding down a specified key while pressing Break, a complex system allowing five files open simultaneously and a dual drive system is initialised. In this case PAGE is raised to &1600 which is still lower than that claimed by the DFS. Note that the disc system claims space for five open files, whether you need them or not — which you normally don't.

All in all, the file handling capability is very impressive for such a cheap system, but you do have to be a programmer to take full advantage of it. For example, most, if not all of the commercially available software making use of random access file (eg for database management) is disc specific.

While each micro-cassette holds more than a 100K disc, it is controlled by four separate catalogues which entails much slower access time, if you start at the wrong loop, and a need to keep a written record of the tape catalogues. However, the sort of development work which requires frequent resaving of files is done within a single loop, and the experience here resembles a slow but friendly disc drive and bears no relation at all to the use of normal cassette tape. Whilst the system would be inadequate for all but the smallest of business applications, it provides a cheap alternative to discs for home owners. (The economic consideration is, of course, quite different if you already have a disc drive interface fitted.) Owners will, however, need to be fairly sophisticated in their understanding of the micro to get the best use from the system. Another potential market is in schools which cannot afford to upgrade to discs, particularly where the main use, as in many primary schools, is the running of supplied software. Since most educational software seems to be in BASIC and unprotected, no great expertise will be needed to transfer it on to the micro-cassettes. Finally, whilst I hope that I have fairly outlined the limitations of the system, I must nevertheless recommend it as an excellent buy at the price.

## FOOTNOTE TO ULTRADRIIVE REVIEW

Since this review was written Ikon have produced an upgraded filing system ROM which, among other things uses control-key presses to avoid accidental triggering from the menu. They have also added to the utilities, including a \*INFO. They are also developing software to facilitate transfer of commercial programs from ordinary cassette tape. These upgrades are being supplied free of charge to those who purchased the first release. The speed with which they have responded to problems raised by myself and other customers is impressive, and bodes well for future service.

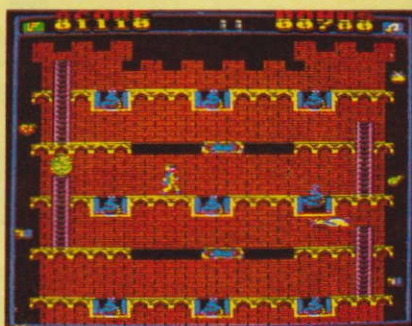
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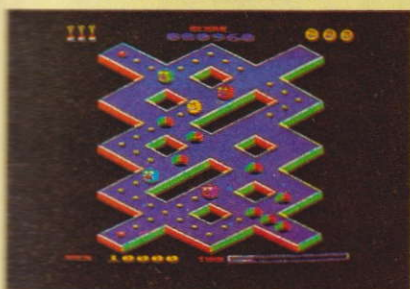
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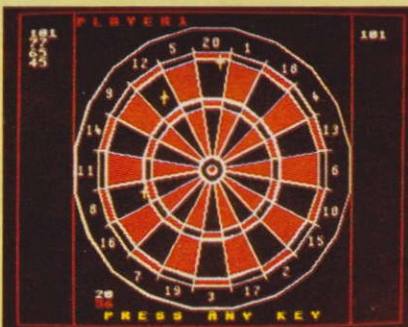
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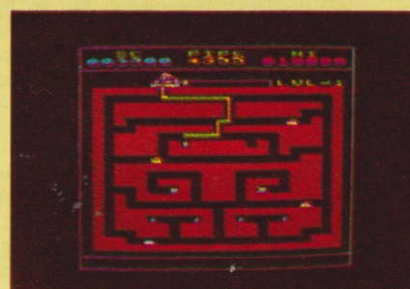
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# Electron Plus 1... Equals

The eagerly awaited Electron Plus 1 turns out to be a very interesting product indeed. Take out your Electron; unplug everything; turn it over and make sure the two supporting screws of the Plus 1 are flush with the plastic edge; now push together. Your Electron now has an Analogue to Digital port for making use of joystick controllers or for measuring analogue voltages, a Centronics printer interface for connection to most popular printers and a couple of ROM cartridge slots for instant access to games and applications software.

It turns your Electron, appearance wise at least, into a two-thirds size BBC. As usual an excellently produced Acorn manual accompanies the Plus 1. It gives details on how to wire up the connectors for the two ports (if you fancy do-it-yourself), offers advice on the sort of printers and joysticks available and goes into the basics of programming in BASIC and using (official) assembler in conjunction with the new facilities.

Acorn also feel it necessary to advise on how to deal with problems that might occur, in both hardware and software. For instance: the need to specify the tape filing system after using ROM cartridges. Those who have recently moved over to discs with their BBC will recognise the problem.

## PERIPHERAL PROBLEMS

When the Plus 1 is slotted onto the edge connector and the screws tightened home, there is very little give and, one would imagine, no room for any misalignment. However on first connection I did have difficulties and could not get the printer interface to function. Don't panic! I followed the advice given in the manual, checking for dirt on the edge connector, giving it a quick wipe clean and reconnecting. Hey Presto, it worked.

The Centronics interface you get with your Plus 1 is not based upon the 6522 VIA. The BBC uses the 6522 (its two bi-directional input/output ports)

## The first Acorn add-on for the Electron.



for the Centronics and User ports but in the Plus 1, unlike some other Electron expansions, only the Centronics has been implemented. From designing a most advanced chip, the uncommitted logic array, of the Electron itself, Acorn have now implemented a simple TTL Centronics port.

This need be of no concern whatever to the Electron owner who wants to utilise his/her computer alongside a printer but it is difficult to see how with the Plus 1, anyone could also add a user port. Acorn plainly do not see this as a widely required option. Broadway Electronics employ the 6522 in their interface, utilising it for a user port. There are even firms which use a 6522 and ignore one side completely, merely implementing the Centronics interface — an uneconomic proposition.

The printed circuit board of the Plus 1 carries an 8K Eprom which contains the software to drive the printer interface, analogue to digital conversion and a RS423 interface. The software is needed to queue whatever is being sent for printing and to talk to the printer to check

if it is ready for further information.

All the software features characteristic of the BBC are present with the Plus 1. \*FX5,0 selects the printer sink - output for printing is ignored — while \*FX5,1 selects the default situation, the printer driver in operation. CTRL B and CTRL C have their turn on and off effects from the keyboard. VDU 2 and 3 replace them within programs. \*FX3, with a choice of second parameters, effects the output to screen and printer in various combinations. \*FX6 selects the printer ignore character specified by an ASC11 code and \*FX21,3 flushed the output buffer, into which all output to the printer is first sent.

The Plus 1 then supplies the facility to print out program listings, wordprocessed text (if you can find a good wordpro on tape) and graphic dumps. The Centronics port supports most of the printers which an Electron owner would wish to use and if, for some reason, there is a serial printer available, then it may be possible to connect up via the cartridge sockets.

## GAMES CONTROL

The next most important of the rather cheap looking plugs on the back of the Plus 1 is the Analogue to Digital port. The ADC allows the use of the multitude of BBC compatible joysticks now available to the games player. Acorn's own have been somewhat surpassed by more sophisticated games controllers with numerous buttons which can be programmed to take on the function of keyboard controls. The range is remarkable and now immediately available to the Plus 1 owner.

The converter reads four channels like the BBC but the resolution is 8 bits (1 in 256) rather than the 12 bit resolution of the Beeb. The software still generates numbers in the range of 0 to 65280 (the BBC manual gives 65520) for BBC compatibility. The interface still enables other devices to be read but its usefulness is reduced by the less accurate resolution of the chip. If greater accuracy is required there are suitable BBC related products which should do the trick. The various \*FX16 calls are implemented for masking channels in and out.

## INTERESTING DEPARTURE

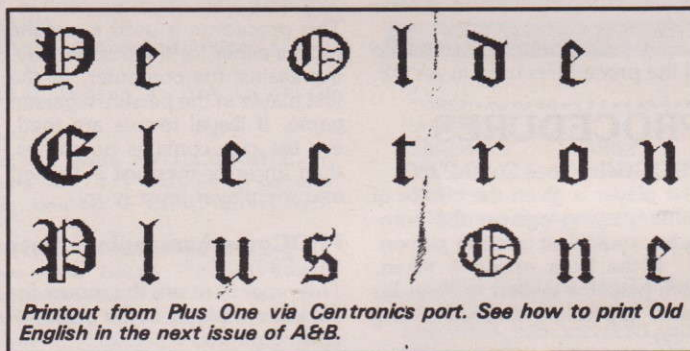
The most interesting feature of the Plus 1, and a complete departure from the BBC, is the implementation of two cartridge sockets. These two sockets enable the use of games cartridges, programs in paged ROM and a serial link for printer, modem or any other of the many devices which employ a RS232 interface.

The ROM filing system is accessed with \*ROM and programs can be auto run with SHIFT/BREAK, the familiar !BOOTing of disc systems. Other commands available are \*CAT, LOAD and CHAIN. \*TAPE is required to return your cassette system. The front cartridge port takes preference over the back. Paged ROMs (LISP alone is



available at the time of writing) are called by entering an asterisk and the language name. Not only languages are available in this form for the BBC but word-processors, spreadsheets, programming aids and so on. There is no reason why a ROM box or board should not be connected to one cartridge port and a number of ROMs paged in and out. The parallel program takes the place of BASIC between &8000 and &C000.

Games currently available for the cartridge system include old favourites like Snapper and Countdown to Doom. A new favourite at some time in the future may be the addition of a modem to the Electron system, since this is one of the fastest growing areas in personal computing. The software in the aforementioned 8K EPROM ELK 1.00 tells us that it is for the Electron expansion 1.00 (C) 1984 Acorn, ADC/Printer/RS423. In conjunction with the RS423 there is the necessary software to run an Acorn Prestel adaptor. The commands familiar from the function key strip are all implemented. This means that the Electron is not only adding facilities which the BBC has had



from the start, but it is actually catching it up.

## EXTENDING

Indeed, with the Plus 1 cartridge facility, the Electron moves into an area as yet unrealised by the BBC Micro. Much of the more 'useful' BBC software available on disc and EPROM may well find a home in an Electron cartridge. The ROM filing system is sufficiently the same to make the transfer fairly simple. Like BBC owners in the past, Electron owners will become impatient with tape loading - although it will still have to be used for filing purposes - and the ROM filing

system brings both speed and convenience.

The Plus 1 is not an imposing piece of hardware and it takes a long look to realise that Acorn have very successfully and fairly cheaply (£59.95) supplied four very necessary features for a home computer: analogue to digital conversion, printer output, cartridge filing system and RS423 communication. As well as being an important step for those who already own an Electron, it should also prove an important draw for those considering a new computer this Christmas. The Plus 1 of course requires the services of the 6502 and can slow up all but the best commercial

games. From BASIC programs it is simple to turn off all unnecessary ADC channels or indeed the whole servicing of the Plus 1 with \*FX163, 128, 1. This can be done during a program whenever Plus 1 operations are not needed and switched back on as soon as they are.

The software does not appear to allow for a user specialist printer routine to be called and other than the setting up of the function keys and a couple of error messages, the RS423/Prestel adaptor link is undocumented. Micro Power and Microdeal games for the Electron worked a treat with their joystick option but A&F's Cylon attack, inexplicably, did not.

The Plus 1 is purpose built and seems to have been the planned extension during the development of the Electron itself. It is a reasonably priced enhancement allowing access to the sort of facilities which have become so popular with BBC and other micro owners. The documentation is a straight addition to the Electron manual, covering all the new relevant commands. Acorn continuity obviously counts for a great deal and Plus 1 is a worthy product.

# AYO

E M Nicholl

The game AYO is a Nigerian version of a very ancient group of African and Asian games known as Mancala. There are several varieties of Mancala, but all involve the movement of stones, seeds, or shells round a board. The board contains cups, and the object of a Mancala game is to move the stones (as we shall now refer to them) from cup to cup in an attempt to capture opposing stones.

In AYO there are twelve cups on the board, and each initially contains four stones. Each player thus controls six cups. Play starts by the toss of a coin to decide who makes the first move. In his turn, each player takes the stones from a cup in his row and deals them one at a time in an anticlockwise direction round the board. Thus, if there are four stones in a player's cup, they are dealt into each of the next four cups.

A capture is made if a player deals his stones into one of his opponent's cups, such that this cup, as a result, contains exactly two or three stones. If a capture can be made, it must be made. Capturing continues cup-by-cup in a clockwise manner, as long as the cups in the opponent's row contain exactly two or three stones.

If a player is left with no stones to play, the game ends and the opposing player forfeits all his remaining stones to that player.

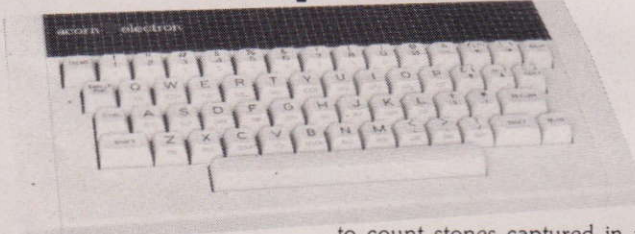
In this version of AYO, the game will also end when there are nine or fewer stones left on the board. The game is won by the player who has captured the most stones.

It may sound very simple, but AYO is a surprisingly challenging game. Playing AYO, either against the computer or another player, will take a lot of concentration.

## DESCRIPTION OF THE PROGRAM

The program for AYO has been written in two parts. The first part, AYO1, contains the instructions for the game. The second

**On the surface a simple game but in play AYO requires careful calculation and logical thought to beat the computer.**



part, AYO2, is the game proper. This program may be run independently of AYO1 when you are familiar with the rules.

As no Mode 7 instructions have been used, the program will be fully compatible with the Electron.

A description is given below of the procedures used in AYO2.

## PROCEDURES

### PROCtitle (lines 2670-2930)

The player is given the choice of either playing against the computer, or against another person.

If the latter option is taken, each player is invited to enter his name (up to six characters long only).

A coin is then tossed to see who starts. This is done here by dividing a RND(time) number by 2, with the remainder (1 or 2) deciding who starts.

### PROCinit (lines 1470-1570)

This procedure initialises the following variables;

S%(n) each player's score.

N%(n) the cup contents on the actual board.

M%(n) the cup contents during calculations.

T%(n) the cup contents in assessing moves.

A(n) the weight given to assessment of moves.

stonecount this variable used to check that there are always nine or more stones on the board.

CAPTURE% this variable used

to count stones captured in any one move.

With the player playing the computer, who plays first is decided here.

### PROChumanplay (lines 320-480)

This procedure is used to set the moves either for the person playing against the computer, or the first player in the person-v-person game. If illegal moves are tried, e.g. the cup contains no stones, then an error message is flashed and the player must re-try.

### PROCotherhumanplay (lines 510-590)

This procedure sets the moves for the second player in the game involving person-v-person.

### PROCcomputerplay (lines 620-1160)

This is the largest procedure in the program, and sets the moves of the computer.

The best move for the computer to make is assessed and given a weight, A(n). This weighting is set, initially, by the distribution of stones on the board. It is then recalculated depending on the outcome of playing each cup, depending on whether that play will result in a capture or captures or whether the opponent will benefit.

### PROCmove (lines 1190-1260)

This procedure is used at the calculation level to move the stones round the board. Note

that if the cup from which the stones are being dealt contains more than 12 stones, it is missed out as the stones continue to be dealt round.

### PROCcomputercapture (lines 1290-1340)

At the end of each move, — at the calculation level, the final cup is examined to determine whether it is a) in the opponents row and b) contains exactly two or three stones.

If both these criteria are met, a capture is made, — the player's score being increased accordingly and the cup being emptied.

The movement for capture continues in a clockwise direction until the two criteria are not met.

This procedure is used for both the computer and the second player.

### PROChumancapture (lines 1370-1440)

This procedure is just as for PROCcomputercapture, but is applied to the first player or the player-v-computer.

### PROCboard (lines 1600-1820)

Here the game is translated from the calculation level back into real, graphic representation.

The first player (or player-v-computer) owns cups A-F, whilst the second player (or computer) owns cups G-L.

At every move, the score of each player is adjusted and displayed at the bottom of the board. Also, the board is examined to see whether there are more than nine stones still left.

### PROCfinalscore (lines 1990-2200)

Should there be nine or fewer stones left on the board, the game ends and the player's scores are finally presented. The win, lose, draw situation is also displayed.

### PROCemptyrowcheck (lines 2230-2470)

For each play, the board is checked to see whether the player whose turn it is does not have an empty row. If he does, the game ends, with all the stones from his opponent's row being forfeit to him.

# PROGRAM LISTING 1

```

10REM*****
20REM*
30REM*      AYO1      *
40REM* - instructions *
50REM*   for the game *
60REM*
70REM*****
80
90MODE5:PROctitle
100pause=INKEY(200)
110COLOUR2:COLOUR128
120PRINTTAB(0,20)"Would you like the""instructions f
""playing AYO (Y/N)?"
130REPEAT:ans$=GET$:UNTIL ans$="Y" OR ans$="N"
140IF ans$="Y" THEN 150 ELSE 160
150MODE4:PROinstructions
160MODE5:PROctitle:COLOUR2:COLOUR128:PRINTTAB(5,29)""
=CHAIN"AYO2"
170END
180
190DEFPROCinstructions
200CLS:VDU23,1,0;0;0;0;
210PRINTTAB(0,2)"AYO is a board game played by 2 play
ers."
220PRINTTAB(0,4)"Each player has 6 cups, and each cup
""contains 4 stones at the start."
230PRINTTAB(0,7)"One player's cups are lettered A - F
""and the other's are lettered G - L."
240PRINTTAB(0,9)"When playing the computer YOUR cups
are""numbered A - F."
250PRINTTAB(0,12)"The computer tosses a coin to decid
e""who starts."
260PRINTTAB(0,15)"MOVES""-----"
270PRINTTAB(0,17)"All moves are made ANTICLOCKWISE.""
""The first player to move takes all 4""stones from one
of his cups and deals""them, one-at-a-time, anticlock
wise""round the board."
280PRINTTAB(0,23)"Moves continue by players taking it
in""turns to take the stones from THEIR""cups, deali
ng them anticlockwise""one-at-a-time."
290PRINTTAB(0,29)"PRESS <SPACEBAR> TO CONTINUE"
300REPEAT:ans$=GET$:UNTIL ans$=" "
310CLS
320PRINTTAB(0,2)"Note that stones may not be dealt ba
ck""into the source cup in the same move.""Thus, if
you have to deal more than""11 stones, you skip the so
urce cup as""you deal round."
330PRINTTAB(0,9)"CAPTURING""-----"
340PRINTTAB(0,11)"At the end of each move the player"
""looks at the LAST CUP THAT HE HAS""DEALT TO."
350PRINTTAB(0,14)"If this cup is in his OPPONENT'S RO
w""and contains EXACTLY 2 or 3 stones,""then the sto
nes in that cup are""captured."
360PRINTTAB(0,18)"Capturing continues in a CLOCKWISE"
""direction, as long as the cups in his""opponent's ro
w contain exactly 2 or 3""stones."
370PRINTTAB(0,23)"Where it IS possible to capture, yo
u""MUST do so."
380PRINTTAB(0,29)"PRESS <SPACEBAR> TO CONTINUE"
390REPEAT:ans$=GET$:UNTIL ans$=" "
400CLS
410PRINTTAB(0,2)"WINNING""-----"
420PRINTTAB(0,4)"The game ends when neither player ca
n""make any more captures because there""are too few
stones left."

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430PRINTTAB(0,8)"In this game, this is set for when "
""there are 9 or less stones left on ""the board."
440PRINTTAB(0,12)"The score for each player is then t
he""number of stones that he has already""captured, P
LUS the number of stones""left in his row."
450PRINTTAB(0,18)"The game also ends should a player
have""NO STONES left to play.""In this case, all the
stones in the ""opposing row are forfeit to that""pla
yer."
460PRINTTAB(0,25)"WOULD YOU LIKE TO READ THE INSTRUCT
IONS""AGAIN (Y/N)?"
470REPEAT:ans$=GET$:UNTIL ans$="Y" OR ans$="N"
480IF ans$="Y" THEN 200 ELSE 490
490CLS
500ENDPROC
510
520
530DEFPROCtitle
540VDU23,1,0;0;0;0;
550VDU23,230,255,255,255,255,255,255,255,255
560COLOUR1:COLOUR130
570VDU19,3,4,0,0,0
580PRINTTAB(5,8)STRING$(11,CHR$230)
590PRINTTAB(5,9)CHR$230;" "CHR$230
600PRINTTAB(5,10)CHR$230;" "CHR$230
610PRINTTAB(5,11)CHR$230;" "COLOUR3:PRINT"AYO";:C
OLOUR1:PRINT " "CHR$230
620PRINTTAB(5,12)CHR$230;" "CHR$230
630PRINTTAB(5,13)CHR$230;" "CHR$230
640PRINTTAB(5,14)STRING$(11,CHR$230)
650ENDPROC

```

# PROGRAM LISTING 2

```

10REM*****
20REM*
30REM*      AYO2      *
40REM* - the game of AYO *
50REM*
60REM*****
70
80
90MODE 5:COLOUR0:COLOUR130:TIME=0
100VDU23,1,0;0;0;0;
110VDU23,225,255,255,255,255,255,255,255,255
120ON ERROR:MODE7:PRINT ERL:REPORT:END
130PROctitle
140IF choice$="P" THEN 220 ELSE IF choice$="C" GOTO 1
50
150CLS:PROCinit
160 IF P=1 THEN GOTO 170 ELSE GOTO 190
170 PROCcomputerplay:P=2:GOTO 160
180:
190 PROChumanplay:PROChumancapture:PROCsore
200 FOR count%=1 TO 12:N%(count%)=M%(count%):NEXT cou
nt%
210 P=1:GOTO 160
220CLS:IF P=2 THEN GOTO 230 ELSE IF P=1 GOTO 270
230PROChumanplay:PROChumancapture:PROCsore
240FOR count%=1 TO 12:N%(count%)=M%(count%):NEXT coun
t%
250P=1: GOTO 220
260:
270PROCotherhumanplay:PROCcomputerplay:PROCsore
280FOR count%=1 TO 12:N%(count%)=M%(count%):NEXT coun
t%

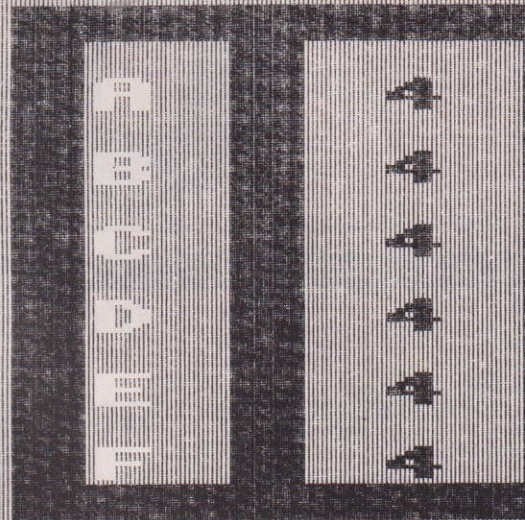
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290P=2:GOTO 220
300
310
320 DEF PROChumanplay
330FOR count%=1 TO 12:M%(count%)=N%(count%):NEXT count%
340PROCboard:PROCEmptyrowcheck
350 IF choice$="P" THEN 360 ELSE 370
360 PRINTTAB(1,26);"Your move ":COLOUR1:PRINTTAB(11,26);PLAY1$:COLOUR0
370PRINTTAB(1,26);"Your move"
380PRINTTAB(1,28);"Enter cup letter";
390REPEAT:Z$=GET$:UNTILZ$="A"ORZ$="B"ORZ$="C"ORZ$="D"ORZ$="E"ORZ$="F"
400COLOUR1:PRINTZ$:PRINTTAB(0,24)"
COLOUR0
410length%=LEN(Z$):IF length%>1 GOTO 440
420CUPNUM%=ASC(Z$)-64
430IF CUPNUM%<0 OR CUPNUM%>6 THEN GOTO 440 ELSE GOTO450
440VDU19,0,9,0,0,0:PRINTTAB(1,28);"Illegal.Try again!";PROCwait(3):VDU19,0,0,0,0,0:GOTO370
450IF N%(CUPNUM%)=0 THEN GOTO 440 ELSE GOTO 460
460CAPTURE%=0:move%=CUPNUM%
470PROCmove
480ENDPROC
490
500
510DEFPROCotherhumanplay
520 FOR count%=1 TO 12:M%(count%)=N%(count%):NEXT count%
530PROCboard:PROCEmptyrowcheck
540PRINTTAB(1,26);"Your move ":COLOUR3:PRINTTAB(11,26);PLAY2$:COLOUR0:PRINTTAB(0,28);"Enter cup letter";
550REPEAT:Z$=GET$:UNTILZ$="G"ORZ$="H"ORZ$="I"ORZ$="J"ORZ$="K"ORZ$="L":COLOUR1:PRINTZ$:COLOUR0
560CUPNUM%=ASC(Z$)-64:IF CUPNUM%<7 OR CUPNUM%>13 THEN GOTO 560 ELSE GOTO 570
560VDU19,0,9,0,0,0:PRINTTAB(0,7);"ILLEGAL.TRY AGAIN."
570IF N%(CUPNUM%)=0 THEN GOTO 560 ELSE GOTO 580
580CAPTURE%=0:move%=CUPNUM%:PROCmove
590ENDPROC
600
610
620 DEF PROCcomputerplay
630 PROCboard:PROCEmptyrowcheck:PROCwait(1)
640 LOCAL CHOICE%
650FOR LOOP3%=7 TO 12
660TACTIC1=N%(LOOP3%)+LOOP3%+1
670IF TACTIC1 < 13 THEN GOTO 700
680TACTIC1=TACTIC1-12
690GOTO 670
700A(LLOOP3%)=0
710IF N%(LOOP3%)+LOOP3%>18 OR N%(LOOP3%)+LOOP3%<12 THEN 770
720IF LOOP3%=7 THEN 770
730IF N%(TACTIC1)>1 THEN 770
740FOR LOOP4%=7 TO LOOP3%-1
750IF N%(LOOP4%)+LOOP4%>12 THEN A(LLOOP4%)=11
760NEXT LOOP4%
770NEXT LOOP3%
780IF N%(2)=0 AND N%(12)>0 AND N%(11)=1 THEN A(11)=-6
790IF N%(1)+N%(2)+N%(3)+N%(4)+N%(5)+N%(6)=0 THEN PROCtacsub1
800IF (N%(1)+N%(2)+N%(3)+N%(11)+N%(12)=0) AND N%(4)<6 AND N%(5)<5 AND N%(6)<4 THEN PROCtacsub2

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YOU

— — — — —

8

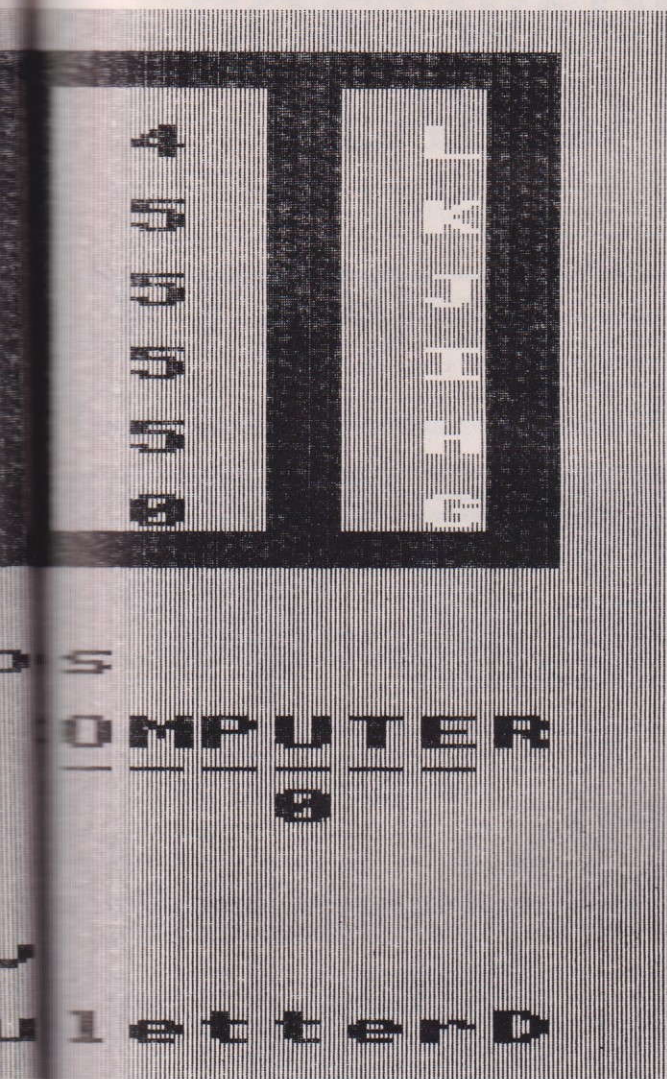
YOUR move

Enter cup

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810FOR LOOP5%=7 TO 12
820 IF LOOP5%>7 GOTO 850
830 IF N%(LOOP5%)=0 THEN A(LLOOP5%)=-9999:GOTO 1060
840 IF N%(LOOP5%)>0 THEN GOTO 850
850IFN%(LOOP5%)=0 THEN A(LLOOP5%)=-9999:GOTO1070
860IF N%(LOOP5%)>12-LOOP5% THEN A(LLOOP5%)=A(LLOOP5%)-5
870X%=LOOP5%+N%(LOOP5%)
880IF X%<13 THEN 900
890X%=X%-12:GOTO 880
900IF X%<7 AND N%(X%)=0 THEN A(LLOOP5%)=A(LLOOP5%)-2
910IF N%(LOOP5%)=1 THEN A(LLOOP5%)=A(LLOOP5%)+LOOP5%-7
920FOR count%=1 TO 12:M%(count%)=N%(count%):NEXT count%
930CAPTURE%=0:CUPNUM%=LOOP5%:move%=CUPNUM%:PROCmove:PROCcomputercapture
940FOR count%=1 TO 12:T%(count%)=M%(count%):NEXT count%
950A(LLOOP5%)=A(LLOOP5%)+10*CAPTURE%
960OBM%=0
970FOR LOOP6%=1 TO 6
980FOR count%=1 TO 12:M%(count%)=T%(count%):NEXT count%
990CAPTURE%=0:CUPNUM%=LOOP6%:move%=CUPNUM%:PROCmove:PROChumancapture
1000IF CAPTURE%>OBM% THEN OBM%=CAPTURE%
1010NEXT LOOP6%
1020A(LLOOP5%)=A(LLOOP5%)-10*OBM%
1030 IF LOOP5%=7 THEN bestmove%=A(7):CHOICE%=LOOP5%
1040 IF A(LLOOP5%)>bestmove% THEN 1060
1050GOTO 1070
1060bestmove%=A(LLOOP5%):CHOICE%=LOOP5%
1070NEXT LOOP5%

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1360
1370 DEF PROCchumancapture
1380 IF M%(CUPNUM%)=2 OR M%(CUPNUM%)=3 THEN GOTO 1400
1390GOTO 1440
1400 IF CUPNUM%<7 THEN GOTO 1440
1410 CAPTURE%=CAPTURE%+M%(CUPNUM%)
1420 M%(CUPNUM%)=0
1430 CUPNUM%=CUPNUM%-1:GOTO 1380
1440 ENDPROC
1450
1460
1470 DEF PROCinit
1480DIM S%(2):DIM N%(12):DIM M%(12):DIM T%(12):DIM A(1
2):stonecount=0:emptyrow%=0
1490S%(1)=0:S%(2)=0:CAPTURE%=0
1500FOR LOOP1%=1 TO 12
1510M%(LOOP1%)=4:N%(LOOP1%)=4
1520NEXT LOOP1%
1530:
1540RANDOM=RND(-TIME)
1550PLAYER1=RND(2)
1560IF PLAYER1=1 THEN P=1 ELSE P=2
1570ENDPROC
1580
1590
1600 DEF PROCboard
1610stonecount=0:PRINTTAB(1,2);STRING$(17,CHR$225)
1620FOR LOOP2%=1 TO 6:LOOP8%=2*LOOP2%-1:LOOP9%=2*LOOP2
%
1630PRINTTAB(1,2+LOOP8%);CHR$225;" ";CHR$225;" ";ST
RING$(3,CHR$225)
1640PRINTTAB(1,2+LOOP9%);CHR$225;:COLOUR3:PRINTCHR$(64
+LOOP2%);:COLOUR0
1650PRINTTAB(3,2+LOOP9%) "CHR$225" ";
1660COLOUR1:PRINTTAB(6,2+LOOP9%);N%(LOOP2%):COLOUR0
1670IF N%(LOOP2%)>9 THEN PRINTTAB(8,2+LOOP9%);STRING$(
3,CHR$225) ELSE PRINTTAB(7,2+LOOP9%);" ";STRING$(3,CHR$
225)
1680PRINTTAB(11,2+LOOP8%);" ";CHR$225;" ";CHR$225
1690IF N%(13-LOOP2%)>9 THEN 1700 ELSE 1710
1700PRINTTAB(11,2+LOOP9%);" ";COLOUR1:PRINTTAB(12,2+LO
OP9%);N%(13-LOOP2%);:COLOUR0:PRINTCHR$225;" ";:COLOUR3:
PRINTCHR$(77-LOOP2%);:COLOUR0:PRINTCHR$225:GOTO1720
1710PRINTTAB(11,2+LOOP9%);" ";COLOUR1:PRINTTAB(12,2+LO
OP9%);N%(13-LOOP2%);:COLOUR0:PRINT " ";CHR$225;" ";:COLO
UR3:PRINTCHR$(77-LOOP2%);:COLOUR0:PRINTCHR$225
1720stonecount=stonecount+N%(LOOP2%)+N%(13-LOOP2%)
1730NEXT LOOP2%;PRINTTAB(1,15);STRING$(17,CHR$225)
1740IF stonecount <9 OR stonecount = 9 THEN 1750 ELSE
1760
1750dummy=INKEY(200):PROCfewstones
1760PRINTTAB(4,18);" Scores"
1770 IF choice$="C" THEN 1780 ELSE 1790
1780 PRINTTAB(1,20);" YOU COMPUTER":GOTO1800
1790 PRINTTAB(1,20)PLAY1$,PLAY2$
1800PRINTTAB(1,21);"-----"
1810PRINTTAB(1,22);" ";S%(2);" ";S%(1)
1820ENDPROC
1830
1840
1850 DEF PROCfewstones
1860CLS:PRINTTAB(1,5);"As there are 9 or"
1870PRINTTAB(1,6);"less stones left,"
1880PRINTTAB(1,7);"THE GAME IS ENDED."
1890PROCwait(5)
1900PROCfinalscore

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```

1080CAPTURE%=0:CUPNUM%=CHOICE%:move%=CUPNUM%
1090FOR count%=1 TO 12:M%(count%)=N%(count%):NEXT coun
t%
1100PROCmove:PROCcomputercapture
1110FOR count%=1 TO 12:N%(count%)=M%(count%):NEXT coun
t%
1120PROCscore:PROCboard
1130PRINTTAB(1,24);"I played cup ";:COLOUR1:PRINTCHR$(
64+CHOICE%):COLOUR0
1140PRINTTAB(1,26);STRING$(60," ")
1150 PROCwait(2)
1160 ENDPROC
1170
1180
1190 DEF PROCmove
1200 STONES%=M%(CUPNUM%):M%(CUPNUM%)=0
1210 IF STONES%=0 THEN ENDPROC
1220 STONES%=STONES%-1:CUPNUM%=CUPNUM%+1
1230 IF CUPNUM%=move% THEN CUPNUM%=CUPNUM%+1
1240 IF CUPNUM%>12 THEN CUPNUM%=CUPNUM%-12
1250 M%(CUPNUM%)=M%(CUPNUM%)+1:GOTO1210
1260 ENDPROC
1270
1280
1290 DEF PROCcomputercapture
1300IF M%(CUPNUM%)=2 OR M%(CUPNUM%)=3 THEN GOTO 1320
1310GOTO 1340
1320IF CUPNUM%>6 OR CUPNUM%<1 THEN GOTO 1340
1330CAPTURE%=CAPTURE%+M%(CUPNUM%):M%(CUPNUM%)=0:CUPNUM
%=CUPNUM%-1:GOTO 1300
1340ENDPROC
1350

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```

1910ENDPROC
1920
1930
1940 DEF PROCwait(time%)
1950TIME=0:REPEAT:UNTIL TIME>time%*100
1960ENDPROC
1970
1980
1990 DEF PROCfinalscore
2000VDU19,0,9;0;
2010IF emptyrow%=1 THEN 2020 ELSE 2030
2020FOR count%=1 TO 6:S%(1)=S%(1)+N%(count%):S%(2)=S%(
2)+N%(count%+6):NEXTcount%:GOTO 2090
2030FOR count%=1 TO 6:S%(1)=S%(1)+N%(count%+6):S%(2)=S
%(2)+N%(count%):NEXT count%
2040COLOUR1
2050IF S%(1)>S%(2) THEN PRINTTAB(3,26);" I win."
2060IF S%(1)=S%(2) THEN PRINTTAB(3,26);"It's a draw."
2070IF S%(1)<S%(2) THEN PRINTTAB(3,26);" YOU win!!!"
2080 GOTO 2130
2090COLOUR1
2100 IF S%(1)>S%(2) THEN PRINTTAB(1,26);" ";PLAY2$;" -
YOU WIN!"
2110 IF S%(1)=S%(2) THEN PRINTTAB(1,26);"IT'S A DRAW"

2120 IF S%(2)>S%(1) THEN PRINTTAB(1,26);" ";PLAY1$;" -
YOU WIN!"
2130IF choice$="C" THEN 2140 ELSE 2150
2140PRINTTAB(1,20);" YOU      COMPUTER":GOTO2160
2150PRINTTAB(1,20)PLAY1$,PLAY2$
2160PRINTTAB(1,21);"-----"
2170PRINTTAB(1,22);" ";S%(2);"          ";S%(1)
2180PRINTTAB(1,24);"
"
2190END
2200ENDPROC
2210
2220
2230 DEF PROCemptyrowcheck
2240 IF (P=1 AND (N%(7)+N%(8)+N%(9)+N%(10)+N%(11)+N%(1
2))=0) THEN 2270
2250 IF (P=2 AND (N%(1)+N%(2)+N%(3)+N%(4)+N%(5)+N%(6))
=0) THEN 2370
2260 GOTO 2470
2270 FOR count%=1 TO 6:S%(1)=S%(1)+N%(count%+6):NEXT c
ount%:emptyrow%=1
2280 IF choice$="C" GOTO 2290 ELSE 2320
2290PRINTTAB(0,10)"You have left me "
2300PRINTTAB(0,11)"with no stones to play"
2310PRINTTAB(0,12)"I claim the rest      "" and the gam
e ends.":GOTO2460
2320PRINTTAB(0,10)PLAY1$;" ,you have left"
2330PRINTTAB(0,11)"me no stones to play."
2340PRINTTAB(0,12)"I claim the rest,"
2350PRINTTAB(0,13)"and the game ends."
2360GOTO2460
2370 FOR count%=1 TO 6:S%(2)=S%(2)+N%(count%):NEXT cou
nt%:emptyrow%=1
2380 IF choice$="C" GOTO 2390 ELSE 2420
2390PRINTTAB(0,10)"You are left with "
2400PRINTTAB(0,11)"no stones to play"
2410PRINTTAB(0,12)"YOU claim the rest      ""and the ga
me ends.":GOTO2460
2420PRINTTAB(0,10)PLAY2$;" ,you have left"

2430PRINTTAB(0,11)"me no stones to play."
2440PRINTTAB(0,12)"I claim the rest,"
2450PRINTTAB(0,13)"and the game ends."
2460PROCfinalscore
2470ENDPROC
2480
2490
2500 DEF PROCtacsub1
2510FOR LOOP%=7 TO 12:IF N%(LOOP%)>12-LOOP% THEN A(LOO
P%)=A(LOOP%)+50
2520NEXT LOOP%:ENDPROC
2530
2540
2550 DEF PROCtacsub2
2560FOR LOOP%=7 TO 12:TACTIC3=LOOP%+N%(LOOP%)
2570IF TACTIC3<13 THEN A(LOOP%)=A(LOOP%)+N%(LOOP%)*5
2580NEXT LOOP%:ENDPROC
2590
2600
2610 DEF PROCscore
2620IF P=1 THEN S%(1)=S%(1)+CAPTURE%
2630IF P=2 THEN S%(2)=S%(2)+CAPTURE%
2640ENDPROC
2650
2660
2670 DEFPROCtitle
2680VDU23,1,0;0;0;0;CLS
2690VDU19,3,4;0;:COLOUR3:PRINTTAB(8,7);"AYO":PROCwait(
2)
2700COLOUR0:PRINTTAB(1,12);"You can play AYO"" ag
ainst":COLOUR1:PRINTTAB(3,14)"the computer":COLOUR0:PRI
NTTAB(8,15)"or":COLOUR1:PRINTTAB(1,16)" another player"

2710COLOUR0:PRINTTAB(0,21);"Enter":COLOUR1:PRINTTAB(6,
21);"C":COLOUR0:PRINTTAB(8,21);"or":COLOUR1:PRINTTAB(11
,21)"P":COLOUR0:PRINTTAB(13,21)"to play"
2720PRINTTAB(0,23);"the computer(C)":PRINTTAB(0,25);"o
r another player(P)"
2730choice$=GET$
2740PRINTTAB(5,27)choice$
2750IF choice$="C" GOTO 2770 ELSE IF choice$="P" GOTO
2780
2760GOTO 2710
2770IF choice$="C" THEN ENDPROC
2780CLS:PRINTTAB(0,3);"Please enter your":PRINTTAB(0,4
);"names."
2790PRINTTAB(0,5);"(Up to 6 letters)"
2800PRINTTAB(1,10)"Player 1":COLOUR1:INPUTTAB(10,10);P
LAY1$:COLOUR0
2810long%=LEN(PLAY1$):IF long%>6 THEN PLAY1$=LEFT$(PLA
Y1$,6)
2820IF long%<1 THEN GOTO 2800
2830PRINTTAB(1,12)"Player 2":COLOUR3:INPUTTAB(10,12);P
LAY2$:COLOUR0
2840long%=LEN(PLAY2$):IF long%>6 THEN PLAY2$=LEFT$(PLA
Y2$,6)
2850IF long%<1 THEN GOTO 2830
2860time = TIME
2870PROCwait(2):PROCinit
2880starter = (RND(time)) MOD 2
2890IF starter=1 THEN P=1 ELSE P=2
2900IF P=2 PRINTTAB(1,16);PLAY1$;"-you start" ELSE PRI
NTTAB(1,16);PLAY2$;"-you start"
2910IF P=2 PRINTTAB(1,18);"Your cups are A-F" ELSE PRI
NTTAB(1,18);"Your cups are G-L"
2920PROCwait(5)
2930ENDPROC

```

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# New Tabs for Old

Barry Landsbeg and Tony Wingrove

There have been many articles concerning bugs and limitations in operating system 0.1, and perhaps the majority concentrate on how programs which have been written for later operating systems do not work on the earlier one. This article does quite the reverse by describing how programs which have even been published work on OS 0.1 but don't work on later versions. Two methods of solving this problem are presented, and one of them does not involve altering the program in any way and may be used even if the program is protected.

## IT'S ALL VDU

The normal operation of the BBC micro is that text is written at the text cursor. This means that to write characters at the text position X,Y on the screen, a PRINTTAB (X,Y) command must be issued. It is important to understand that PRINTTAB (X,Y) and VDU 31,X,Y are entirely equivalent. If a VDU 5 command has been sent, the BBC User Guide assures us that text is now written only at the graphics cursor and must be positioned using statements like MOVE 100,500, and that PRINTTAB commands will not affect the display. Note that MOVE 100,500 is equivalent to VDU 25,4,100,500; or even VDU 25,4,100,0,224,1. The last VDU command may look rather strange but all it is doing is expressing the numbers 100 and 500 one byte at a time ( $1 \times 256 + 244$  does equal 500). A VDU 4 or MODE statement will return from the graphics cursor mode to the normal mode.

However, if you are using OS 0.1, PRINTTAB does affect the text position, while in the subsequent operating systems it does not. This means that software developed and tested with OS 0.1 may not work for other systems.

Program 1, which is based on part of an actual published program demonstrates the fault and shows how to get round it. The program displays a menu and a block cursor which can be

## Investigating the problems posed by the 0.1 Operating System leads to some interesting all-purpose code.

moved about the screen by means of the four arrow keys. The required option is selected from the menu by positioning the cursor over the first letter in the option and hitting RETURN. When you do this, the cursor co-ordinates are displayed at the bottom of the screen. In the published program, this information was used to determine which option had been selected.

As given, the program will work under OS 0.1, but not under OS 1.2 because the PRINTTAB instruction in line 390 is ignored while VDU5 is active. If you attempt to run the program under OS 1.2 the block cursor forms a vertical line which moves down the left-hand edge of the screen, regardless of which of the arrow keys you press. If we delete line 390 and activate line 400 by removing the REM, the program now runs correctly.

## CO-ORDINATE CONVERSION

Having demonstrated that the problem can indeed be overcome by replacing the command PRINTTAB (X,Y) by MOVE (M,N), the question is how do we convert the co-ordinates M and N? Fortunately we can derive a simple formula to do this, which can be used for any mode that allows text and graphics. (The MOVE command cannot be used in the text-only modes 3 and 6, nor in mode 7, the Teletext mode).

The co-ordinates X and Y in the PRINTTAB command are in fact the column and line numbers. The text origin is at the TOP left-hand corner of the screen. The left-hand column is column 0 and there are 20, 40 or 80 columns according to the mode. The top line is line 0 and there are always 32 lines in the modes which interest us. The graphics origin is at the BOTTOM left-hand corner of the screen. There are 1280 'columns' and 1024 'lines' on the graphics screen. These graphics columns and lines are referred to as 'graphics units' in the User Guide.

Hence in mode 0, for example, which has 80 columns of text, each column equals  $1280/80 = 16$  graphics units, so to convert the column number X to the graphic co-ordinate M, we simply multiply X by 16. Similarly, in 40-column modes (modes 1 and 4), we multiply by 32, and in 20-column modes (modes 2 and 5), by 64.

Because there are always 32 lines of text in the graphics modes, each line equals  $1024/32 = 32$  graphics units. However we have to allow for the text origin being at the top of the screen and the graphics origin at the bottom, and this is done by subtracting the figure we obtain from 1024.

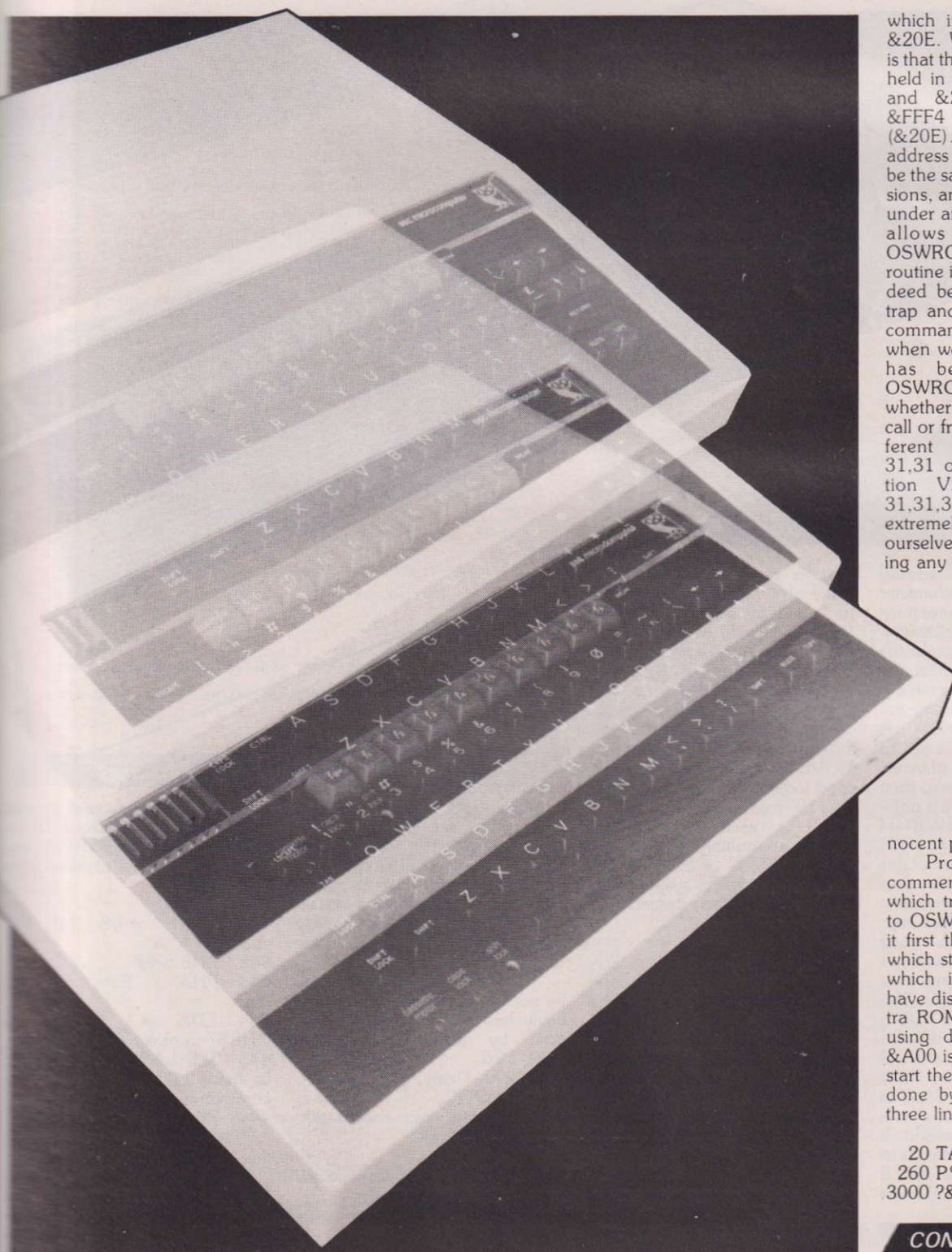
To sum up, we can change PRINTTAB (X,Y) to MOVE (M,N) by saying  $M = X * f$   $N = 1024 - 32 * Y$ , where the value of f is 16 for mode 0, 32 for modes 1 and 4, and 64 for modes 2 and 5.

## ELEGANT SOLUTION

Simple as it might seem at first sight to replace all offending PRINTAB statements by the corresponding MOVE command, it

is all too easy to either overlook one of them or to be unsure of which graphics mode the program is in at any time if the program flow is complex. The latter is especially true if the program is sometimes in the non-graphics modes 3, 6 or 7 where the effect of VDU 5 is totally ignored. What if the software has been compiled or even protected? A much more elegant solution is possible which does not involve altering the BASIC program at all, and also allows the program to run under any of the operating systems.

Whenever any text is written to the screen, or a VDU-related command is issued, a routine within the MOS is called which processes each character, and is known as the Operating System Write Character routine or more intimately as OSWRCH. This routine is entered at &FFF4.



which immediately indirects via &20E. What this actually means is that the address of OSWRCH is held in memory locations &20E and &20F and the code at &FFF4 is the statement JMP (&20E). This is done because the address of OSWRCH need not be the same in different MOS versions, and allows programs to run under any of the versions. It also allows us to redirect all OSWRCH calls to our own routine if we wish, and we will indeed be doing that in order to trap and process all PRINTTAB commands. The problem is that when we do find that CHR\$(31) has been passed through OSWRCH, it is not obvious whether it is from a PRINTTAB call or from something totally different (for example, MOVE 31,31 or even character definition VDU 23,255,31,31,31,31,31,31,31,31) and we must be extremely careful not to let ourselves get confused by blocking any 31 that is actually an in-

nocent part of another VDU call.

Program 2 is a fully-commented listing of a program which traps every character sent to OSWRCH, and instead sends it first through our own routine which starts at &D00, an address which is not used unless you have disc drives, ECONET or extra ROMS. Note that if you are using disc drives, then perhaps &A00 is a more sensible place to start the routine and this may be done by retyping the following three lines.

```
20 TABLE = &AE0
260 P% = A00
3000 ?&20E = 0; ?&20F = &A
```

**CONTINUED OVER**



What the program actually does when it receives a character is to look up how many bytes must follow it if it is a control character (ASCII 0-31), for example the VDU 23 command must be followed by 9 bytes. This table is set up by lines 20-60 using the data in lines 6000-6010. A variable called PassOn is set to the value of that number of bytes, and, if it is greater than zero then that number of characters is passed through to OSWRCH whatever they might be. Remembering that the aim of this is to replace PRINTTAB commands with the corresponding MOVE commands where appropriate, the program must always keep track of whether VDU 5 is active or not, and what mode the system is in. The variable Vdu4 is set to 1 if VDU 5 is not active, otherwise it is set to 0. Whenever a MODE (or VDU 22) call is made, it sets the value of Thismode and resets Vdu4 to 1. Finally, whenever it receives a TAB (or VDU 31) command, it checks to see that the system is in a graphics mode and that VDU 5 is active, and only then does it

start its conversion, setting the value of a variable called Modify to 2 and by sending VDU25.4 (MOVE) instead of the VDU 31 (PRINTTAB) it received. Only when the value of Modify is greater than zero does the program convert the values originally designed for PRINTTAB into those for the corresponding MOVE command. Note that a second lookup table (setup by lines 70-110 from the data in line 6200) is used to determine whether to multiply the first TAB value by 16,32 or 64 according to which mode the system is in, as has already been described.

## THE CODE

Note that this program does not take account of any VDU28 commands (which redefine the text origin) or VDU24 and VDU29 commands (which redefine the graphics origin), but it is possible to extend the program to do so.

This code has been tested with a wide range of BASIC programs without causing any difficulties, but one side effect it has is that it seems to affect program listings. We do not have any explanation for this and would be

grateful to any reader who supplies one.

Finally, once a program like this has been written, it may be used for a variety of useful or amusing purposes. For example it may easily be reprogrammed to ignore any set of VDU commands (especially VDU 1 and VDU 2 which send output to a printer), convert lower to upper case, 'beep' every time a certain letter is pressed or so scramble the I/O as to totally bewilder the user.

Two specific instances may be useful, and for each it is probably best to unclutter the program by getting rid of lines 280-390, 490-850, and 900-1290. Firstly, if you want to stop CTRL -G (CHR\$7) from beeping, you should add the following lines:

```
441 CMP #7 /Or any other
442 BNE SKIP
443 RTS
444 .SKIP
```

Secondly, you may wish to beep whenever the character 'A' is passed through OSWRCH, and in this case, you should add the following:

```
441 CMP #65 /If the
character is 'A'...
442 BNE SKIP
443 PHA /...Put it on the
stack...
444 LDA #7 /...Insert a
CHR$7 to make a beep...
445 JSR LABEL /(There may
be many LDA and JSR LABEL
commands)
446 PLA /...and retrieve and
original character
447 .SKIP
```

Omitting lines 441 and 442 will cause a beep whenever any key is pressed or any character is sent to the screen.

## PROGRAM LISTING 1

```

10 *TV255
20 MODE 4
30 :
40 REM Display menu options
50 PRINTTAB(15,4)"M E N U"
60 PRINTTAB(15,5)"=====
70 PRINTTAB(8,12)"LOAD"TAB(25,12)"EDIT"
80 PRINTTAB(8,16)"SAVE"TAB(25,16)"INSERT"
90 PRINTTAB(8,20)"PRINT"TAB(25,20)"DELETE"
100 :
110 X=0:Y=0:REM Initialise cursor co-ords
120 VDU 5:REM Position text at graphics cursor
130 VDU 23,255,255,255,255,255,255,255:REM
Make CHR$(255) block cursor
140 GCOL 4,7:REM Invert when printing cursor
150 :
160 PROCcursor:REM Print cursor at current position
170 :
180 REM Disable cursor editing, get character,
re-enable editing
190 *FX 4,1
200 CS=GETS
210 *FX 4,0
220 :
230 PROCcursor:REM Delete cursor at old position
240 :
250 REM Determine which cursor key was hit and update
cursor co-ords
260 IF CS=CHR$(88) AND X>0 THEN X=X-1
270 IF CS=CHR$(89) AND X<39 THEN X=X+1
280 IF CS=CHR$(8A) AND Y<31 THEN Y=Y+1
290 IF CS=CHR$(8B) AND Y>0 THEN Y=Y-1
300 IF CS<>CHR$(13) THEN 160:REM Repeat until
<return> hit
310 :
320 REM X,Y are now co-ords of final cursor position
330 VDU 4
340 PRINTTAB(8,30);"Cursor co-ords: X="X;" Y="Y
350 GOTO 110
360 END
370 :
380 DEFPROCcursor
390 PRINTTAB(X,Y) CHR$(255):REM **** INVALID IN OS
1.2 ****
400 REM MOVE 32*X,1024-32*Y:PRINT CHR$(255):REM ****
OK IN OS 1.2 ****
410 ENDPROC

```

## PROGRAM LISTING 2

```

10 LABEL = %20F*256 + %20E:REM LABEL now contains the address of OSWRCH
20 TABLE = %DE0
30 FOR I = 0 TO 31
40 READ J
50 TABLE?I = J
60 NEXT I
70 MTABLE = %78
80 FOR I = 0 TO 7
90 READ J
100 MTABLE?I = J
110 NEXT I
120 MODE 7
130 Modify = %70
140 PassOn = %71
150 GetMode = %72
160 THISmode = %73
170 Vdu4 = %74
180 Workspace = %75
190 Factor = %76
200 ?Modify = 0
210 ?PassOn = 0
220 ?GetMode = 0
230 ?THISmode = 7
240 ?Vdu4 = 1
250 FOR I = 0 TO 3 STEP 3
260 P% = %D00
270 [OPT I
280 LDX GetMode
290 BEQ L0
300 LDX #0
310 STX GetMode
320 STA THISmode
330 JMP LABEL
340 .L0
350 LDX Modify
360 BEQ L1

```

```

370 DEC Modify
380 JMP CONVERT
390 .L1
400 LDX PassOn
410 BEQ L2
420 DEC PassOn
430 JMP LABEL
440 .L2
450 CMP #32
460 BMI L3
470 JMP LABEL
480 .L3
490 CMP #4
500 BNE L4
510 LDX #1
520 STX Vdu4
530 JMP LABEL
540 .L4
550 CMP #5
560 BNE L5
570 LDX #0
580 STX Vdu4
590 JMP LABEL
600 .L5
610 CMP #22
620 BNE L6
630 LDX #1
640 STX GetMode
650 STX Vdu4
660 JMP LABEL
670 .L6
680 CMP #31
690 BNE L7
700 LDX Vdu4
710 BNE L7
720 LDX THISmode
730 CPX #7
740 BEQ L7
750 CPX #6
760 BEQ L7
770 CPX #3
780 BEQ L7
790 LDX #2
800 STX Modify
810 LDA #25
820 JSR LABEL
830 LDA #4
840 JMP LABEL
850 .L7
860 TAX
870 LDY TABLE,X
880 STY PassOn
890 JMP LABEL
900 .CONVERT
910 LDX Modify
920 CPX #1
930 BNE YBYTE
940 LDX THISmode
950 LDX MTABLE,X
960 STY Factor
970 LDX #0
980 STX Workspace
990 LSR Factor
1000 .M0
1010 ASL A
1020 ROL Workspace
1030 LSR Factor
1040 BNE M0
1050 JSR LABEL
1060 LDA Workspace
1070 JMP LABEL
1080 .YBYTE
1090 LDX #0
1100 STX Workspace
1110 LDX #32
1120 STX Factor
1130 LSR Factor
1140 .M1
1150 ASL A
1160 ROL Workspace
1170 LSR Factor
1180 BNE M1
1190 SEC
1200 EOR %FF
1210 BEQ M2
1220 CLC
1230 .M2
1240 PHP
1250 JSR LABEL
1260 PLP
1270 LDA #4
1280 SBC Workspace
1290 JMP LABEL
1999]
2000 NEXT
3000 %20E = 0: %20F = %D :REM This diverts OSWRCH call to our own ...
3010 :REM ... routine at %D00
6000 DATA 0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0
6100 DATA 0,1,2,5,0,0,1,9,8,5,0,0,4,4,0,2
6200 DATA 16,32,64,0,32,64,0,0

```

# In The Beginning

G.W. Gallagher

The two sections of Form 7 are of interest to different types of school. If your school has no pupils over the age of 15 on the required date (August 31 of the appropriate year), then 7A is the form which interests you. In that case the only pieces of information needed are date of birth, sex and class.

If the school includes pupils over the age of 15, then courses and/or subjects taken become important. First of all, there is the distinction between those on 'A', 'O'/C.S.E. and 'other' courses may need further consideration in the future, as I understand that there is no precise distinction at present between for example, C.S.E. and C.E.E.

For 'A' level subjects, there is further differentiation to be made between mathematics, mathematics/science and 'other' subjects. In the program described here, the mathematics/science group includes: mathematics, further mathematics, biology, physics, geology, technical drawing.

## VARIATIONS

At this stage, it will be necessary to check which other subjects in your curriculum come under the heading of 'science'. There are many variations of the titles of

**Our final instalment of the schools database tackles Form 7 and supplies a menu for the entire suite of programs.**



## SECTION A

(Listing 1) On this form, numbers of pupils are collected under sex and form reference. The arrays used are:

FS(20)

This array holds the form references. Only 10 forms have been used in the example, but the appropriate number for the school concerned must be included here, whether it be 30, 50 or other total.

BA(20,6)

In this array, the numbers of boys in each form and each age group are collected. '20' is the number of classes, as already mentioned. '6' is the number of years (5) + 1 for the totals.

GA(20,6)  
B(20,11)

G(20,11)  
BT(11)

GT(11)

TB(6)

TB(6)

is the equivalent array for the girls.  
'20' is the number of classes as before, '11' is the number of half-years (10) + 1 for the total.  
(boys)

is the equivalent array for the girls.  
holds the total number of boys in each half-year group + the total number of boys.  
holds the total number of girls in each half-year group + the total number of girls.  
holds the total number of boys in each full year + the total number of boys.  
holds the total number of girls in each full year + the total number of girls.

courses, and it is important to look carefully at the timetable, in conjunction with the notes which come with the form itself to check the division of subjects between 'science' and 'others'.

There are two variables which are used in both programs, YR as the base year, and D as the yearly counter from the base year. YR is the year which appears in the row titled '19+'. For the form which was completed in January 1982, YR was 62, in January 1983 YR was 63, and so on.

Starting from the base year YR,

for 19+ students, D=1  
for 18+ students, D=2  
for 17+ students, D=3 etc.

The range of values of D is therefore determined by the range of ages of the pupils. If the age range was 15+ to 19+, then the value of D varies from 1 to 5.

In a school in which the ages of the pupils range from 9+ to 12+, the range of values of D would be 8 (for the 12+) to 11 (for the 9+). The range of values of D should be decided before entering the program. A range wider than necessary will not cause errors, but it will lead to a wider printed table of values than needed, and will use extra array space, which could cause memory problems.

When the tables are printed out, it will be seen that BT(11) = TB(6) and GT(11) = TG(6). YR (the base year) is taken as 64.

## THE PROCS USED

**PROCcheck** (1000-1410) In this section each record is read from the file, and checked to see which array it belongs to.  
 1010 checks that the pupil is still in the school.  
 1020-1030 The form is checked against the array F\$ until the correct form member is found.  
 1040 D is given the SMALLEST value to be used, in this case 8.  
 1050 X is the year of birth.  
 1060 Y is the month of birth.  
 ZQ\$ is the letter 'F' of 'M'.  
 1080-1120 checks whether the value of D fits the record being looked at.  
 1130-1360 If the value of D fits the record, the correct array members are increased.  
 1390 increases D.  
 1400 loops back for another class reference.  
 (1500-1640) In this section, the totals are calculated for the full and half years so that all array sections are complete and ready for printing.

**PROCTotals** (1650-1760) reads a record from the file until the end of the file is reached, 'number' being the number of the record being checked.

**PROCfromfile** (1900-1970) In this section, the choice is given of yearly or halfyearly figures. Since the form is composed of a mixture of both types, it is simplest to print out both and use the sections required.

Figure 1 shows a complete run-off of yearly and halfyearly figures for FORM 7A, using the age groups 9+ to 12+, with the value of D ranging from B (for 12+) to 11 (for 9+).

Figure 1A is the list of yearly totals, and figure 1B is the list of half-yearly totals, each two columns of B adding up to the equivalent column in A.

**PROCprint** (1980-2400) Remembering that YR was equivalent to D=1, the headings in lines 2002, 2082, 2202, 2264 should be for the years appropriate to your own list.  
 1980 is the beginning of the yearly printout for 'BOYS'.  
 2002 sets the year headings, in the example for 12+ to 8+, the last column not being used. If the range of ages is greater than 5 years, then this line should be supplemented to include all the years.  
 2010 The value of J should cover the number of classes involved.  
 2020 The spacing on this line should match that of line 2002.  
 2050 Using the same spacing, the column totals are printed.  
 2060 The boys' table is completed, and the computer waits to be told to proceed.  
 2080-2150 The above process is repeated for 'GIRLS'.  
 2200-2400 Similar processes are carried out for the half-yearly figures.  
 2202 sets out the headings, for the September

figures, leaving the columns of 1st of April figures without a heading.

2210 sets out the pattern for the printing of the columns of numbers of. Care should be taken to allow for more columns if you are including figures for more than 5 years, as in the earlier listings.

## SECTION C

(Listing 2) The example used here is of an age range from 15+ to 19+, which includes the standard ages for 'O' level, 'A' level, C.S.E. or similar examination. The value of YR is taken as 64, and D carries the range from 1 (for 19+) to 5 (for 15+).

The variables used are: Z\$=MID\$(A\$,41,1): This is the reference which gives the academic year, and the references used in the example are:

0 indicates an 'O' level or C.S.E. course.

1 indicates the first year of an 'A' level course.

2 indicates the second year of an 'A' level course.

3 indicates a pupil beyond 'O' level or C.S.E. but not 'A' level.

4 indicates a pupil not already included.

The arrays used are:

### BOYS

BB(6)

holds numbers of students taking the first year of an 'A' level course based entirely on the mathematics/science group of subject.

BC(6)

second year students as above.

BD(6)

holds numbers of students taking the first year of an 'A' level course containing 'other' subjects only.

BE(6)

second year students as above.

BF(6)

holds numbers of students taking the first year of mixed 'A' level courses.

BG(6)

second year students as above.

BH(6)

contains students in academic category 3.

BI(6)

contains students in academic category 0.

BJ(6)

contains students in academic category 4.

BK(6)

contains the totals of all the previous groups.

BL(6)

contains the numbers of first year 'A' level mathematics students whether they take science or 'other' subjects.

BM(6)

is the second year equivalent of above.

One column has not been included, and that is the first column, A. This contains the numbers of students who are taking courses beyond 'A' level. In most schools the only students who could come into this category are those who, having completed their 'A' level courses, then stay on to take university entrance examinations in the Autumn term. If your school has some of these, and if they are still on the school role in January, then a separate reference number, e.g. 5 will be needed.

### GIRLS

The arrays for the girls are equivalent to those for the boys, with the leading letter G instead of B, e.g. GB(6) instead of BB(6).

### THE PROCS USED

PROCcheck

The variables used here are:

(1000-1420)

SC is the number of 'science' subjects taken by a pupil.

AR is the equivalent number of 'other' subjects.

**CONTINUED OVER**

1080-1120

1130-12209  
11341142  
1138

1142-1154

1158

X = VAL(MID\$(A\$,34,2),i.e. the year of birth.  
Y = VAL(MID\$(A\$,32,2),i.e. the month of birth.

ZQ\$ = MID\$(A\$,29,1), i.e. M or F.  
Z\$ = MID\$(A\$,41,1) i.e. the form reference  
0,1,2,3,4 (or 5 if used)  
K\$ = MID\$(A\$,1,2), i.e. a subject reference,  
checking from 1=42

checks whether the value of D is correct for the particular record being looked at.

complete the check for BOYS.

looks for the subject MATHEMATICS, under the reference MA, moving to line if MA is not present.

adds the mathematicians to BL or BM according to whether the student is first or second year.

contain all the subjects listed as 'science'. Other subjects required should be included in this section.

If the subject was not included in the 'science'

for a particular group of students, in the appropriate 15+ to 19+ age group.

## A MENU FILE

If you have not already made a 'MENU' program for your disc using the method suggested earlier, then Listing 3 provides a short program to fulfil this purpose. To use it, the following steps should be carried out:

1. Type in the program, including the names and descriptions which you have used for your own

1200-1218

1232-1420  
PROCtotals  
(1500-1735)  
1510-1520

1540-1630

1640-1730  
PROCfromfile  
(1980-2160)  
PROCprint  
(1980-2160)

group then it must be added to the 'other' variable, AR

check the values of SC and AR to add 1 to the appropriate groups, or bypass this section if the subjects are not first or second year 'A' level to lines 1216-1218.

repeat the process for GIRLS

In this section the various totals are calculated to complete the form.

The values for the arrays BK and GK are found by totalling the values in the first five arrays. The A column figure should be added here it used.

The sixth value in each of the 'boy' arrays is calculated. If there are pupils in the A column, a line should be included here for a BA array. calculates similar values for the 'girl' arrays. reads the records from the file one by one.

In this section the two tables are printed out, in the same order as on the form. If the column A is to be used, an extra space must be included on the lines which set out the format of the printout, i.e. lines 2025, 2040, 2060, 2105, 2120 and 2140.

## GENERAL COMMENTS

The program has been written in the simplest way that I could see, so that alterations for individual schools can be made easily. The printer was put on line outside the program in both cases which means that any printer can be used. To include the VDU2 instruction in the program, it needs only to be added between 1980 and 2000 on the second program, for example. Figure 2 shows the tables as printed out

programs, and save it under the name 'MENU'.  
2. Type \*BUILD !BOOT and press RETURN.

3. The screen will display line numbers from 1 onwards. Type  
1 CHAIN"MENU"  
2 (Press ESCAPE on this second line)
4. Make the 'BOOTING' of this file automatic by typing \*OPT 4 3

Pressing SHIFT and BREAK together will now bring the MENU onto the screen, allowing any one of the programs to be

CHAINED in.

## NEXT TIME

This program ends the original set devised for the series, but I have taken up one suggestion which came from a reader. This was that the regular parent-teacher sessions involve a considerable amount of matching interview times for parents with teachers, and that this process could be taken over by the computer. There will be a program to do this, probably in the next issue of A&B.

## PROGRAM LISTING 1

```

OREM...G.W.GALLAGHER...1984...FORM7A
10DIMF$(20),BA(20,6),GA(20,6),B(20,11),G(20,11),BT(1
1),GT(11),TB(6),TG(6)
20PRINT""What is the earliest year mentioned"
30PRINT""on the form,e.g. 61?":INPUT YR
40IF YR<60 OR YR>80 THEN 20
50PROCforms
60number=1:F=0
70PROCfromfile
80PROCcheck
90number=number+1:IF F=1 THEN 160 ELSE 70
160PROCtotals
170PROCwhichlist:IF choice=3 THEN 990
180PROCprint:GOTO 170
990MODE7:END
1000DEFPROCcheck
1010IF MID$(A$,38,4)="ZZZZ" THEN ENDPROC
1020FOR J=1 TO 10:REM...EACH FORM
1030IF MID$(A$,38,3)<>F$(J) THEN 1400
1040D=B
1050X=VAL(MID$(A$,34,2))
1060Y=VAL(MID$(A$,32,2)):REM...MONTH

```

```

1070ZQ$=MID$(A$,29,1):REM..M OR F
1080IF X>(YR+D-1) THEN 1390
1090IF X=(YR+D-1) AND Y<4 THEN 1130
1100IF X=(YR+D-2) AND Y>8 THEN 1130
1110IF X=(YR+D-1) AND Y<9 THEN 1180
1120GOTO 1390
1130IF ZQ$="F" THEN 1150
1140 B(J,2*D-1)=B(J,2*D-1)+1:GOTO 1350
1150 G(J,2*D-1)=G(J,2*D-1)+1:GOTO 1350
1180 IF ZQ$="F" THEN 1200
1190B(J,2*D)=B(J,2*D)+1:GOTO 1350
1200G(J,2*D)=G(J,2*D)+1:GOTO 1350
1350BA(J,D)=B(J,2*D-1)+B(J,2*D)
1360GA(J,D)=G(J,2*D-1)+G(J,2*D)
1390 D=D+1:IF D<12 THEN 1080 ELSE 1410
1400NEXT J
1410ENDPROC
1500 DEFPROCtotals
1510XG=0:XB=0
1520FOR J=1 TO 10
1530BA(J,6)=BA(J,1)+BA(J,2)+BA(J,3)+BA(J,4)+BA(J,5)
1540GA(J,6)=GA(J,1)+GA(J,2)+GA(J,3)+GA(J,4)+GA(J,5)

```

```

1550XG=XG+GA(J,6):XB=XB+BA(J,6)
1560TB(1)=TB(1)+BA(J,1):TB(2)=TB(2)+BA(J,2):TB(3)=TB(3)
+BA(J,3):TB(4)=TB(4)+BA(J,4):TB(5)=TB(5)+BA(J,5):TB(6)
=TB(6)+BA(J,6)
1570TG(1)=TG(1)+GA(J,1):TG(2)=TG(2)+GA(J,2):TG(3)=TG(3)
+GA(J,3):TG(4)=TG(4)+GA(J,4):TG(5)=TG(5)+GA(J,5):TG(6)
=TG(6)+GA(J,6)
1580BT(1)=BT(1)+B(J,1):BT(2)=BT(2)+B(J,2):BT(3)=BT(3)+
B(J,3):BT(4)=BT(4)+B(J,4):BT(5)=BT(5)+B(J,5):BT(6)=BT(6)
+B(J,6):BT(7)=BT(7)+B(J,7):BT(8)=BT(8)+B(J,8):BT(9)=BT
(9)+B(J,9):BT(10)=BT(10)+B(J,10)
1590GT(1)=GT(1)+G(J,1):GT(2)=GT(2)+G(J,2):GT(3)=GT(3)+
G(J,3):GT(4)=GT(4)+G(J,4):GT(5)=GT(5)+G(J,5):GT(6)=GT(6)
+G(J,6):GT(7)=GT(7)+G(J,7):GT(8)=GT(8)+G(J,8):GT(9)=GT
(9)+G(J,9):GT(10)=GT(10)+G(J,10)
1600NEXT
1610FOR J=1 TO 10
1620B(J,11)=B(J,11)+B(J,1)+B(J,2)+B(J,3)+B(J,4)+B(J,5)
+B(J,6)+B(J,7)+B(J,8)+B(J,9)+B(J,10)
1625G(J,11)=G(J,11)+G(J,1)+G(J,2)+G(J,3)+G(J,4)+G(J,5)
+G(J,6)+G(J,7)+G(J,8)+G(J,9)+G(J,10)
1628NEXT
1630BT(11)=BT(1)+BT(2)+BT(3)+BT(4)+BT(5)+BT(6)+BT(7)+B
T(8)+BT(9)+BT(10)
1635GT(11)=GT(1)+GT(2)+GT(3)+GT(4)+GT(5)+GT(6)+GT(7)+G
T(8)+GT(9)+GT(10)
1640ENDPROC
1650DEFFPROCfromfile
1660X=OPENIN("List84")
1680PTR#X=(number-1)*70
1700INPUT#X,A#
1720IFPTR#X+70>EXT#X THEN 1740 ELSE 1750
1740F=1
1750CLOSE#X
1760ENDPROC
1800DEFFPROCforms
1810F$(1)="A 1":F$(2)="A 2":F$(3)="A 3":F$(4)="A 4":F$
(5)="A 5":F$(6)="A 6":F$(7)="A 7":F$(8)="A 8":F$(9)="A
9":F$(10)="A10"
1830ENDPROC
1900DEFFPROCwhichlist
1910PRINT""Type 1 for yearly figures"
1920PRINT""2 for twice-yearly figures"
1930PRINT""3 to end."
1950INPUT choice
1960IF (choice-1)*(choice-2)*(choice-3)<>0 THEN 1950
1970ENDPROC
1980DEFFPROCprint
1990ON choice GOTO2000,2200,2400
2000PRINT"BOYS"
2001PRINT"born before 1st September "
2002PRINT;TAB(5);YR+7;TAB(10);YR+8;TAB(15);YR+9;TAB(20)
;YR+10;TAB(25);YR+11;TAB(30);"Total"
2010FOR J=1 TO 10

```

```

2020PRINT;F$(J);TAB(5);BA(J,1);TAB(10);BA(J,2);TAB(15)
;BA(J,3);TAB(20);BA(J,4);TAB(25);BA(J,5);TAB(30);BA(J,6)
)
2030NEXT
2050PRINT;TAB(5);TB(1);TAB(10);TB(2);TAB(15);TB(3);TAB
(20);TB(4);TAB(25);TB(5);TAB(30);TB(6)
2060PROCWAIT
2080PRINT"GIRLS"
2081PRINT"born before 1st September "
2082PRINT;TAB(5);YR+7;TAB(10);YR+8;TAB(15);YR+9;TAB(20)
;YR+10;TAB(25);YR+11;TAB(30);"Total"
2090FOR J=1 TO 10
2100PRINT;F$(J);TAB(5);GA(J,1);TAB(10);GA(J,2);TAB(15)
;GA(J,3);TAB(20);GA(J,4);TAB(25);GA(J,5);TAB(30);GA(J,6)
)
2110NEXT
2130PRINT;TAB(5);TG(1);TAB(10);TG(2);TAB(15);TG(3);TAB
(20);TG(4);TAB(25);TG(5);TAB(30);TG(6)
2140PROCWAIT
2150GOTO 2400
2200PRINT"BOYS"
2201PRINT"born before 1st September "
2202PRINT;TAB(5);YR+7;TAB(15);YR+8;TAB(25);YR+9;TAB(35)
;YR+10;TAB(45);YR+11;TAB(55);"Total"
2205FOR J=1 TO 10
2210PRINT;F$(J);TAB(5);B(J,1);TAB(10);B(J,2);TAB(15);B
(J,3);TAB(20);B(J,4);TAB(25);B(J,5);TAB(30);B(J,6);TAB
(35);B(J,7);TAB(40);B(J,8);TAB(45);B(J,9);TAB(50);B(J,10)
;TAB(55);B(J,11)
2230NEXT
2240PRINTTAB(5);BT(1);TAB(10);BT(2);TAB(15);BT(3);TAB
(20);BT(4);TAB(25);BT(5);TAB(30);BT(6);TAB(35);BT(7);TAB
(40);BT(8);TAB(45);BT(9);TAB(50);BT(10);TAB(55);BT(11)
2250PROCWAIT
2260PRINT"GIRLS"
2262PRINT"born before 1st September "
2264PRINT;TAB(5);YR+7;TAB(15);YR+8;TAB(25);YR+9;TAB(35)
;YR+10;TAB(45);YR+11;TAB(55);"Total"
2270FORJ=1 TO 10
2280PRINT;F$(J);TAB(5);G(J,1);TAB(10);G(J,2);TAB(15);G
(J,3);TAB(20);G(J,4);TAB(25);G(J,5);TAB(30);G(J,6);TAB
(35);G(J,7);TAB(40);G(J,8);TAB(45);G(J,9);TAB(50);G(J,10)
;TAB(55);G(J,11)
2290NEXT
2300PRINT;TAB(5);GT(1);TAB(10);GT(2);TAB(15);GT(3);TAB
(20);GT(4);TAB(25);GT(5);TAB(30);GT(6);TAB(35);GT(7);TA
B(40);GT(8);TAB(45);GT(9);TAB(50);GT(10);TAB(55);GT(11)
2310PROCWAIT
2400ENDPROC
2500DEFFPROCWAIT
2600X=GET:IF X<>32 THEN 2600
2610ENDPROC

```

## PROGRAM LISTING 2

```

OREM...SECTION7C...G.W.GALLAGHER...1984
10DIMBB(6),BC(6),BD(6),BE(6),BF(6),BG(6),BH(6),BI(6)
,BJ(6),BK(6),BL(6),BM(6),BN(6),BO(6),BP(6),BQ(6),BR(6),
BS(6),BT(6),BU(6),BV(6),BW(6),BX(6),BY(6),BZ(6)
20PRINT""What is the earliest year mentioned"
30PRINT""on the form,e.g. 61?":INPUT YR
40IF YR<60 OR YR>80 THEN 20
60number=1:F=0
70PROCfromfile
80PROCcheck
90number=number+1:IF F=1 THEN 100 ELSE 70
100PROCtotals
170FOR Z=1 TO 2
180PROCprint:PROCWAIT
190PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PR
INT:PRINT:NEXT
990MODE7:END
1000DEFFPROCcheck

```

```

1040D=1:SC=0:AR=0
1045Z$=MID$(A$,41,1):REM..0,1,2,4
1050X=VAL(MID$(A$,34,2))
1060Y=VAL(MID$(A$,32,2)):REM...MONTH
1070ZQ$=MID$(A$,29,1):REM..M OR F
1080IF X>(YR+D-1) THEN 1320
1090IF X=(YR+D-1) AND Y<9 THEN 1130
1100IF X=(YR+D-2) AND Y>8 THEN 1130
1120 GOTO 1320
1130IF ZQ$="F" THEN 1232
1132FOR I=42 TO 67 STEP 2
1134K$=MID$(A$,I,2):IF K$="MA"THEN1138
1136GOTO 1142
1138IF Z$="1" THEN BL(D)=BL(D)+1:GOTO1142
1140IF Z$="2" THEN BM(D)=BM(D)+1

```

CONTINUED OVER

```

1142IF K$="MA" THEN SC=SC+1:GOTO 1160
1144IF K$="CH" THEN SC=SC+1:GOTO 1160
1146IF K$="BI" THEN SC=SC+1:GOTO 1160
1148IF K$="FM" THEN SC=SC+1:GOTO 1160
1150IF K$="PH" THEN SC=SC+1:GOTO 1160
1152IF K$="GL" THEN SC=SC+1:GOTO 1160
1154IF K$="TD" THEN SC=SC+1:GOTO 1160
1158IF K$>" " THEN AR=AR+1
1160NEXT I
1200IF Z$="0" OR Z$="3" OR Z$="4" THEN 1216
1202IF Z$="2" THEN 1210
1204IF SC>0 AND AR=0 THEN BB(D)=BB(D)+1:GOTO 1220
1206IF SC=0 AND AR>0 THEN BD(D)=BD(D)+1:GOTO 1220
1208IF SC>0 AND AR>0 THEN BF(D)=BF(D)+1:GOTO 1220
1210IF SC>0 AND AR=0 THEN BC(D)=BC(D)+1:GOTO 1220
1212IF SC=0 AND AR>0 THEN BE(D)=BE(D)+1:GOTO 1220
1214IF SC>0 AND AR>0 THEN BG(D)=BG(D)+1:GOTO 1220
1216 IF Z$="0" THEN BI(D)=BI(D)+1:GOTO 1220
1217 IF Z$="3" THEN BJ(D)=BJ(D)+1:GOTO 1220
1218 IF Z$="4" THEN BH(D)=BH(D)+1
1220GOTO 1320
1232FOR I=42 TO 67 STEP 2
1234K$=MID$(A$,I,2):IF K$="MA" THEN 1238
1236GOTO 1242
1238IF Z$="1" THEN GL(D)=GL(D)+1:GOTO 1242
1240IF Z$="2" THEN GM(D)=GM(D)+1
1242IF K$="MA" THEN SC=SC+1:GOTO 1260
1244IF K$="CH" THEN SC=SC+1:GOTO 1260
1246IF K$="BI" THEN SC=SC+1:GOTO 1260
1248IF K$="FM" THEN SC=SC+1:GOTO 1260
1250IF K$="PH" THEN SC=SC+1:GOTO 1260
1252IF K$="GL" THEN SC=SC+1:GOTO 1260
1254IF K$="TD" THEN SC=SC+1:GOTO 1260
1258IF K$>" " THEN AR=AR+1
1260NEXT I
1300IF Z$="0" OR Z$="3" OR Z$="4" THEN 1316
1302IF Z$="2" THEN 1310
1304IF SC>0 AND AR=0 THEN GB(D)=GB(D)+1:GOTO 1320
1306IF SC=0 AND AR>0 THEN GD(D)=GD(D)+1:GOTO 1320
1308IF SC>0 AND AR>0 THEN GF(D)=GF(D)+1:GOTO 1320
1310IF SC>0 AND AR=0 THEN GC(D)=GC(D)+1:GOTO 1320
1312IF SC=0 AND AR>0 THEN GE(D)=GE(D)+1:GOTO 1320
1314IF SC>0 AND AR>0 THEN GG(D)=GG(D)+1:GOTO 1320
1316 IF Z$="0" THEN GI(D)=GI(D)+1:GOTO 1320
1317 IF Z$="3" THEN GH(D)=GH(D)+1:GOTO 1320
1318 IF Z$="4" THEN GJ(D)=GJ(D)+1
1320 D=D+1:IF D<6 THEN 1080 ELSE 1420
1420ENDPROC
1500 DEFPROCtotals
1510FOR D=1 TO 5:GK(D)=GB(D)+GC(D)+GD(D)+GE(D)+GF(D)+GG
(D)+GI(D)
1520BK(D)=BB(D)+BC(D)+BD(D)+BE(D)+BF(D)+BG(D)+BI(D)
1530NEXT
1540BB(6)=BB(1)+BB(2)+BB(3)+BB(4)+BB(5)
1550BC(6)=BC(1)+BC(2)+BC(3)+BC(4)+BC(5)
1560BD(6)=BD(1)+BD(2)+BD(3)+BD(4)+BD(5)
1570BE(6)=BE(1)+BE(2)+BE(3)+BE(4)+BE(5)
1580BF(6)=BF(1)+BF(2)+BF(3)+BF(4)+BF(5)
1590BG(6)=BG(1)+BG(2)+BG(3)+BG(4)+BG(5)
1595BH(6)=BH(1)+BH(2)+BH(3)+BH(4)+BH(5)
1600BI(6)=BI(1)+BI(2)+BI(3)+BI(4)+BI(5)
1605BJ(6)=BJ(1)+BJ(2)+BJ(3)+BJ(4)+BJ(5)

```

```

1610BK(6)=BK(1)+BK(2)+BK(3)+BK(4)+BK(5)
1620BL(6)=BL(1)+BL(2)+BL(3)+BL(4)+BL(5)
1630BM(6)=BM(1)+BM(2)+BM(3)+BM(4)+BM(5)
1640GB(6)=GB(1)+GB(2)+GB(3)+GB(4)+GB(5)
1650GC(6)=GC(1)+GC(2)+GC(3)+GC(4)+GC(5)
1660GD(6)=GD(1)+GD(2)+GD(3)+GD(4)+GD(5)
1670GE(6)=GE(1)+GE(2)+GE(3)+GE(4)+GE(5)
1680GF(6)=GF(1)+GF(2)+GF(3)+GF(4)+GF(5)
1690GG(6)=GG(1)+GG(2)+GG(3)+GG(4)+GG(5)
1695GH(6)=GH(1)+GH(2)+GH(3)+GH(4)+GH(5)
1700GI(6)=GI(1)+GI(2)+GI(3)+GI(4)+GI(5)
1705GJ(6)=GJ(1)+GJ(2)+GJ(3)+GJ(4)+GJ(5)
1710GK(6)=GK(1)+GK(2)+GK(3)+GK(4)+GK(5)
1720GL(6)=GL(1)+GL(2)+GL(3)+GL(4)+GL(5)
1730GM(6)=GM(1)+GM(2)+GM(3)+GM(4)+GM(5)
1735ENDPROC
1740DEFPROCfromfile
1745X=OPENIN("List84")
1750PTR#X=(number-1)*70
1755INPUT#X,A$
1760IF PTR#X+70>EXT#X THEN 1780 ELSE 1785
1780F=1
1785CLOSE#X
1790ENDPROC
1980DEFPROCprint
2000PRINT"BOYS"
2010PRINT"born before"
2020PRINT"1st Sept"
2025PRINT;TAB(5);"B";TAB(10);"C";TAB(15);"D";TAB(20);"
E";TAB(25);"F";TAB(30);"G";TAB(35);"H";TAB(40);"I";TAB
45);"J";TAB(50);"K";TAB(55);"L";TAB(60);"M"
2030FOR I=1 TO 5
2040PRINT;YR+I-1;TAB(5);BB(I);TAB(10);BC(I);TAB(15);BD
(I);TAB(20);BE(I);TAB(25);BF(I);TAB(30);BG(I);TAB(35);B
H(I);TAB(40);BI(I);TAB(45);BJ(I);TAB(50);BK(I);TAB(55);
BL(I);TAB(60);BM(I)
2050NEXT
2060PRINT;"TOTAL";TAB(5);BB(6);TAB(10);BC(6);TAB(15);B
D(6);TAB(20);BE(6);TAB(25);BF(6);TAB(30);BG(6);TAB(35);
BH(6);TAB(40);BI(6);TAB(45);BJ(6);TAB(50);BK(6);TAB(55);
;BL(6);TAB(60);BM(6)
2070PROCWAIT
2080PRINT"GIRLS"
2090PRINT"born before"
2100PRINT"1st Sept"
2105PRINT;TAB(5);"B";TAB(10);"C";TAB(15);"D";TAB(20);"
E";TAB(25);"F";TAB(30);"G";TAB(35);"H";TAB(40);"I";TAB
45);"J";TAB(50);"K";TAB(55);"L";TAB(60);"M"
2110FOR I=1 TO 5
2120PRINT;YR+I-1;TAB(5);GB(I);TAB(10);GC(I);TAB(15);GD
(I);TAB(20);GE(I);TAB(25);GF(I);TAB(30);GG(I);TAB(35);G
H(I);TAB(40);GI(I);TAB(45);GJ(I);TAB(50);GK(I);TAB(55);
GL(I);TAB(60);GM(I)
2130NEXT
2140PRINT;"TOTAL";TAB(5);GB(6);TAB(10);GC(6);TAB(15);G
D(6);TAB(20);GE(6);TAB(25);GF(6);TAB(30);GG(6);TAB(35);
GH(6);TAB(40);GI(6);TAB(45);GJ(6);TAB(50);GK(6);TAB(55);
GL(6);TAB(60);GM(6)
2150PROCWAIT
2160ENDPROC
2500DEFPROCWAIT
2600X=GET:IF X<>32 THEN 2600
2610ENDPROC

```

### PROGRAM LISTING 3

```

10CLS:PRINT"" "TYPE"
20PRINT"1. to add names or make a new file."
30PRINT"2. to add or change subjects."
40PRINT"3. to extract information."
50PRINT"4. to make alterations to records."
60 PRINT"5. for FORM 7A"
70 PRINT"6. for FORM 7C"

```

```

80INPUTN:IF (N-1)*(N-2)*(N-3)*(N-4)*(N-5)*(N-6)<>0 TH
EN 90 ELSE 100
90END
100DN N GOTO 110,120,130,140,150,160
110CHAIN"ADMIN1R"
120CHAIN"ADMIN2R"
130CHAIN"ADMIN3R"
140CHAIN"ADMIN4R"
150CHAIN"FORM7A"
160CHAIN"FORM7C"

```

# BBC Computers in Control

Julie Mitchell

If the brain of a robot is the microcomputer then a very important part of the system is the computer program which controls the way in which the robot and computer talk to each other.

It ought to be said straight away that you don't need to be a computer expert to be able to use a robot because the effects of the computer are so practical that it is only the practice that you need to understand.

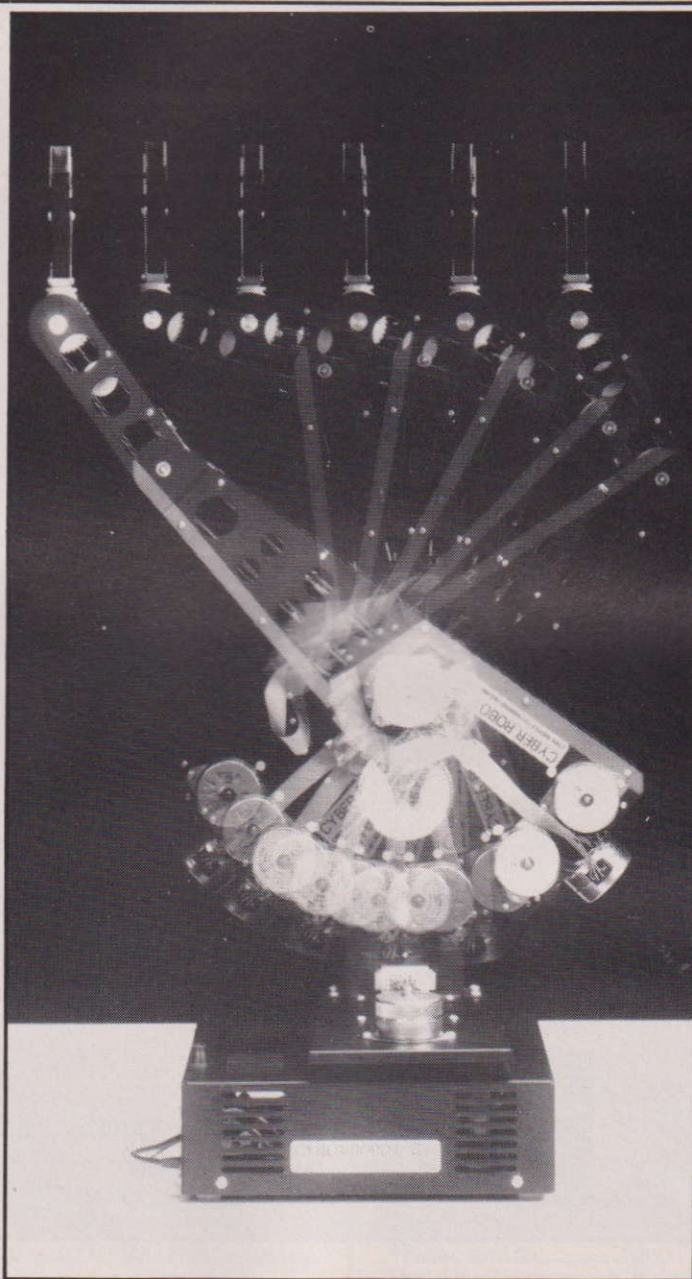
In designing a flexible robot arm or turtle it is advisable to try to avoid excessive hardware because, for example, to add vision systems to a robot arm in some cases slows the robot down to a totally unacceptable level. This explains the present day emphasis on the development of software solutions.

## COMMUNICATION CONTROL

It is possible to write a program to control a robot in almost any computer language but some will result in a better performance than others. The crucial point being that the language used to control must enable the robot to carry out tasks with the option to add conditional branches, such as small programs within larger ones. In other words the robot must be able to change its behaviour at the will of the operator.

There are three additional criteria which should be taken into account when assessing languages in controls and they are:

1. Speed of operation — a robot or turtle must be able to work at a reasonable rate because in full sized industrial robots a reduction in speed may well lead to a loss in production, making the system totally inefficient.
2. Memory — when using a small computer such as the personal computer it is important to choose a language that is economical in memory.
3. Easy to write — some language can be said to be more logical and easier to understand than others. The sinister image of complexity surrounding robotics



**Complex robotics  
needn't just be for  
computer experts.  
Simple English language  
is enough to bring your  
computer to life.**

in the past can be overcome by using educational robots such as the Cyber 310. The ideal language should enable a hierarchy of commands to be built up to provide the user with even the most complex of robot application from a very simple framework. To be honest there is a need for a language that is so user friendly that it can be programmed in English!

There have in fact been many different computer languages designed especially for control applications. BASIC is probably the most familiar language and it is quite possible to use BASIC as the foundation of a robot control language.

## ROBOTIC LINGUISTICS

Basic is an ideal beginners' language. However, for many applications and in fact to emulate all the moves of an industrial robot, BASIC is considered too slow in operation and it is not very economical in memory.

ASSEMBLER has the major advantage of being fast in operation and economical in memory. It is, however, almost impossible to understand and probably even more difficult to write. Perhaps a better use of ASSEMBLER is to write small parts of a larger program, the majority of which should be written in another language.

Cyber Robotics Ltd of Cambridge have chosen a control language using FORTH because it is compact and is 20 to 40 times faster than BASIC. It is only 17% as efficient as machine code but the advantage comes from care of programming without any speed penalty. FORTH is slightly more difficult to learn than BASIC but Cyber Robotics have produced an extension of FORTH, called ROBOFORTH for use with the Cyber 310 educational robot. ROBOFORTH has overcome the problem of the complexity of FORTH but has still retained all the advantages by using

**CONTINUED OVER**

simple English for all commands  
e.g. to move the shoulder 500  
steps, print:

Shoulder 500 Move

Such facilities bring complex  
robotics into the reach of every  
layman. An example of program-  
ming a robot move — to re-  
orientate an object (in this case a  
4mm sq. brick).

#### AUTOHOME

Part of Cyber Robotics new  
application software pack  
which in a computer con-  
trolled home or datum po-  
sition allows exact known start  
position for any programs.

#### START NEW DEMO

##### SHOULDER

This selects the shoulder to  
move.

800 move

The shoulder moves down  
800 steps

##### ELBOW

Elbow selected

300 move

Elbow moves down 300 steps

##### WRIST

300 move

Wrist moves 300 steps

##### BASE 50 MOVE

The base swivels to position  
the gripper over the object.

- 5 MOVE

Too far! Back a bit

##### SHOULDER 50 MOVE

Move shoulder down

##### WRIST - 80 MOVE

Wrist was in the wrong place,  
adjust position. Now it is  
ready to pick up.

##### SHOULDER - 50 MOVE

Raise shoulder so that the  
grripper is poised above the  
object.

##### LEARN

Learn the position. When the  
robot program is played back  
the gripper may come into a

position at an angle and  
knock into the object, so the  
position immediately above  
the object must be logged  
first.

##### SHOULDER 50 MOVE

Lower gripper round object

##### 200 GRIP

Grip object

##### 50 GRIP

LEARN

150 TWIST

Turn object round

LEARN

SHOULDER - 50 MOVE

Lift object up

LEARN

150 TWIST

Turn object round

LEARN

SHOULDER 50 MOVE

Lower object down

LEARN

UNGRIP

Let go of object

SHOULDER - 50 MOVE

UNTWIST LEARN

Raise gripper and unwrist it

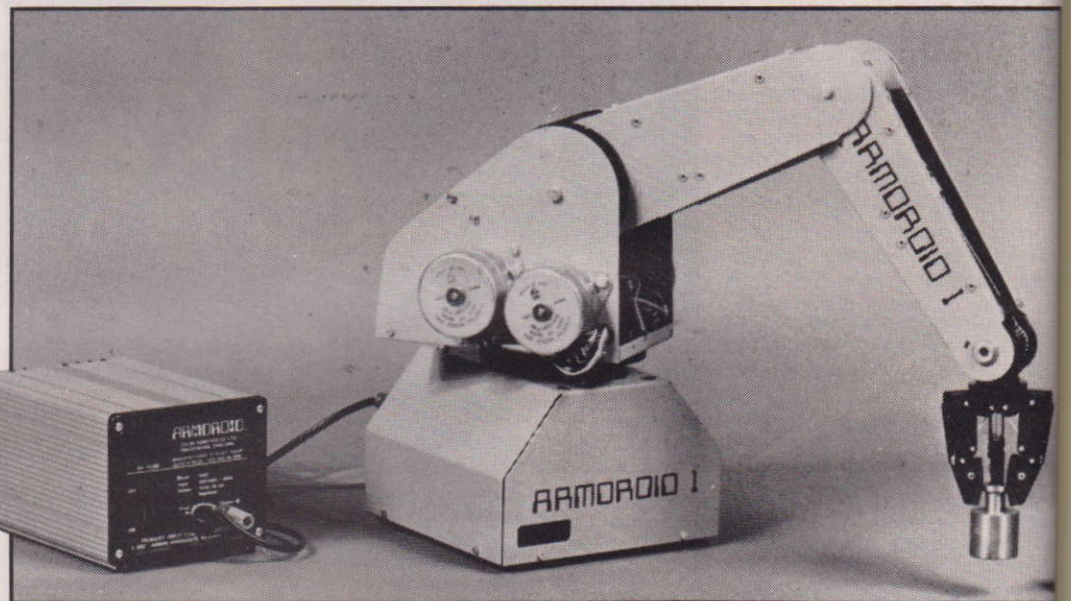
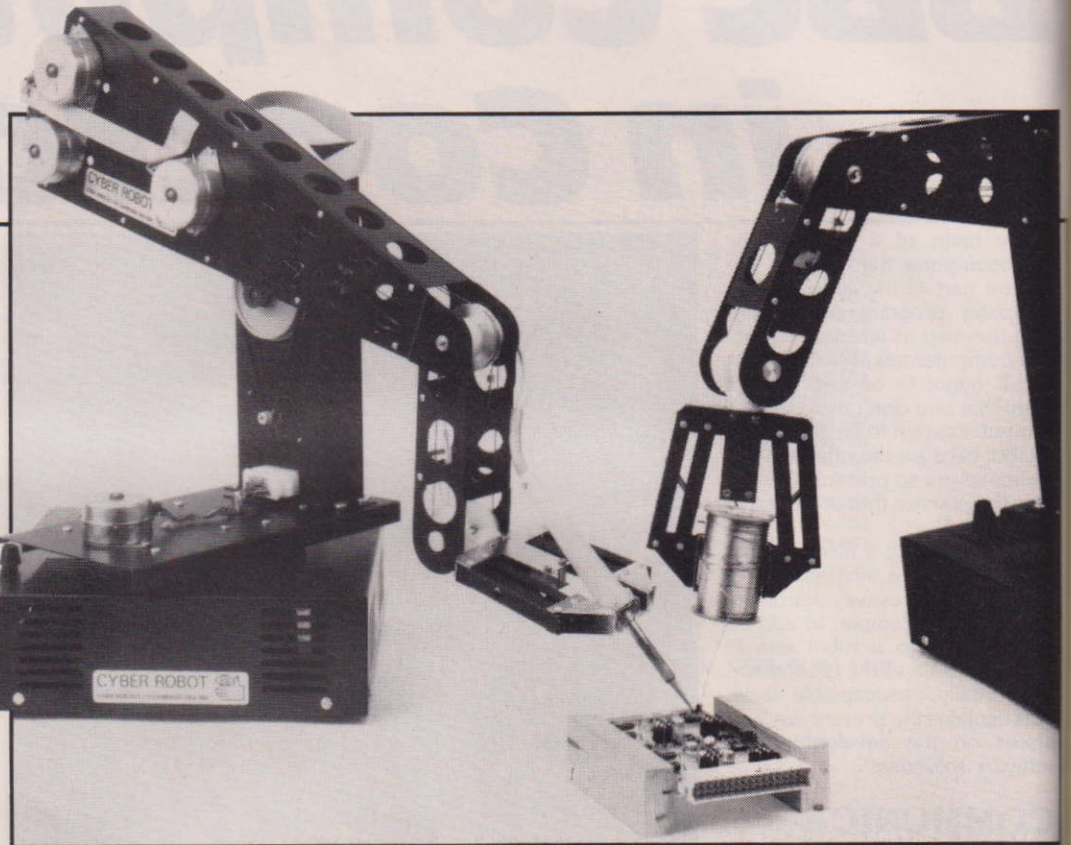
HOME LEARN

Relieve arm to rest position

Program complete

RUN

Do it all again



# YES!

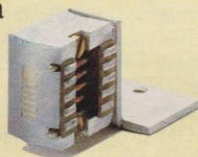


## A 100k BBC-drive for £99 + VAT

We've done it! We've built a storage system for your BBC Micro with the power and convenience of a floppy disk drive, at a fraction of the price. Interface to the BBC costs £26 + VAT and runs up to 8 drives.

### PHLOOPY's special secret

PHLOOPY does not record on a disk, but on a loop of quarter-inch tape contained in a rugged interchangeable cartridge.



The heart of PHLOOPY is a unique "byte-wide" magnetic head, that gives it its speed by recording nine tracks across the tape. Typically, you can access a file in only 3 or 4 seconds.

If you're used to waiting for a cassette tape to bundle programs into your BBC, you'll be amazed at PHLOOPY's performance – up to 100 times faster.

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PHLOOPY's own software makes it respond to standard BBC filing system and Basic commands. Programs written to run on disk or cassette should run on PHLOOPY without problem. And because your PHLOOPY drive contains its own

microprocessor – a second computer which does most of the hard work – it puts very little load on the BBC. The on-board computer also checks and automatically corrects any read errors.

### Your PHLOOPY Library

PHLOOPY cartridges hold a full 100k of data. You can buy blank cartridges for £3.75 each plus VAT. Many BBC programs will be available on PHLOOPY.



**Phi Mag Systems Ltd.** PO Box 21,  
Falmouth, Cornwall TR11 3TD Tel: (0326) 76040

#### Order Form

- Please send me further details about the PHLOOPY 100k data storage system for the BBC Model B.
  - Please send me \_\_\_\_\_ (qty) PHLOOPY starter pack(s) for my BBC Model B microcomputer, including PHLOOPY drive, BBC interface, leads, connections, operating system in firmware, manual, and two PHLOOPY 100k cartridges, at £147.75 each including VAT, postage and packing. Amount £ \_\_\_\_\_
  - Please send me \_\_\_\_\_ (qty) packs of 5 PHLOOPY cartridges at £19.75 including VAT, postage and packing. Amount £ \_\_\_\_\_
- I enclose a cheque/PO for £ \_\_\_\_\_ OR Please debit my  
Access card Number: \_\_\_\_\_  
Your order will be acknowledged within 10 days, giving a delivery date.  
Name \_\_\_\_\_  
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Town: \_\_\_\_\_ Post code \_\_\_\_\_  
Send this coupon to: Phi Mag Systems Ltd, PO Box 21, Falmouth,  
Cornwall TR11 3TD. Telephone: Falmouth (0326) 76040.  
14 day money-back option.

A&B

# Strictly Sidewise

Clive Grace

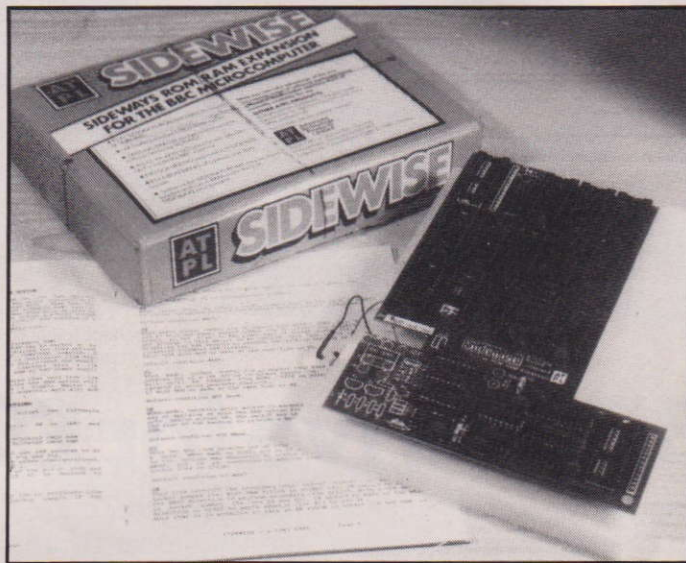
In the March/April issue of *A&B Computing* there were a number of ROM Boards in an overall look at the state of this rapidly growing corner of the software market. In reality these ROMs, or more commonly EPROMs, provide a comfortable environment for a program to reside, there are Word Processors, Languages, Data Bases and Toolkits. The ROM has a few distinct advantages such as being readily available in the computer's memory and more importantly making use of memory which is not strictly speaking usable for anything else, thus we can take the example of a word processor in ROM and compare it with a program in RAM where the user has the disadvantage of loading the program, which is cumbersome, and which also takes up space which the ROM version would use for common storage.

To cater for the increase in Firmware (software in a ROM) there have been a number of ROM boards produced which increase the BBC micro's initial four sockets, to anything up to the full 16 allowed by the 1.2 OS, one is already occupied with the BASIC ROM and if the user wishes to use disc drives then an additional socket is used. There are a lot of boards to choose from and some have different features as could be seen in the previous article but a few boards had features which made them more than just ROM boards and one of them was the ATPL 'Sidewise' ROM board.

## HIGHER STANDARDS

The ATPL (Advanced Technology Products Limited) board is manufactured to a higher standard than all of the other boards I have as yet seen, it can be bought from many of the reputable computer specialists and it is endorsed by Computer Concepts in their advertising, it can be ordered through the post and it is ruggedly packaged, sandwiched between two hefty slabs of foam, the delivery is recorded for extra security and although the box had suffered

## A sidelong glance at the ROM board that gives you just that bit more.

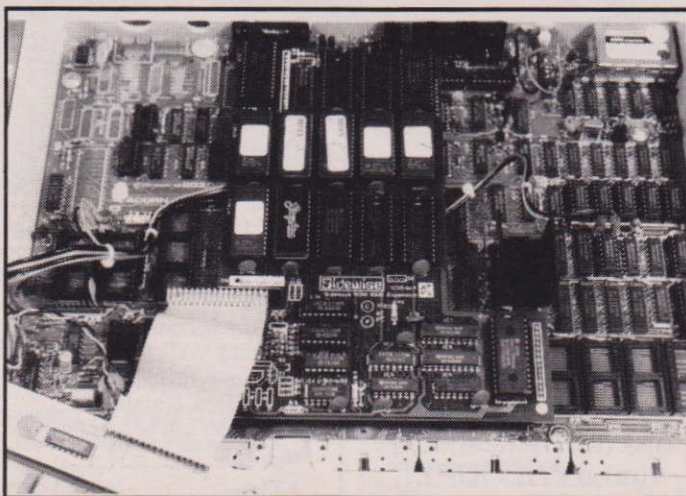


*Sidewise arrives.*

somewhat, the board itself was not even moved from its casing.

The board comes complete with a 10 page manual which is type written and in reduced print which is readable and clear; The manual is divided into six sections going from a general introduction on sideways ROMs and the ROM filing system, through to fit-

ting the board and selecting various start up options. There are also diagrams to help the user fit Sidewise. The manual also deals with the Battery backed up RAM option which users can purchase with the board or can buy as a kit and have fitted. This opens some exciting doors in ROM program development.



*ROM congestion is a thing of the past.*

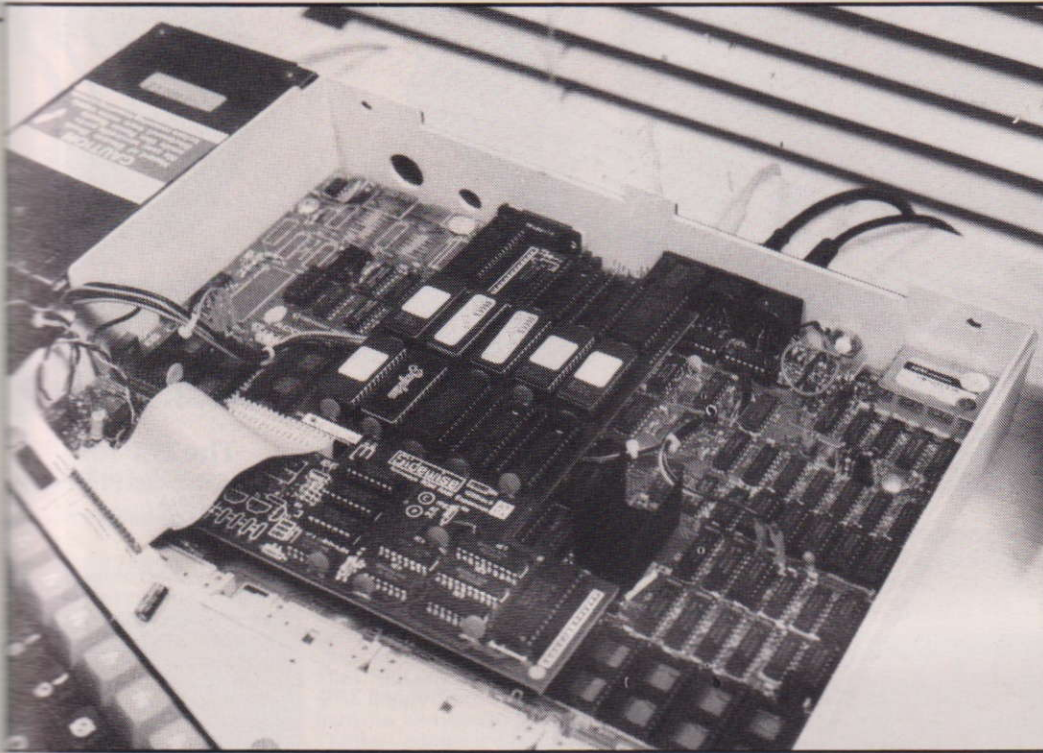
## FITTING SIDEWISE

Sidewise is very easy to fit as there is no soldering to be made and if like me, you found that you were swapping ROM's a lot before Sidewise then you will be familiar with the procedure.

To fit Sidewise, the user must first take out the BASIC ROM and the MOS, the MOS can be placed in the socket in the lowest right hand side, this is clearly marked and there can be no confusion as to where it must go. The BASIC ROM must go in socket 14 (in the centre bottom row); finally the Analogue to Digital Converter chip must be removed and placed in the socket set aside on the top left of the board, that is basically it. The user must then connect two flying leads to the board and, then making sure that the pins going down underneath the board centre in on the A.D.C. socket on the BBC's main board and into the socket where the MOS used to go, firmly pushing the board into place will fit Sidewise securely in place.

I did however experience a slight problem when fitting it to the main BBC board, the wires which are used to distribute power to various parts of the PCB are sealed in a thick plastic covering for insulation this makes the pins higher than Sidewise when in their normal position, and pushing the board further down is likely to either shear the cables or damage the board. I found that by bending the cable connectors so they are roughly parallel with the board (ie bend the connecting pins as near to 90 degrees as possible) this should leave plenty of space for both Sidewise and any connecting cables on the board. There are full instructions with the manual.

All that remains is for the user to fit the spare sockets provided on the board (not forgetting that the four vacated sockets can still be used) and the user can replace the BBC's lid. If anything should go wrong (I mislocated one of the legs on my first attempt) then the manual gives very helpful hints and also gives a



*Sideways rests neatly on the BBC Micro and is held firmly in place by connecting pins.*

checklist to go through if the board should not behave as expected. The board should sit comfortably on the BBC's main PCB evenly and parallel with the A.D.C. socket and the MOS socket. It is held further in place by a small plastic bump which sits on the board for added stability. The 1.2 OS treats Sideways as ROM sockets 4 to 14

and the BBC's original sockets as 0 to 3, they can be called up by simply using the paged call for that ROM (ie \*WORD, \*PASCAL etc) or can be addressed via \*FX142,n (where n is the number of the ROM socket requested). If the user does not feel confident enough to fit Sideways themselves then a workshop or an approved Acorn

service dealer can help for a fee. The board is very easy to fit although it can be harrowing for a first time user. The board is very sturdy and should take a lot of abuse but if you are in any doubt as to your abilities in fitting Sideways then I would strongly recommend a qualified engineer to fit it.

## SIDEWAYS RAM

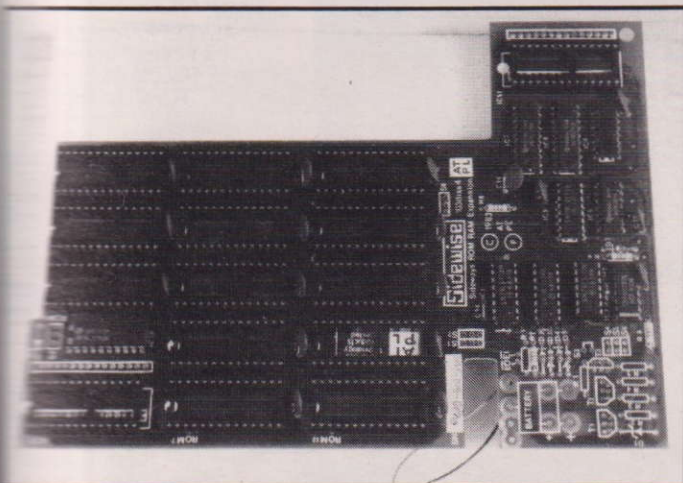
The last section of the manual is for the user who has a sideways RAM option fitted onto the board (every board has the ability to hold two 8K RAM chips, they simply lack the components) and this feature will become very useful when, God forbid, you should run out of ROM sockets on Sideways.

The Sideways RAM option allows the user to develop programs in RAM which behaves as if it is a paged ROM and allows the user to write software which may be EPROMed assuming that it is language independent (ie assembler) but this can also be used for those who have no ROM space left because the ROMs can

be transferred to disc and then moved over into RAM by simply \*LOADing the file into 8000 which is the start address for paged ROMs. The user can have a limitless supply of ROMs on disc. Of course this opens the door to Firmware pirating as ROMs cannot be protected as well as software. This is a shame but it does give the user peace of mind that there need be no worry about the fact that they might one day run out of sockets. Using discs with the RAM option is more likely because of the difficulties experienced with loading tapes and in every way the RAM option behaves like a ROM. Back it up with the battery and the user has a completely separate non volatile 16K of memory to play with, so a program undergoing development can be kept safely or even your favourite game can be moved up!! The user can use the RAM as a printer buffer storage area if they take the trouble to write the driving software, thus saving the user the money involved in buying a printer buffer, this is of course not an easy thing to write but no doubt an enterprising programmer will come out with one.

## CONCLUSIONS

Sideways is truly a remarkable product, it offers features which other boards cannot match and at a price which is affordable and in my mind extremely good value for money: the standard board is sold for around £38.00 plus VAT and the RAM option will cost around £100.00 more. For the facilities it offers it is excellent value for money. The mere fact that it extends the ROM space from four to the full sixteen sockets available under current software is enough for many, but the addition of Sideways RAM with Battery Back-up gives the user undreamed of possibilities. Coupled with the fact that the board is made to such a high standard, is reason enough to make this deservedly a market leader. For information ATPL can be contacted at: Station Road, Clowne, Chesterfield, Derbyshire, S43 4AB. (0246) 811 585.



*The sideways board is manufactured to a high standard.*

# Unicorn. Five new Here's the fun

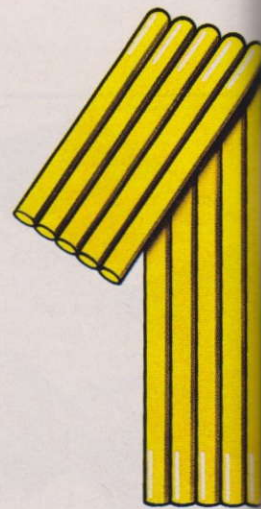


The new UNICORN range from TORCH Computers gives the enthusiast and professional user a choice of upgrades which takes the BBC Model B Micro to the ultimate height of performance.

The result of TORCH'S total commitment to the BBC Micro is the only complete range of high performance hardware available. Offering every BBC Micro owner five new upgrade channels, UNICORN will transform your BBC into a fully communicating workstation, a CP/M® compatible business machine or the ultimate in high powered 32-bit data processing.

At the top of the range, THE UNICORN, offers the power and sophistication of System III UNIX® whilst other channels make available the flexibility of languages such as FORTRAN, PASCAL, BCPL and COBOL. All models, with the exception of the HDP240, provide BBCBASIC (Z80) on the Z80 rather than the Model B's 6502.

Tune in to the Channel that most suits your requirements. Whichever level you choose you can be sure of a system with infinitely expandable potential for a confident future in the world of computing.



## The ZEP 100

- Z80 Extension Processor
- 4MHz Z80A
- 64K RAM
- 24K ROM

The object of any upgrade is to improve processing ability and increase data storage capacity. The UNICORN ZEP100 is the first stage upgrade which opens channels into the world of serious computing.

The ZEP100 is the proven 8 bit second processor for BBC Model B micro. A Z80 extension processor which enables the use of the well established CPN operating system, giving access to the vast range of applications programs and languages available for all CP/M micros. When fitted to a BBC model microcomputer with compatible quality disc drives it provides a complete business or scientific computer which can run large applications programs or use advanced languages, with the ability to switch back to standard BBC programs any time.

Any ZEP100 can be linked, via the Econet® option on the BBC, to a network of other TORCH computers to provide a workstation running on TORCH Full TORCH operating systems software is provided to allow access to information anywhere on the network, or to communicate with other computers.

The 64K ZEP100 supplied with full software support including word processing, spreadsheets, database and utilities. **The ZEP100 around £299 (ex. VAT).**



# Channels for the BBC. programme.



## The ZDP 240

● 8MHz Z80A ● 64K RAM  
● ROM  
● Double sided 400K  
flop disc  
● Independent integral  
power supply



The ZDP 240 (Torch Z80 Disc Pack) is the proven choice for the BBC Model B micro-computer. Offering the use of more powerful and flexible languages such as Pascal, BCPL and Cobol, it provides 800K of disc storage plus a Z80 processor with 64K RAM and TORCH's own CP/M® compatible operating system based in ROM. This advanced design means that almost all of the 64K RAM provided on the Z80 board is available for programming use - an option no other BBC micro can offer.

If your BBC micro has the option, there is a further choice the ZDP240 can offer. TORCHNET can link together up to 16 Model B's on a local network, so for enthusiasts, Schools it is a simple and easy way to achieve networking.

The discs can be used for use under the Acorn DFS system for CP/M® programs and data. A comprehensive software package is provided with the disc pack. It includes word and data processing, spreadsheet program, along with utility programs and manuals. The TORCH Z80 Disc pack is recommended by the CCTA for educational use. The ZDP 240 - around £699 (ex. VAT).

## The HDP 240

- 20Mbyte hard disc Winchester
- Double sided 400K floppy disc
- Integral power supply

For users who need much more storage capacity than is available on floppy discs and who require the large speed gains that a Winchester hard disc provides, the third new channel is now available. The UNICORN HDP240 combines a 400K floppy disc drive with a 20Mb hard disc and its associated controller. The pack connects directly to the disc and 1MHz bus sockets on the BBC Model B.

In conjunction with a ZEP100, it provides a powerful business computer for running CP/M® programs with large amounts of data. The floppy disc can be used for storage with the Acorn DFS system, and both discs can be used by other TORCH systems on the TORCHNET local area network. The HDP240 - around £1995 (ex. VAT).



## The HDP68K

- 8MHz MC68000 ● 6MHz Z80B
- 256K RAM (68000)
- 64K RAM (Z80)
- 20 Mbyte hard disc Winchester
- Double sided 400K floppy disc
- Integral power supply

The fourth channel in the UNICORN range is for users who need the extra processing power of a 68000 32 bit processor, as well as the Z80 running standard software. The UNICORN HDP68K provides the ultimate in performance, offering an extra 256K RAM and a 68000 processor running at 8 million cycles per second. It also contains a Z80 processor to allow the running of existing TORCH software.

The HDP68K - around £2495 (ex. VAT).

## The Unicorn

Spec. as HDP68K PLUS UNIX® operating system.

UNIX® System III is the recognised operating system of the '80's. A very powerful and sophisticated multi-tasking system, it includes a vast library of utility programmes.

The fifth channel and top of the range, THE UNICORN, puts UNIX® within reach of the individual user, at a price unmatched by any other UNIX® systems, by combining the reliability of the BBC micro with advanced technology from TORCH Computers.

TORCH UNIX operates under the network operating system. Using UNICORN products, a low-cost network of BBC Micros can be configured to offer the most complete range of educational computing facilities available anywhere.

Other facilities available include UCSDp-System, LISP, FORTH, PILOT and PROLOG. The UNICORN - around £2895 (ex. VAT).

# UNICORN

## Open channels for the BBC micro.

To: Torch Computers Ltd., Abberley House,  
Great Shelford, Cambridge CB2 5LQ.  
Telephone: Cambridge (0223) 841000.

Please send further information on the UNICORN  
range plus your FREE 1984 Software Catalogue.

Name

Address

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# TORCH

COMPUTERS

CP/M is a registered trademark of Digital Research Inc.  
Econet is a registered trademark of Acorn Computers Ltd.  
Unix is a registered trademark of Bell Telephone Laboratories Inc.

UK version Model B necessary.  
Disc interfaces are necessary for use with the Unicorn range.

Text and Graphics provided by BBC Model B.  
Keyboard provided by BBC Model B.

# Mailsort

Dear Editor

Here is a procedure that can be used in any mode. It "draws" a tick or a cross according to whether the answer to a problem was correct (A is TRUE or A = -1) or incorrect (A is FALSE or A = 0). In graphics modes the symbol may be placed in the bottom righthand corner of either the graphics window (W\$ = "G") or the text window (W\$ = "T"). In text modes it will be placed in the bottom righthand corner of the text window (which is the whole screen in teletext mode).

The procedure ascertains the mode of the calling program for itself and then takes suitable action. I have not so far encountered any published procedure which does this. No user-defined characters are used in case these are required elsewhere and no variables outside the procedure are altered.

Yours faithfully  
Mary E. Clayton  
Pitstone  
Beds.



## A&B readers' personal printout of programs and opinion.

Dear Editor

In the March/April issue of **A&B** you published an article on ROM expansion boards.

Very much on the strength of that article, I subsequently purchased an ATPL Sidewise ROM expansion board — this being recommended by you. However, I had a somewhat unfortunate experience in fitting the board, and thought that I would write to you so that a warning could be passed-on to your readers.

When you come to install the ATPL board, there are two flying leads from the BBC Micro's power-pack to the main board, DIRECTLY BENEATH the ATPL board's installed position. As these two leads project up about an inch or so, it is necessary to bend them flat.

Unfortunately, as I was to discover, these two leads are joined to the main board by very weak plugs. In my case the inevitable happened, and I had to take my BBC micro to a dealer to be repaired — at some significant expense and inconvenience.

I feel that you ought to draw your readers' attention to this potential problem. Advertising for the ATPL board makes it appear as though fitting the board is simplicity itself. It is — PROVIDING that the two power leads on the BBC micro don't suffer. If the leads are damaged, a lot of the benefits of the ATPL board begin to look rather pale.

I know that other people have damaged these leads, so it is not just my clumsiness.

Having said the above, I find the ATPL board to be fine in use and am otherwise perfectly happy with it.

Yours faithfully  
E. Nicholl  
Stockton-on-Tees  
Cleveland

**ATPL are aware of the problem caused by the protruding leads and the new version of the manual has instructions in it detailing how to bend them out of the way. In the meantime it seems that some people have suf-**

fered through being left in the dark. Now purchasers of the board face a new problem; Acorn are using new tougher plastic shielding which cannot be bent and will therefore have to be cut before bending. Don't worry though, ATPL are putting an instruction sheet in their manuals to explain how to go about it.

Dear Editor

I would like to point out some errors in Mr. Lucas's "Death in Poglovla" adventure game.

1. The map references after 'on a narrow footpath towards the forest' on line 2090 should read 0,0,17,19. As listed the player would find him/himself back in the high street not in the forest.

2. Although there are locations in the data listing for areas in the swimming baths, Mr. Lucas has not allowed us the ability to get into and out of the baths. Therefore the following lines should be added.

```
1055 IF P% = 12 THEN PRINT
X$ (27):P% = 14:K = 1:END-
PROC
1025 IF P% = 59 THEN PRINT
X$(27):P% = 12:K = 1:END-
PROC
```

10 MODE 7

20 PROCsym("G",0)

```
10010 DEF PROCsym(W$,A):REM A tick or cross is drawn in the bottom r.h. corner of either the screen (mode 7), or the graphics window(W$<>"G"). If A=-1(true) a tick is drawn, if A=0(false) a cross.
```

```
10020 REM LOCAL X,Y,G,H: REM Nothing outside the procedure is altered.
```

```
10030 X=?&30A-?&308:REM X holds the rightmost column of the text window.
```

```
10040 Y=?&309-?&30B:REM Y holds the lowest line of the text window.
```

```
10050 G=(?&305*256+?&304)*2^(?&355 MOD 3+1):REM G holds the righthand edge of the graphics window.
```

```
10060 H=4*(?&303*256+?&302):REM H holds the bottom edge of the graphics window.
```

```
10070 IF ?&355 <> 7 10080 ELSE IF A PRINT TAB(X-3,Y-1);CHR$(147);CHR$(100);CHR$(38
```

```
);TAB(X-1,Y-2);CHR$(147);CHR$(56); ELSE PRINT TAB(X-3,Y-2);CHR$(145);CHR$(34);CHR$(100);CHR$(38);TAB(X-3,Y-1);CHR$(145);CHR$(40);CHR$(33);CHR$(41);:REM Mode 7 10080 IF ?&355=7 THEN 10100 ELSE IF ?&355=3 OR ?&355=6 OR W$<>"G" THEN 10090 ELSE IF A VDU25,4,G-80;H+32;25,6,G-64;H;25,6,G;H+96; ELSE VDU25,4,G-64,H+64;25,6,G;H;25,4,G;H+64;25,6,G-64;H;:REM Draw symbol in graphics window.
```

```
10090 IF W$="G" AND ?&355<>3 AND ?&355<>6 THEN 10100 ELSE IF A PRINT TAB(X-3,Y);"/";TAB(X-1,Y-1);"/";TAB(X,Y-2);"/" ELSE PRINT TAB(X-3,Y-3);"\";TAB(X-2,Y-2);"\";TAB(X-2,Y-1);"/";TAB(X-3,Y);"/";:REM Draw symbol in text window.
```

```
10100 ENDPROC:REM Symbol has been drawn by either line 10070,10080, or 10090 according to the mode and the setting of W$.
```

Once in the swimming baths Mr. Lucas appears to have got his P%'s mixed up. I suggest the following would sort the matter out:

```
1120 IF P% = 14 THEN PRINT
" S P L A S H !!! " :
SOUND0, -15, 190, 10 : P% =
59 : K = 1 : ENDPROC
```

change 1130 DEFPROCjump to  
1115 DEFPROCjump

On the credit side, I tried this "Puss in Boots" program with great success.

Yours faithfully  
R.P. Merrell  
Shotgate  
Essex

To the editor of **A&B Computing**.

I liked both the Epson Colour dump in your Jan/Feb issue and the Disc Menu program in the March/April issue.

Unfortunately I encountered a few "bugs" which are worth mentioning. Epson Colour dump: In the suggested modification for Disc systems + Basic 2 replace the suggested line 1910 by 1910 OSCLI "SAVE CDUMP" + STR\$ HIMEM + " + STR\$ ~O% + " + STR\$ ~ relocate % + " + STR\$ ~relocate %

Disc Menu/the PROC-check doesn't work, because of the variable "offset%" in PROCgetfilenames, introduced to eliminate the "MENU" and "BOOT" from the menu. The execution addresses are not corrected!

To overcome this problem there are two solutions: 1) The easiest way is eliminating the "offset" idea, thus modify

```
680 fileno% = ?&F05/8
710 PROCpeek(&EOO + count% * 8, &20)
```

2) The "offset" idea makes the menu more attractive. To store the execution addresses the array exec%(count%) may help. The program modifications are:

```
DEFPROCgetfilenames
690 DIM file$(fileno%), dir$(fileno%), exec$(fileno%)
```

```
755 exec%(count%) =
?(&F03 + (count% + offset%) * 8)
```

```
DEFPROCcheck
430 IF exec%(reply%) = 680
CHAIN dir$(reply%) + ".
" + file$(reply%)
```

The menu shows some dummy menu options so:

```
260 FOR count% = 1 TO
fileno% - offset%
270 IF count% / 2 = INT
(count% / 2) THEN PRINTTAB
(23) : ELSE IF (fileno% - offset%
17) PRINT TAB(4) : ELSE PRINT
TAB(4) :
```

```
680 fileno% = ?&F05/8 offset %
The variable no% in line
420 is out of place:
```

```
420 DEFPROCcheck(reply%)
```

It is very easy to use the program with a disc without the menu program:

- 1) LOAD "MENU"
- 2) Enter your disc
- 3) \*LOAD" (you get the error message "No such file")
- 4) RUN

In this way you can modify the program and use it for double-sided discs!

Sincerely yours  
Wouter Kokman  
V.Hallstaat 13  
2613 ck Delft Holland

Dear Editor

I am sure I am not the only BBC computer user whose addictive hobby has been interrupted by burglary and theft, and it occurs to me that you could perform a useful service by publishing a list of stolen equipment, with serial numbers. This could set honest dealers and users on their guard when offered second hand equipment, and possibly lead to the conviction of thieves and others handling stolen property.

My experience is conceivably a warning to other computer users, as only micro related equipment was stolen. I have to ask myself whether I have talked about the equipment to any strangers who could have taken a dishonest fancy to it.

I do not wish to risk having my replacement equipment stolen, so I ask you not to publish my name and address. A list of the items stolen from my home on March 7 is attached.

Keep up the good work in the magazine. The school database project and your many reviews I find particularly useful.



Thanks for your suggestion. Naturally A&B would like to help so here are the items of equipment stolen and the serial numbers: BBC Model B computer, 1.2 OS, serial number 105521. Shinwa CP80 printer, with cable, serial number 5002853. Ferguson TX colour television, grey cabinet, model 37140, 14", serial number G104205. Sony TCS300 portable cassette recorder with rechargeable batteries, serial no. 98274. Tandata TD110 Prestel adapter, serial number 29135.

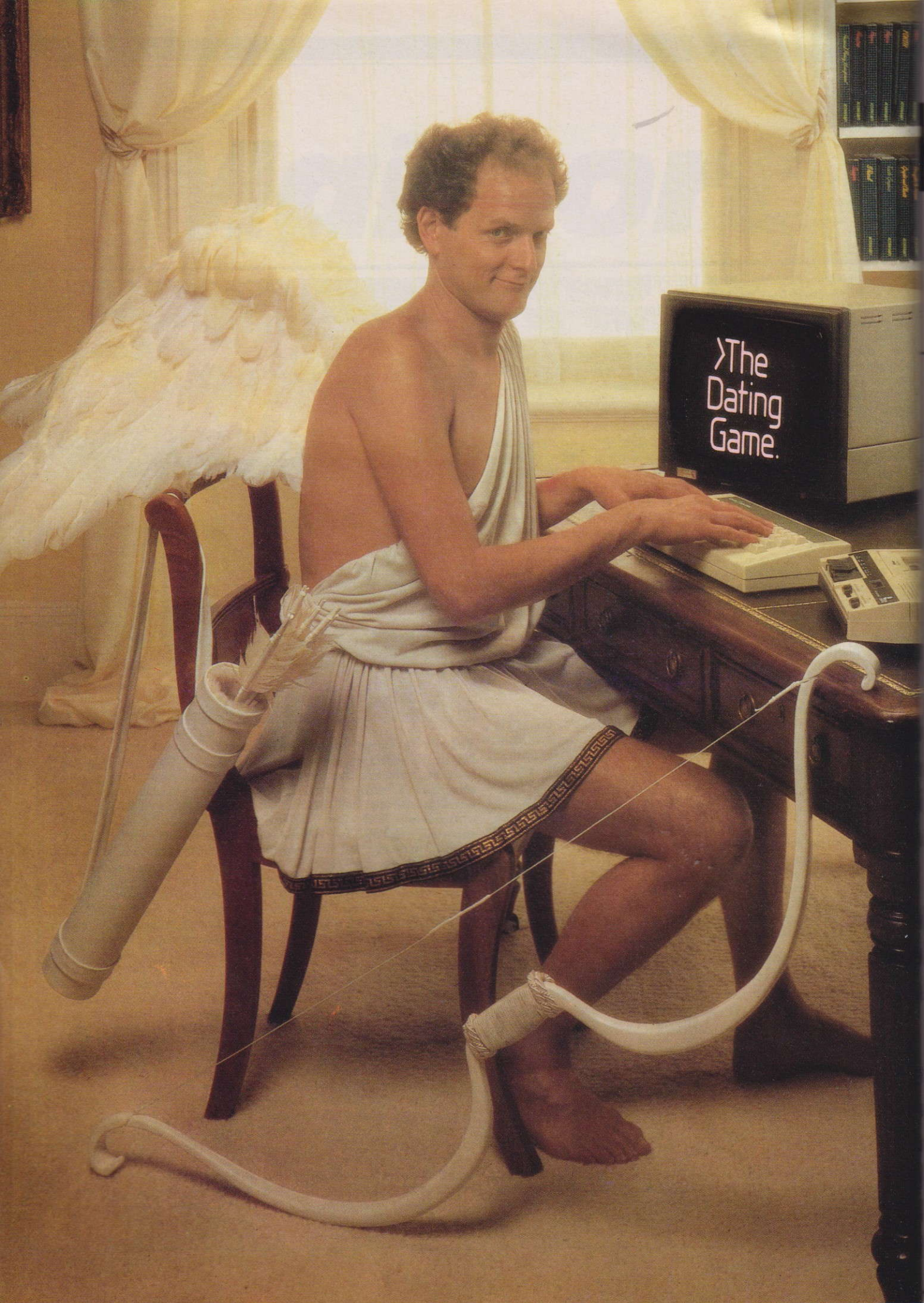
Dear Editor

I am intending to purchase a BBC Micro shortly but am confused by the different operating systems that your magazine mentions. Could you please tell me which version of the O.S. I would get with a new machine and also which version of BASIC. Secondly is it possible to get back copies of **A&B Computing**?

Yours faithfully  
S.J.R. Davies  
Woolwich  
London

Thank you for your letter to A&B Mr. Davies. The BBC Micro has now been through three stages of evolution with its operating system. Early machines had OS 0.1. This lacked many of the features that were promised by Acorn and so an upgrade OS 1.0 was issued. This is the full specification which Acorn promised to the BBC and allows you to use most of the add-ons that you would want. The latest OS is the 1.2. It is rare to find a piece of software which will only work with 1.2; most work with 1.0 or greater. Some will only work with 0.1. This is to do with a trick in accessing the keyboard scan, and some will not work with 0.1 if it uses the new features.

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# The Electron has added even more strings to its bow.

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Alternatively, you can send off for the Electron catalogue and order through the post by writing to Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Tel: 0933 79300.

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# Modem Operandi

Jeremy E San

In the growing world of modern computers, people have now realised that their digital-toys are little more than pocket calculators unless they can access large powerful mainframes, or can retrieve information from on-line storage areas, such as Prestel. Real number-crunching computer POWER simply does not fit into a home computer... well, not YET anyway! But a puny microcomputer can still have 'access' to that power; by communicating via phone-lines to a neighbourly mainframe. Also, there are many new databases springing up throughout the world; such as Prestel, Knowledge Index, the Source, Compuserve. All these systems cater for the microcomputer user with a vast amount of on-line information.

Your computer has neither the ability or knowledge to access a distant system, thus you will need two things to get your communications underway: a Modem, and some Terminal Software. 'Modem' comes from the words 'MODulate' and 'DEModulate'. It is simply a device that will accept serial signals emanating from the computer, and transmit them as audible pulses into the phone system. 'Terminal Software' is a collective name for special programs that allow communication with different types of modems and systems. Some of these 'emulate' other existing machines, while others are 'dumb'. Dumb Terminals merely transmit and receive data; they have no intelligent functions of their own.

There are many different standards for the transmission of data; V21 and V23 being the most popular in Britain. V21 is a 300 baud (30 characters a second) standard where data can both be transmitted and received at 300 baud simultaneously, whereas V23 is a special case in that data is received at 1200 baud, but transmitted at 75 baud; useful for information-retrieval systems because the large majority of dataflow will be TO the user, and thus a fast speed is desirable. This transmission rate is commonly known as the 'PRESTEL' standard, since that is where it is

**Dial into the outside world with a little help from a modem and some terminal software. The communications era is just beginning.**



Acorn Prestel Adaptor: Good Value

most widely used.

## WIDE MODEM RANGE

Modems are available in all sorts of shapes and sizes. Prices range from around £50 for a 'cheap-and-cheerful' one, to upwards of £500 for an 'intelligent modem'. The fifty-pound types usually only accommodate a single standard; eg: 300 baud, but the more

expensive modems have switches allowing them to work at many different speeds and frequencies. Some of the more expensive modems are able to 'autodial' — This is a feature allowing the modem to communicate automatically with a 'host computer'; thus the user need not even wiggle their digits on a rotary dial! (Gettin' lazy in our old age?) Anyone who has seen the film 'Wargames' will realise that autodialling has some obvious

advantages. A thought springs to mind of some teenager-hacker leaving his computer dialling all the computers in the area until one replies: 'Shall we play a game?'

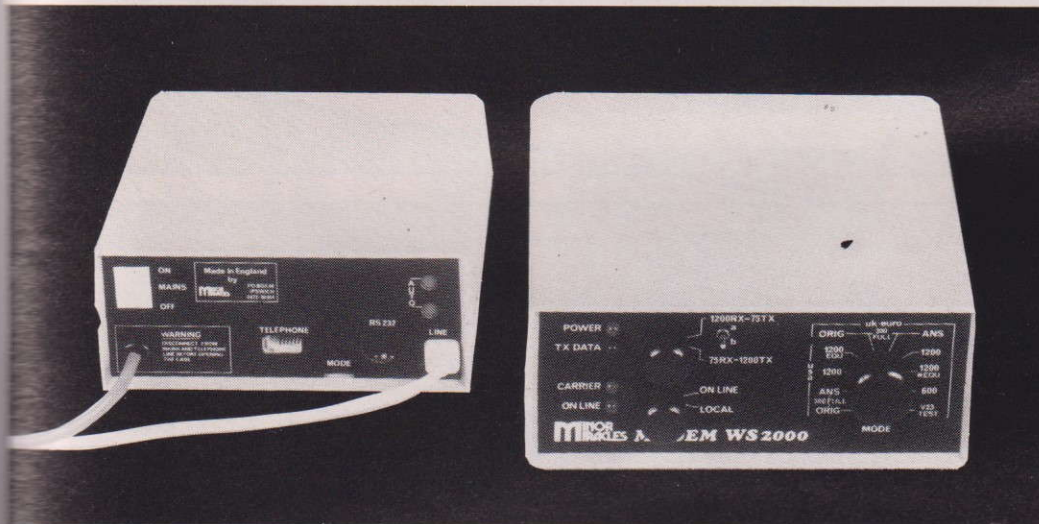
Another feature often found on the higher quality modems is 'Autoanswer'. This allows the computer to receive incoming computer-calls from other 'hackers' thus allowing your

system to act as a message centre or 'bulletin board'. The modem usually waits for one ring of the phone, and then answers the line with an ear-piercing shriek like tone. It's a great way to stop obscene phone-callers but also has its more serious uses.

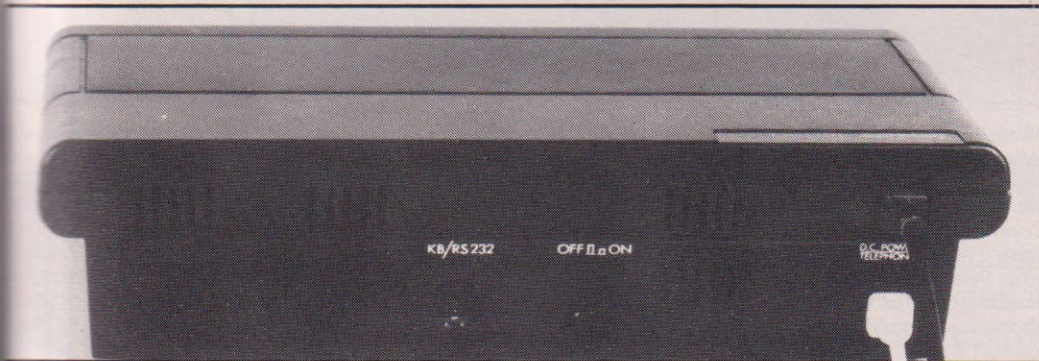
There is one inherent problem with having multiple standards for modem communications: that is, no one likes keeping to the same standard. The ardent micro-hobbyists much prefer



Minor Miracles: A full range of options



Telephone and computer connections



The Tandata TM100, a true "black box"

and thus will not notice the slow uploading speeds, however the 'crunch' comes when trying to upload a program: you are now working at computer speeds and not human-typing speeds anymore. The slowness of 75 baud transmission really takes its toll.

The dominant multi-standard modem at the moment is undoubtedly Minor Technology's WS2000. It caters for all speeds and even has a switch for the American frequencies. Also, an optional auto-dial and auto-answer board is available. The modem is of high

quality and is very reliable. I have had one in use now for many months with no problems whatsoever. Other modems of a similar type are the Interlekt PORTMAN, the Tandata TM120, and the Pace GRAPEVINE (or NIGHTINGALE!). All these modems are essentially the same, but have not sold in such vast quantities as the Miracle Technology due to their late arrival on the market. The Interlekt modem also features an auto-answer mode fitted as standard — a nice touch! Expect to pay between one and two hundred pounds for each of these modems.

## COMMUNICATION

One of the recent modems to be launched is the long-awaited Acorn Prestel modem. It has only 1200-75 baud capability but is excellent value at £113.85. It features very comprehensive Prestel software (written by Bob Clark of Soft-Machinery) and even has auto-dialling as standard. The Prestel ROM is probably the most advanced Prestel terminal program yet written for the home user. Bob has been writing it for over a year now, and it has undergone many improvements along the way. Acorn's modem is a quality Prestel modem, and many people have expressed compliments

**CONTINUED OVER**

about its clever design. It can be used for other systems too, such as BT Gold or PSS through the use of the appropriate software. The only software package available at the moment that supports Acorn's auto-dialling modem is Communicator, available from Computer Concepts.

An important part of your ability to 'communicate' is the type of software that you use. There are a few major packages available, notably: 'Communicator' and 'Termi II' from Computer Concepts; and 'Commstar' from Pace. Each has its own advantages but it is safe to say that Communicator is the most advanced and user-friendly of the pack. (It is also the most expensive, priced at just under £60.) Communicator emulates a VT100 terminal. This is one of the major 'standard terminals' in existence and is a popular choice to go for. Communicator also has some pretty advanced specifications; such as Interrupt-driven handshaking, disk file-transfer at very high speeds, and it contains multiple character sets and windows etc. Termi II is a 'stripped down' Communicator, with most of the technical features but not the character sets. It sells at a lower price and so is also worth considering. Both Communicator and Termi II are essentially for use with mainframes and communicating with large systems, whereas Commstar has been designed for use with the hobbyist bulletin boards. Commstar has a special method of file-transfer known affectionately as 'Christiansen protocols'; named after an IBM engineer: Ward Christiansen. It features error-checking and will re-transmit parts of the file if there were any errors during the transfer. The Protocol, has some interesting limitations, but since it is a 'standard', who am I to argue?

When it comes to file transfer, almost every program in existence uses a different method of accomplishing it. Some have the ability to download pure-ASCII text using flow-control and

handshaking (à la Communicator). Others use special encoding and protocols to ensure the reliability of their data (like Commstar and Prestel CET format). The problem with encoding your data, is that the 'host' (the beastie at the other end of your phone line) must also be able to support the same file — transfer method — or all hell breaks loose! The CET format is only suitable for Prestel since it is clumsy in operation and has been 'frigged' to get it to work on Prestel. The 'Christiansen protocols' do not allow data transmission via most commercial mediums (à la BT Gold and PSS), because they do not take into account that only 7 bits can

be transmitted on these systems. So it is really a case of 'six of one and half-a-dozen of the other!' You pick the standard most useful to you... or if you can afford it, get all three!

## WHICH MODEM?

The right modem for you depends on how much money you would like to spend, and what features you consider a 'must' to own. It is very useful to have a modem that can do both Prestel (1200/75 baud) and Bulletin Boards (300 baud); and also Auto-dialling does save your poor 'ole fingers from doin' the walking! It is likely there will be a

fall in modem prices soon, due to the incredible 'wonderchips' that are becoming available (the AM7910 is a multi-standard modem-on-a-chip). A new version of Miracle Technology's WS2000 modem is promised soon that allows very advanced expansion capabilities. We hope to review one shortly, together with the new Tandata offering (like the TM120).

The 'communications era' is just beginning — It's only a matter of time before ALL computers are connected together. It's a fascinating hobby which has untold advantages, and with the recent surge of wonder-modems who can resist the temptation to Communicate?



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# Advanced Graphics

Bruce Smith

In the March/April issue of A&B we had a delve into the colour palette, but what exactly is the palette and how does it function? These are a couple of questions put to me recently by readers so this month I'll try to provide some answers to these interesting queries. My profuse apologies to Electron owners but most of what follows is basically for the Beeb only as it is hardware specific. However the read/write palette techniques are applicable to both Bees and Elgies alike as is the animation program towards the end of this article which is performed by reprogramming the palette as discussed in an earlier issue. Electron owners will also have their own 'palette special' at a later date as soon as I can prise some specific information from the Acorn workshops!

But first what is the palette? Well basically it consists of eight bytes (64 bits) of RAM situated in the Video ULA. The Video ULA (Uncommitted Logic Array) is a form of programmable chip designed specially by Acorn Computers to handle many aspects of the screen display housekeeping such as providing the Red, Green and Blue (RGB) outputs for the video circuitry, determining the width of the cursor and determining the relationship between logical and physical colours.

The palette has a single byte register that is memory mapped located at &FE21 or more correctly within Sheila at location &21 thus allowing Tube compatibility. Figure 1 illustrates the palette registers construction. As can be seen it is divided into two halves each of four bits. The high nibble (bits 4 to 7) form the Logical Colour Register while the lower nibble (bits 0 to 3) form the Actual or Physical Colour Register.

## PHYSICAL COLOUR REGISTER

Writing colour data into the palette can be done most easily using an \*FX155 call, it should be remembered that this call does write to the whole of the register

## A dash of colour this month with a lengthy look at the palette.

so it is generally better programming practise to use a VDU19 call to program exactly what you want. Program 1 illustrates the 'direct' technique with the value to be written held in the X register, or variable X%. The value actually written to the register is first exclusively ORed (EOR) with 7 to invert the three colour bits (bits 4,5 and 6). Running Program 1 will cause the screen to rapidly change colour. To program a particular colour into the Video ULA then the physical colour value should be written to the Palette Register using the \*FX155 call. For example to implement a flashing black-white screen in MODE 2 we would normally use

```
10 MODE 2
20 COLOUR 136
30 CLS
```

the corresponding \*FX call for this would be

```
10 MODE 2
20 *FX155,8
```

Both of these methods are legitimate as they both inform the MOS what is happening, the former method is a little easier to follow however.

The first three bits of the Palette Register (bits 0,1 and 2) give information on the actual colour whilst the fourth bit, bit 3, determines whether the colour is a flashing colour or not. These first three register bits can be broken down very simply into three components colours from which bit combinations give other colours. Thus,

Bit 0 defines the red component  
Bit 1 defines the green component  
Bit 2 defines the blue component

This gives the RGB (red, green, blue) configuration used by televisions and monitors alike. Other colours are made up of combinations of these bits and therefore colours. Thus

Colour 0 is 0000 which is no-colours giving black  
Colour 1 is 0001 which is red  
Colour 2 is 0010 which is green.  
Colour 3 is 0011 which is red + green = Yellow  
Colour 4 is 0100 which is blue  
Colour 5 is 0101 which is blue + red = magenta  
Colour 6 is 0110 which is blue + green = cyan  
Colour 7 is 0111 which is red + green + blue giving white

By setting bit 4 each of the above colours can be made to flash. Actually flash is not really the correct word, what the colour actually does is to alternate with another colour. The alternating colour is determined by subtracting the main colour from 7 (0111) performed using the EOR instruction. So colour 8 which is black will alternate with colour 7 because.

```
Colour 8 = 1 000
EOR 7    = 0 111
          = 1 111
```

where 111 = 7 giving colour 7, white and the fourth set bit indicates a flash.

## LOGICAL COLOUR REGISTER

In Mode 2 programming the logical colour register is really quite a simple task as there are sixteen possible logical colours possible and the value 16 fits into four bits i.e. 1111 in binary = 16 in decimal. In other modes however problems begin to arise. Firstly in two colour modes the most significant bit, bit 7, defines the logical colour. Thus if logical colour 0 is selected bit 7 will contain 0. Similarly if logical colour 1 is selected bit 7 will be set. However bits 4,5 and 6 must also be programmed to all their possible physical colour conditions.

Secondly in two colour modes, two bits are needed to represent the four possible colour combinations. Table one shows that bit 7 is the more significant of these two bits. As with two colour modes all the other possible combinations must be programmed. Each of these combinations form a table which is located in Page three RAM between &36F and 37E. When a line is drawn in a particular logical colour the Beeb consults this table to see what physical colour is associated with the specified logical colour.

MODE 5 for example is a four colour mode, the normal logical versus physical colour relationship is detailed in Table two. Now if logical colour 3 is specified in the program, e.g. GCOL 0,3, the beeb looks into the palette and 'sees' that logical colour 3 is in fact physical colour white, and so it draws in white rather than yellow.

For those of you interested in poking around in operating system workspace, Table 3 lists the various addresses associated with the display of colour on the Beeb.

## READING THE PALETTE

An OSWORD call is provided in the operating system to allow the current contents of the palette to be read. The call is OSWORD with A% containing the palette read code 11. As with all OSWORD calls the variables X% and Y% are used to hold the address of a five byte block of memory into which the palette can be read. The first byte of this block must contain the logical colour in the palette that is to be read. A suitable palette reading procedure is given in Program 2. A suitable call to this procedure could be performed using the lines

```
10 REM *** read palette
***
20 PROCreadpalette (0,&70)
30 PRINT "logical colour="
?&70
40 PRINT "physical colour="
?&71
```

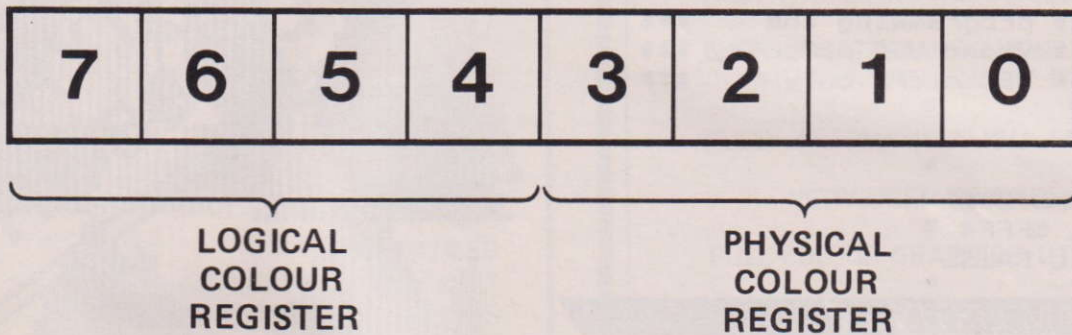


Fig. 1

Although five bytes are required by the call only the first two contain any real information. The remaining three bytes are all set to zero for, to quote the makers, "future expansion", whatever it is!

## WRITING TO THE PALETTE

We have seen that the VDU 19 command can be used to write to the palette, to complement the above call a suitable write palette OSWORD call is also implemented. The advantage of this over the more usual VDU19 call is that it is much quicker and can be readily coded into assembler. The call works almost identically to that of the read routine however the OSWORD call code is 12. The parameter block should consist of five bytes, the first two containing the logical and physical colours with the famous three padding zeros at the end. Program 3 provides a suitable write palette procedure.

## PALETTE ANIMATION

As promised at the start Program

4 illustrates how by reprogramming the palette animation effects can be performed. The program uses MODE 2 to draw a circle of triangles in four different colours namely red, green, yellow and blue (lines 130 to 210). The 'animation' section of the program is held within lines 250 to 340. Each of the four logical colours 1,2,3 and 4 are reprogrammed to a new value given by  $(1+Z\%)\text{MOD } 4+1$ . As we are incrementing and resetting the value of Z% each logical colour will be re-programmed with a new physical colour. As Z% is reset (line 310) every four times through the loop, the colours repeat themselves. For example logical colour 1 will 'rotate' through the following physical colours  
Yellow,  
Blue,  
Red,  
Green,  
Yellow  
etc

The wait loop of lines 320 and 330 provide a suitable delay so that the rotating effect of the wheel can be witnessed. Try experimenting with different colours. you might even like to try implementing a full 16 colour rotating wheel!

Table One

logical colour	bit7	bit6	bit5	bit4
0	0	x	0	x
1	0	x	1	x
2	1	x	0	x
3	1	x	1	x

x = variable depending on physical colour

Table two

Mode five colours	
Logical	Physical
0	0
1	1
2	3
3	7

Table three: Operating System workspace for colour

LOCATION	FUNCTION
&D2-&D3	Text colour masking bytes
&D4-&D5	Graphics colour masking bytes
&357	Foreground Text Colour
&358	Background Text Colour
&359	Foreground Graphics Colour
&35A	Background Graphics Colour
&360	Current number of logical colours minus 1 for current MODE
&362	Left hand Colour mask
&363	Right hand Colour mask
&36F	Logical Colour 1
&370	Logical Colour 2
&371	Logical Colour 3
&372	Logical Colour 4
&373	Logical Colour 5
&374	Logical Colour 6
&375	Logical Colour 7
&376	Logical Colour 8
&377	Logical Colour 9
&378	Logical Colour 10
&379	Logical Colour 11
&37A	Logical Colour 12
&37B	Logical Colour 13
&37C	Logical Colour 14
&37D	Logical Colour 15
&37E	Logical Colour 16

CONTINUED OVER

## PROGRAM LISTING 1

```

10 REM *** programming the ***
20 REM *** Video ULA directly ***
30 REM *** BBC micro only ***
40 MODE 2
50 A%=155
60 REPEAT
70   X%=RND(255)
80   CALL &FFF4
90   UNTIL FALSE

```

## PROGRAM LISTING 2

```

500 DEF PROCreadpalette (logical,block)
510 A%=11
520 X%=block MOD 256
530 Y%=block DIV 256
540 ?block=logical
550 CALL &FFF1
560 ENDPROC

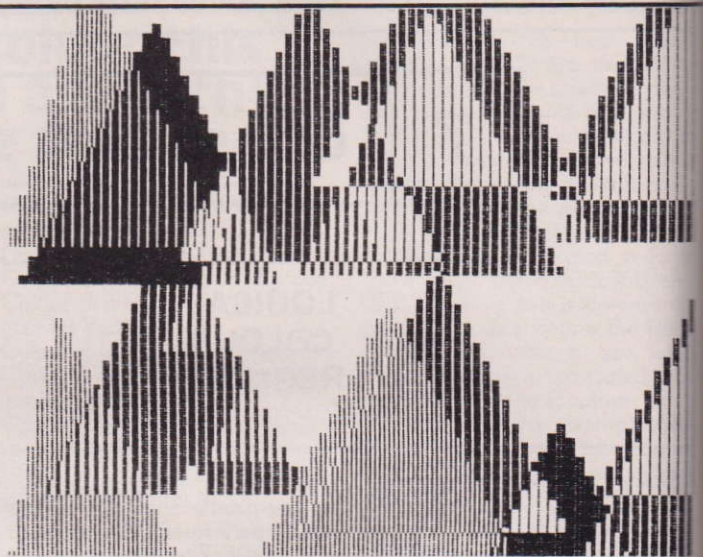
```

## PROGRAM LISTING 3

```

10 REM *** osword call to program ***
20 REM *** colour palette ***
30 REM *** sets logical 0 to physical red ***
40 REM *** red background instead of black ***
50 MODE 2
60 PROCwritepalette (&70,0,1)
70 END
600 DEF PROCwritepalette (block,log,phy)
610 A%=12
620 X%=block MOD 256
630 Y%=block DIV 256
640 ?block=log
650 block?1=phy
660 block?2=0
670 CALL &FFF1
680 ENDPROC

```



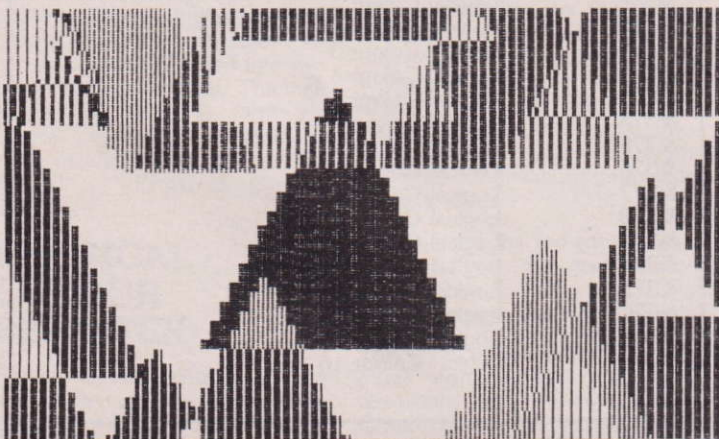
## PROGRAM LISTING 4

>PLEASE KINDLY LIST THE PROGRAM

```

10 REM *** animated rotating wheel ***
20 REM *** performed by programming ***
30 REM *** the colour palette ***
40 REM *** (c) Bruce Smith ***
50 REM *** A & B Computing June 84 ***
60 MODE 2
70 VDU 29,640;512;
80 radius=450
90 col%=0
100 CLG
110 CLS
120 MOVE radius,0
130 FOR angle=0 TO 2*PI STEP PI/30
140   GCOL0,col%
150   MOVE 0,0
160   X=radius*COS(angle)
170   Y=radius*SIN(angle)
180   PLOT85,X,Y
190   col%=col%+1
200   IF col%=4 THEN col%=1
210   NEXT
220 COLOUR 10
230 PRINT"ROTATING WHEEL"
240 Z%=1
250 REPEAT
260   VDU 19,1,((1+Z%)MOD 4+1),0,0,0
270   VDU 19,2,((2+Z%)MOD 4+1),0,0,0
280   VDU 19,3,((3+Z%)MOD 4+1),0,0,0
290   VDU 19,4,((4+Z%)MOD 4+1),0,0,0
300   Z%=Z%-1
310   IF Z%=0 THEN Z%=4
320   FOR wait=0 TO 50
330     NEXT wait
340   UNTIL FALSE

```



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# Creaplot

Roel Grit

The following program allows you to draw several figures by simply hitting a key. In an easy way, you can build up good looking drawings as the examples may show.

The principle is as follows: when the program is running, you will see two arrows on your screen. You can move these around the screen with the grey cursor keys.

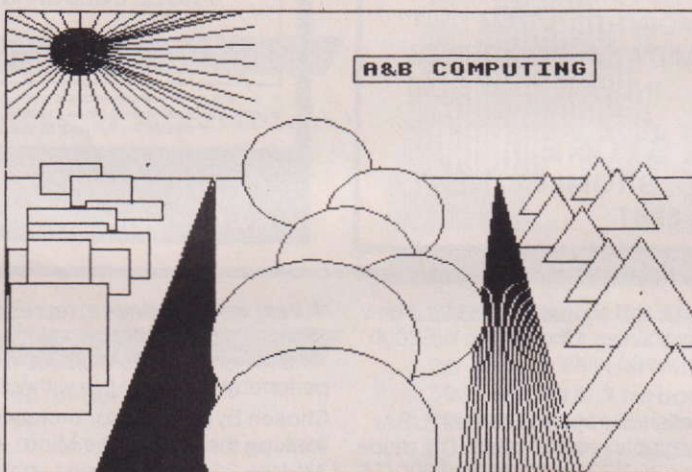
These arrows determine the position of the next figure to draw. You can move one arrow at a time. When you want to move the other arrow just hit return.

You can change arrow velocity by pressing + or -. If you hit 0 (zero), the cursors are joined at the current moving cursor position.

The numbers 1-9 and the letters c and r are used to draw the figures. Number 1 plots a point, number 2 draws a line, number 3 draws a triangle, number 4 draws a square, number 5 draws a pentangle and so on till 9. The letter c gives a circle.

One should notice that the stationary arrow is the middle of

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the figure to draw. The current moving arrow points at an 'angle-point' of the figure.

The letter r gives a rectangle with the arrows in two opposite angle-points.

When you use shift in combination with these figures, the area inside the figure has deleted. Be sure your CAPS-LOCK is not in use, for you might delete an area by accident.

When you draw a figure, you can delete it by pressing delete. This is only possible with the last figure. If you want to delete a figure you made before, you must draw it again. Then you can delete it as described before.

The letter w allows you to print words at the current cursor place. Hit return when your word is finished.

If you own a printer, you can use CTRL-S to make a screendump. You must load your screendump program before running this program, of course. If your screendump runs at another address, you must change line 170.

When you have forgotten all this, press H. The program will Help you to go on.

## THE PROGRAM

lines 50-110	Set up variables and ask you if you want information.
lines 130-400	Main program, waits at line 140 for a key-hit.
lines 420-450	Disable VDU4 and *FX4
PROctitle:	Gives title-page.
PROccircle:	Used to draw circles, triangles, squares etc. by changing the stepsize ST.
PROCrectangle:	Draws rectangles. Contains move statement to use with PLOT 85 statement.
PROctext:	Prints explanation text.
PROcword:	To print words at current cursor place.
PROcplotmove:	Copies the contents of the screen memory in another part of the memory.
PROcplotmoveback:	Copies the old screen back into the screen memory.

## PROGRAM LISTING

```

10REM
20REM
therlands,dec 83
30REM
40ON ERROR GOTO 420
50VDU23,250,254,252,248,252,254,223,142,4:*FX4,
1
60MODE7:PROctitle:MODE4:VDU5

```

```

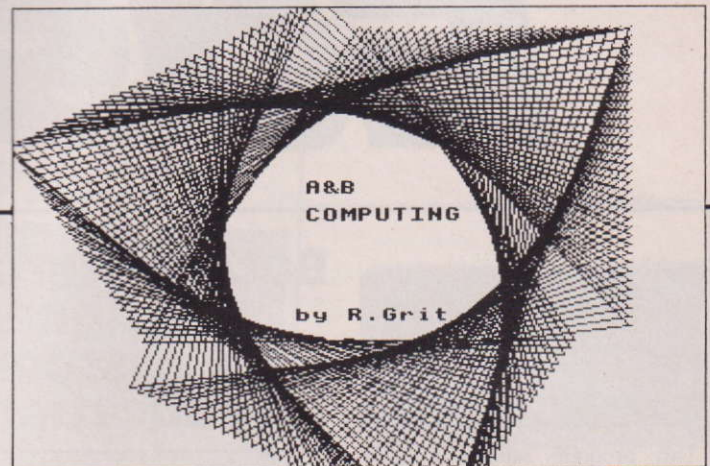
70S=20:P=640:Q=512:MX=640:MY=512+2*S:DX=640:DY=
512:K=13
80PROCrectangle(0,0,1279,1023):MOVE 230,700:PRI
NT"TURN OFF YOUR CAPS LOCK"
90MOVE 100,500:PRINT"DO YOU WANT AN EXPLANATION
(Y/N) ":X$=GET$
100IF X$="Y" OR X$="y" THEN CLS:PROctext
110CLS:PROCrectangle(0,0,1279,1023)
120
130MOVEDX,DY:GCOL3,1:PRINT CHR$(250):MOVEMX,MY:P
RINT CHR$(250)
140X=GET
150MOVEDX,DY:GCOL3,1:PRINT CHR$(250):MOVEMX,MY:P
RINT CHR$(250)
160GCOL0,1
170IF X=&13 THEN CALL&D02
180IF X=ASC("h") OR X=ASC("H") THEN PROCplotmove
:PROctext:PROCplotmoveback
190IF X=ASC("+") THEN:IF S<80 THEN S=S+4
200IF X=ASC("-") THEN:IF S>4 THEN S=S-4
210IF X=&0C THEN 110
220IF X=136 THEN P=P-S
230IF X=137 THEN P=P+S
240IF X=138 THEN Q=Q-S
250IF X=139 THEN Q=Q+S
260IF X=ASC("O") THEN MX=P:MY=Q:DX=P:DY=Q+S
270IF X=&0D THEN P=DX:Q=DY:DX=MX:DY=MY
280MX=P:MY=Q
290IF X=ASC("1") THEN PLOT69,MX,MY
300IF X=ASC("2") THEN MOVE MX,MY:DRAW DX,DY
310IF X=ASC("c") THEN K=13:PROccircle(K,60)
320IF X=ASC("C") THEN K=87:PROccircle(K,60)

```

```

330IF X>50 AND X<58 THEN K=13:ST=X-48:PROCcircle
(K,ST)
340IF X>34 AND X<42 THEN K=87:ST=X-32:PROCcircle
(K,ST)
350IF X=ASC("r") THEN K=13:PROCrectangle(DX,DY,M
X,MY)
360IF X=ASC("R") THEN K=87:PROCrectangle(DX,DY,M
X,MY)
370IF X=ASC("w") OR X=ASC("W") THEN PROCword
380IF X=&7F THEN GCOL3,1:X=HELP:GOTO 190
390GCOL3,1:MOVEDX,DY:PRINT CHR$(250):MOVEMX,MY:P
RINT CHR$(250)
400HELP=X:GOTO140
410
420REM**** LEAVING THE PROGRAM PROPERLY*****
430VDU4:FX4,0
440CLS:REPORT:PRINT;" at line ";ERL
450END
460
470DEF PROCtitle
480PRINTTAB(12,6);CHR$(141);"CREAPLOT"
490PRINTTAB(12,7);CHR$(141);"CREAPLOT"
500PRINTTAB(16,9);"by" TAB(13);"ROEL GRIT" TAB(9
,13);"The Netherlands"
510PRINT TAB(12,20);"HIT ANY KEY":X$=GET$
520ENDPROC
530
540DEFPROCcircle(K,ST)
550VDU29,DX,DY;
560S=SQR((DX-MX)^2+(DY-MY)^2)
570IF MX-DX=0 THEN IF MY-DY>0 THEN AA=-PI/2:ELSE
AA=+PI/2
580IF MX-DX>0 THEN AA=ATN((MY-DY)/(DX-MX))
590IF MX-DX<0 THEN AA=ATN((MY-DY)/(DX-MX))+PI
600XX=S%*COS(-AA):YY=S%*SIN(-AA)
610FORA=0 TO 2*PI STEP 2*PI/ST
620MOVEMX-DX,MY-DY:MOVEXX,YY
630XX=S%*COS(A-AA):YY=S%*SIN(A-AA):PLOTK,XX,YY
640NEXT
650PLOTK,MX-DX,MY-DY:VDU29,0;0;
660ENDPROC
670
680DEFPROCrectangle(X1,Y1,X2,Y2)
690MOVEX1,Y1:PLOT13,X2,Y1:MOVEX1,Y1:MOVEX2,Y1
700PLOTK,X2,Y2:PLOTK,X1,Y2:PLOTK,X1,Y1
710ENDPROC
720
730DEFPROCtext
740GCOL3,1:PROCrectangle(0,0,1279,1023):VDU29,0;
750;
750A=100:B=-46
760MOVE A,0*B:PRINT"          H = HELP"
770MOVE 0,B-12:DRAW1279,B-12
780MOVE A,2*B:PRINT"          ARROWS = CURSOR move"
790MOVE A,3*B:PRINT"          RETURN = CURSOR move chan
ge"
800MOVE A,4*B:PRINT"          +/- = CURSOR speed up/
down"
810MOVE A,5*B:PRINT"          0 = join cursors"
820MOVE A,6*B:PRINT"          DELETE = delete last figu
re"
830MOVE 0,7*B-12:DRAW1279,7*B-12
840MOVE A,8*B:PRINT"          CTRL L = clear screen"
850MOVE A,9*B:PRINT"          1 = plot POINT"
860MOVE A,10*B:PRINT"         2 = draw LINE"
870MOVE A,11*B:PRINT"         3-9 = draw TRIANGLE,S
QUARE etc"
880MOVE A,12*B:PRINT"         c = draw CIRCLE"
890MOVE A,13*B:PRINT"         r = draw RECTANGLE"
900MOVE A,14*B:PRINT"         SHIFT = in combination

```



```

with figu-"
910MOVE A,15*B:PRINT"          res to delete
area"
920MOVE 0,16*B-12:DRAW1279,16*B-12
930MOVE A,17*B:PRINT"          w = print WORDS"
940MOVE 0,18*B-12:DRAW1279,18*B-12
950MOVE A,19*B:PRINT"          CTRL S = SCREENDUMP PRIN
TER"
960MOVE A,20*B:PRINT"          HIT ANY KEY":X$=G
ET$
970VDU29,0;0;
980ENDPROC
990
1000DEF PROCword
1010FX4,1
1020MOVEMX,MY
1030X=GET:IFX=13 THEN ENDPROC ELSE PRINTCHR$X;GO
TO1030
1040FX4,0
1050ENDPROC
1060
1070DEFPROCplotmove
1080FOR MX=&5800 TO &7FFF STEP 4
1090!(MX-10500)=!MX:!MX=0
1100NEXT
1110ENDPROC
1120
1130DEFPROCplotmoveback
1140FOR MX=&5800 TO &7FFF STEP 4
1150!MX=! (MX-10500)
1160NEXT
1170ENDPROC

```

## VARIABLES

S	stepsize cursor move
P	x value cursor move
Q	y value cursor move
MX	x value moving cursor
MY	y value moving cursor
DX	x value not-moving cursor
DY	y value not-moving cursor
K	value in PLOT K,X,Y
X\$	waits for a key hit
X	contains ASCII value in X=GET
ST	number of steps to draw a circle
HELP	remembers value of x
S%	radius of circle
AA	off-set angle in drawing figures
A,M%	counter in FOR..NEXT statement
XX	x value in drawing circles etc.
YY	y value in drawing circles etc.
X1, X2	x values in drawing a rectangle
Y1, Y2	y values in drawing a rectangle
A,B	var. in positioning text

# Edsoft

Title	Countries of the World
Publisher	Hewson Consultants
Machine	BBC Model B
Price	£6.95

This program reflects a huge amount of effort in the programming by Hewson Consultants, yet I am not entirely sure where the market lies for a program such as this. Perhaps its vast range of features will appeal to schools, but I cannot really see many private owners spending their money on such an educationally biased tape.

After loading, straightforward but quite a long process, a well detailed two-colour map of the world is drawn in the top half of the screen. Because of the shape this now produces, the map is a little distorted in appearance near the polar regions. The names of the oceans and continents are clearly lettered, and below appears an options list. Option 1 will display each country automatically, while the second awaits a prompt from the user before each change.

The display shows the approximate position of the country in question, by DRAWING two lines from fixed points to the required point. Underneath the map, along with the name of the selected country, are displayed the capital city, the population, area, currency and main language of the country. Why, oh why, do programmers insist on such dreadful colour combinations for their written information? The choice of white letters on a yellow background is nothing short of illegible. A group of children I showed this program to didn't even notice those particular lines. I suppose the reason is because of the MODE 5 display, but I am sure I won't be the only one wondering why!

The third choice at the options stage rather kindly allows the map to be SAVED onto tape for use in one's own programs. I would imagine that this facility would be of great use in schools and perhaps to private individuals. Overall, it is nearly a

## Both material specifically designed for the classroom and for education at home.

good program, but lacks the right market.

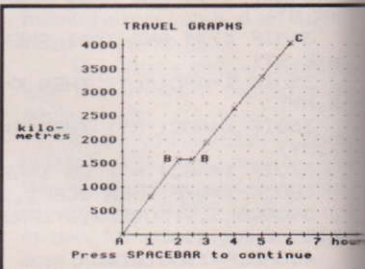
### Ratings Table:

SOUNDS	N/A
GRAPHICS	55%
DOCUMENTATION	80%
EDUCATIONAL VALUE	70%
VALUE FOR MONEY	70%
OVERALL	75%

Title	Computer Assisted Tables Bingo
Publisher	Resource Facilities
Machine	BBC Model B
Price	£10.95/£11.95 disc

This package looked unlike any other I'd ever seen when it arrived from the Editor. As well as the usual cassette in perspex case, there are also a number of bingo cards, complete with little cardboard markers. I confess that it was with little enthusiasm that I CHAINED the program, and sat back, expecting a rather boring and ineffective attempt to brighten up number work. I had a most pleasant shock, however, to find that the program had enough flexibility to be of real use with groups of children in school, and enough educational content to make the time spent well worthwhile.

Each child in the group is given a bingo card, containing several numbers, each of which is the product of two single digit numbers, except for 100 which is  $10 \times 10$ . The teacher then sets the game in motion by entering a delay between the numbers to be "called". These numbers actually appear as table facts, e.g.  $7 \times 6$  so that the child has to quickly calculate the answer and cover it if it appears on his card. At the default level, there is ample time for younger or less able pupils,



### SPECIAL ANGLES & OBTUSE ANGLES

Ratios of special angles which must be learned.

Angle $\theta^\circ$	Sin $\theta$	Cos $\theta$	Tan $\theta$
0°	0	1	0
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90°	1	0	*

If questions have to be done without the use of calculating aids these ratios should be used and the answers left in surd form.

Tan 90° is infinite

Maths Revision from Ampalsoft

but at the fastest game, the process kept my class right on the tips of their toes.

My only reservation concerns the suggestion that a whole class might play at once; I cannot imagine that working well with most schools using the excellent Cub monitor which is not blessed with a large screen.

### Ratings Table:

SOUNDS	N/A
GRAPHICS	60%
DOCUMENTATION	65%
EDUCATIONAL VALUE	80%
VALUE FOR MONEY	80%
OVERALL	70%

Title	T-Square Timetabling Program
Publisher	Yorke House Software
Machine	Model B/DFS
Price	£25.00

The annual task of developing the timetable is one which needs a great deal of hard work and attention to detail. Any program which would aid in carrying out this task must be worth considering.

T-SQUARED is a disc based program which stores files of information containing the details which are needed to construct the timetable and produces, at any stage, printouts of the relevant information.

On the disc is a set of data which can be used to obtain familiarity with the layout of the screen and the controls used to amend and replace items in the timetable. The period by period approach allows the whole to be built up steadily.

The main files are those which contain lists of staff, subjects, rooms, and the printer codes. Considering the PRINT file first, the information is based on an Epson MX 80 printer, and some of the codes used in the file may have to be altered for other printers. They worked correctly on the Star printer which I was using without alteration. If the printer can deal with a character width of 132, then this can be used. Otherwise a condensed form is available. I found the printouts in the condensed form easy to read, but there did seem to be one section which had not been "condensed" because my printout of "free staff" thought the paper was 132 characters wide,

which made rather a mess of the printout!

## STARTING THE TIMETABLE

The most important thing to stress is that the manual should be read thoroughly and carefully before any new work is carried out. The layout of the screen during the editing process is clear, but the use of the controls *does* need practice. As an example of what can happen when the notes are not read carefully enough, I would mention the instruction: "Control O toggle rooms". Neither my dictionary nor myself could find a meaning of the word 'toggle' which seemed to fit the case, but the manual informed me that "Control O (Omit room) allows you to leave room allocation until later." Toggle!! There must be a new dictionary somewhere.

Staff abbreviations, subject abbreviations, rooms and groups to be taught are all entered as strings of three-character length. If the abbreviation is of one or two characters, then spaces must be added at the end to complete the standard three character length in order that the string can be read correctly during the run of the program.

The instructions for making the new files containing the relevant lists of staff etc are clearly laid out in the manual (although the screen instructions are not particularly clear). The only problem arises in the number of staff, rooms, subjects entered.

In each case the manual suggests that it is preferable to add dummy names to the list in case new members of staff, for example, have to be added later. In fact, the logic used means that the programs will not proceed unless the file contains a greater number of items than actually used. If, for example, the timetable was going to use 45 rooms, then the list entered must include more than 45 rooms, so that some dummy ones must be included.

Staff are listed with full name and abbreviation, as are subjects.



Considering the case of a sixth form college, where "A" and "O" levels of the same subject appear on the timetable, I found that I could not follow my standard procedure of writing "eng" for O level and ENG for A level English.

This does mean that a little care is needed in preparing the abbreviations, and probably that it will be necessary to keep a listing of those abbreviations on hand, although the program will not accept a set of characters not in its file. Since there are more than 17,500 possible combinations of three letters of the alphabet, there should be no trouble in finding enough variations!

The facility to transfer the arrangement for the whole or part of a period to another time is very useful, especially when considering those subjects often taught in double or even treble periods. Again, the facility to call up free rooms or free staff can be vitally important information when trying to complete a period.

At any time, it is possible to obtain a printout of the timetable as it exists at that state. The variations available include full timetable, individual staff timetables, individual groups, separate periods as well as room timetables, free staff lists and sub-

ject analysis. There are staff analysis lists and staff loading lists. In fact, the range of printed information is wide and of considerable help in producing the final timetable. My only worry would be that in these days of economies, the full use of the facilities can use a considerable amount of paper!

## SUMMARY

I enjoyed trying this program. Making a new timetable may not be everyone's chosen occupation, but it is a necessary chore. I have one reservation in that there are many schools where the computer would not be available for the lengthy period of time necessary. It seems that some of the advantages gained by using the program rely on the computer being available whenever needed.

Since timetabling is a job which has to be done, if the money and facilities are available, then this could be a good investment.

### Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	65%

Title	"O" level Maths Revision Parts 1 & 2
Publisher	Ampalsoft (Cheshire Cat)
Machine	BBC 32K
Price	£14.95 each

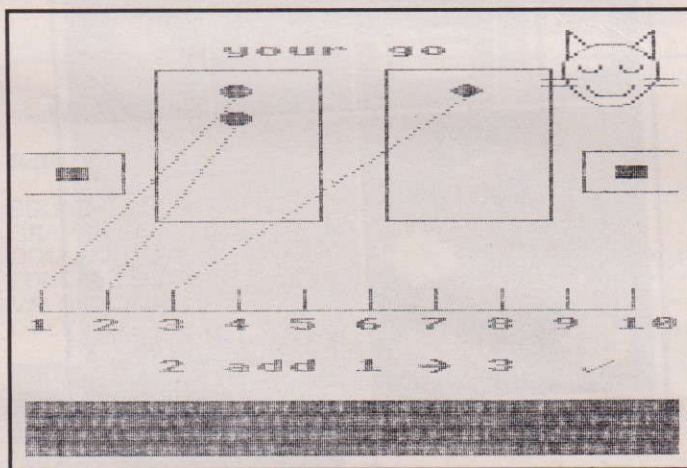
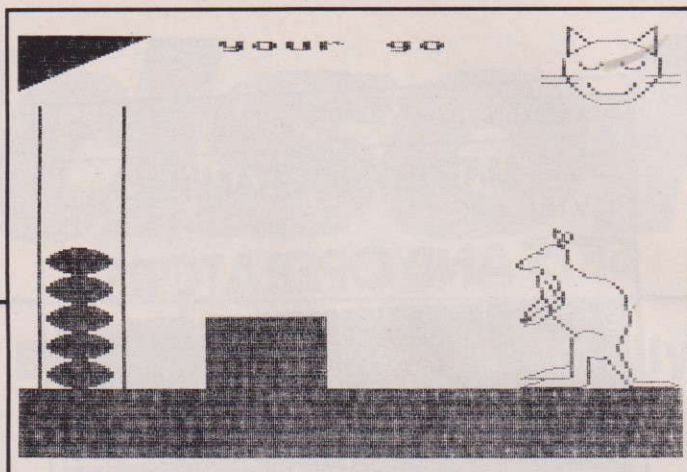
The idea behind this type of program seems great and I have seen packages which can really help the student to revise at this stage in his school career, but these are not of sufficient quality to be worthwhile in my opinion.

Each pack comprises two double sided cassettes with each cassette containing four major topics. These cover the following areas, some areas are split into two topics; Algebra, Trigonometry, Graphs, Calculus, Arithmetic and Constructions. According to the packaging they were written by the maths department of a "top" school. Well perhaps I am not of sufficient calibre to attend such an institution for I don't believe that these programs are anywhere near good enough.

My main criticism is that they are purely static creations and they never change in any way from run to run. To explain what I mean you need to understand what each program comprises. The first screen is a menu from which you select the sub-topic you wish to study. Then you can choose to have screens on the underlying concepts, which is a good idea although there is no remedial section for extra help at all, or to see some worked examples or to try some problems yourself. Now it is at this state that the lack of variation is so critical. Every time you run the program the questions (and indeed the answers) are the same ones so that once you have answered them, or cheated and read the answers!, you have no further use for that section.

This strikes me as plain ludicrous, you can buy, for far less than £30, good text books which can present you with just this type of revision. What I, and indeed most students, would ex-

**CONTINUED OVER**



pect from a package like this is at least some variation in the question so that you can get extra practice at those parts of the syllabus where you are particularly weak. These programs don't provide such a facility and even though in all other respects they are well written and presented I cannot believe that anyone can really get their money's worth from such a package.

The best feature of the programs is the step forward/backward feature which means that you can go from the page you are on to find the vital piece of information you missed. But having said that, you can do that with a book too!

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	60%
DOCUMENTATION	60%
VALUE FOR MONEY	10%
OVERALL	20%

<b>Title</b>	<b>Learn about Words</b>
<b>Publisher</b>	<b>Goldstar</b>
<b>Machine</b>	<b>BBC 32K</b>
<b>Price</b>	<b>£9.95</b>

This program is aimed clearly at those children who are just setting about learning to read and could well help many of them. Developed by Surrey County Council's Media Resources Centre, one can believe it has been well tried and tested but there are other things to be taken into consideration. This program is based on the type of language teaching called "phonics", where words are grouped by the various sounds that they contain and these words are grouped into ai, or, ar, ir and ow sets. This approach is fine if, and it is an important if, the method being used to teach language in your child's school matches this one.

The program involves your choosing a set of words and then being shown a picture for each word. You have to type the word correctly before the next word appears and so on through the set. When you have typed the

whole set you choose which game to play from a maze and noughts & crosses. Both games involve typing the words for the pictures shown and both can be played with another child or against the computer. Noughts & crosses is by far the better game as there is some strategy involved. For the maze you are allowed to make as many moves as letters in the word you have just typed, by moving carefully there are 'booster' moves to be had too.

My criticisms are mostly minor and do not detract from the quality of the program much. They are that some of the words given are plural and some not; in the testing sequence this could cause some confusion as the word "rail" is rejected when the program expects "rails". Some of the pictures show more than a little ingenuity too, for "wait" there is a picture of a bus queue and the word with the picture of the bucket is "pail". Finally there is a strange choice of screen colours in one game, where the letters you type appear as white text on a yellow background. As you can imagine that is rather difficult to read.

Overall, as long as the method of teaching is right for your child, the program is a good example of its type and should

encourage children to learn the sounds of certain digraphs as they occur in words. I can't really understand why Fred the Flea introduces the program as he appears very little in the actual game. The program is well packaged, with a good instruction book which even has a section for the child to colour and to write the words in.

#### Ratings Table:

SOUNDS	60%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	75%

<b>Title</b>	<b>Launching Logic &amp; Sets and Operators</b>
<b>Publisher</b>	<b>Shiva Publishing Ltd.</b>
<b>Machine</b>	<b>BBC Model B</b>
<b>Price</b>	<b>£14.95 each</b>

These are two titles from a set of eleven on Numeracy and Logic, produced by Shiva and aimed at children from five to eight years old. They have been developed by a maths advisor, Iris Hewett, and are already widely used in Kent primary schools. Each has an identical format, with a well-

designed package containing the cassette and a most comprehensive and invaluable teacher's book. Both use a menu to access each program and, as a backup copy is encouraged, I found the whole set on disc was a much better proposition. This is particularly so when BREAK has not been disabled.

Launching Logic is the first of the five under the umbrella of logic, and provides the kind of concrete experience usually gained by the use of attribute blocks or aloblocks. These encourage the child to look at the various properties of a shape (e.g. size, shape, thick/thin, large/small), and to highlight similarities or differences. Key responses are made via a series of buttons which are labelled with an overlay, which is provided. Sets and Operators sensibly uses the same key overlay, as these programs also extend similar ideas. All are strongly aimed towards the game approach and young children will enjoy the use of colours throughout. Logic is an area which many children fail to grasp quickly, and often do not gain a secure knowledge, and I feel these programs will provide valuable extensions to other classroom activities.

The teachers' books are superb, containing full details of each stage of the programs, and also containing very extensive ideas for supplementary activities. The initial cost is high, but the rewards to the children in a school will convince many of their use and value.

Having said that, there may be schools which feel that the money could be better spent on the apparatus itself. The problem of balancing priorities is becoming a very real and persistent one. Perhaps Shiva might be planning to show their programs at various teachers' centres and exhibitions? Then teachers could see the goods before buying.

#### Ratings Table:

SOUNDS	60%
GRAPHICS	70%
DOCUMENTATION	100%
VALUE FOR MONEY	65%
OVERALL	75%



<b>Title</b>	<b>Various Educational Programs</b>
<b>Publisher</b>	<b>Ed Soft</b>
<b>Machine</b>	<b>BBC 32K</b>
<b>Price</b>	<b>£4.95-£5.95 each</b>

By now I hope that you have realised that there is a difference between BBC BASIC and many of the other BASIC dialects around. This means that programs written for other machines and then transferred onto this machine tend to be written in different ways to those written on a BBC in the first place. The reason for mentioning this at this point in time is that these programs are available for other machines and are not, in my opinion, very well written by BBC standards. This is important, not because the programs don't work but because the publisher claims that "modification can be achieved easily", a claim which would be true if the structure of the programs was clear but it isn't true in this case. Therefore beware the easy modification claim, you might be better advised to write your own program in any case, rather than try to adapt someone else's product.

The company offer a range of 18 programs of which I have seen just five. By far the best of the bunch is the two program package "Factors & Fractions". I don't really like "Factors" at all. Although it is interesting, it seems to labour a good idea too much, it is "Fractions" that I find to be very worthwhile. The program can be used as a graphic or teaching aid for the addition and subtraction of fractions and shows the two fractions which you type in as sectors of a circle. It then finds and displays the lowest common denominator for the two before showing the addition or subtraction in animated form. An excellent idea and well executed. I will be using this in school soon.

"Funplot" is the next most interesting program and will provide a good introduction to graphs for primary school children. It provides a full data collection and graph display

routine. You are asked to type in what type of pet you own and if the program knows about that type a picture is shown and the information collected. At any time you can then build graphs of the information in several different formats. Young children, 7-10, will enjoy this process and I can imagine plenty of other ideas occurring to them.

"Matchup" is an infant, shape and colour matching program and whilst it is perfectly all right, it isn't the best I have seen and doesn't convince me that it can be done better on a computer than by using real objects.

The final two programs have an excellent idea as their basis but they fail to get it followed through in the right way. "Spellcheck" is meant to be left in the corner of your classroom whilst your children are writing and to be used to check the spelling of common words. So for example the child might type in "woz" and the computer will respond "You should spell this was." It works well until you type in a word it doesn't know then it says ask your teacher and stops completely. Why couldn't it remember the ones it doesn't know until the end of the session when the teacher can update it easily? Talking of updating, I can see that the author has tried to make the process easy but the program design is such that it is quite difficult. If more thought had been put into a DATA structure then this task could have been simplicity itself.

"Wordflash" suffers mainly from the problem of being a program in search of an application. I have never wanted to use a Tachistoscope in school and I can't see anyone except psychologists wanting to use this at all. Besides all this the instructions bear very little relationship to the BBC version of the program and it behaves in some very strange ways indeed. Overall this is a program to miss.

The programs are all supplied with documentation to a

standard format which would be fine if it was a good one but is very short and skimpy to say the least and could be vastly improved. Prices seem reasonable at first but the programs aren't very sophisticated either. I cannot recommend the bulk of these programs for home use although certain ones might be of use to the teacher.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	70%
DOCUMENTATION	40%
VALUE FOR MONEY	50%
OVERALL	50%

<b>Title</b>	<b>a) Jigsaw Puzzle b) Sliding Block Puzzle c) Drawing Pictures &amp; Puzzles</b>
<b>Publisher Machine</b>	<b>Ega Beva BBC (disc &amp; cassette)</b>
<b>Price</b>	<b>£9.95 each</b>

Ega Beva programs are available on cassette and disc — at the same price! If they can do it, why do some firms need to make an additional charge — £2-£3 not being uncommon? I wondered if this was achieved by upping the price of the cassette version, but each disc is too full for my usual menu program, so I don't think that can be the case. First pat on the back for Ega Beva! A combined review seemed natural, as the programs are so closely linked. Sound is used in all three programs to provide an accolade when the picture has been completed successfully.

a) JIGSAW PUZZLES. First thought when I saw the title was, "Do we really want to use the micro to solve jigsaws?" From the purely practical point of view, how many jigsaws do you have with pieces missing? Unlike the normal jigsaw, these can be matched to the ability of the child at

the touch of a key. While this offers advantages to schools it must be of even greater benefit to the home computer user — having completed the jigsaw, it doesn't have to be packed up and sent off to the jumble sale, it can be tried again at a more difficult level.

On the cassette version, two pictures are recorded on each side and are chained from a title page and instruction program. Once the first one has been completed, the user has the option of trying the same one again or going onto the second. Pressing ESCAPE enables the level to be changed. The disc version runs from a menu which allows the user to select any of the four pictures.

First option allows the program to be run from the keyboard or a Concept Keyboard — very useful for those who have difficulty with the QWERTY keyboard; second permits the picture to be divided into 4,6,9,16 or 25 pieces. Once the picture has been selected, the complete version is shown on the screen for a short period before it is scrambled into the required number of jigsaw pieces, each of which is labelled by a letter of the alphabet. The pieces are moved around the board by pressing the appropriate letters. The number of moves and the time taken is displayed on the screen when the picture has been reconstructed. The user can then attempt to improve his performance, someone else can try to better it, or a higher level of difficulty can be tackled.

b) SLIDING BLOCK PUZZLE. This program works in a similar manner to Jigsaw Puzzles — four pictures, five levels of difficulty. When the picture is scrambled, one of the sections is removed, and the arrow keys are used to move one block at a time into the blank space. When completed, the same options are available.

I found children of all ages enjoyed using these programs. Some welcomed the competitive element with their friends, others preferred to improve their own performance. In these programs the options are theirs. Very little

**CONTINUED OVER**

is seen of jigsaws in schools other than in the infant department, so greatest potential is for home computers. I'll certainly keep them in my collection and expect them to be well used during wet playtimes and in the computer club.

c) **DRAWING PICTURES & PUZZLES.** The attraction of this program is that it allows children (or Mum & Dad) to use their creative talents to produce their own jigsaw puzzles or sliding block puzzles. Main menu gives the choice of:

- 1) Draw a Picture;
- 2) Jigsaw;
- 3) Sliding Block.

Two and three work in exactly the same way as the programs reviewed above with the programs created in one. The "artist" can use any of the colours available to the computer, including flashing colours, and draw lines, dots or paint with a thick "brush" and produce areas in any of the colours. Movements around the screen can be controlled by the cursor keys, a Concept Keyboard or joystick. Other instructions are given by single letters or numbers, all of which are listed in the instructions. Colours can be fixed or added, and areas rubbed out.

Having selected the picture number (0-3), flashing diagonals appear on an otherwise blank screen and the intersection indicates the drawing position. When using the keyboard option, the desired alphanumeric keys are pressed and the lines drawn or areas painted on the screen by pressing the cursor key(s) and the COPY key at the same time. I found it difficult to draw lines at an angle — except at 45 degrees — and as for curves and circles! It might be easier using a joystick, but CIRCLE would be a useful additional command. When painting an area already outlined it is important to ensure that it is completely enclosed, otherwise the colour creeps into the surrounding areas. I found, purely by chance, that pressing the ESCAPE key controls the spread of colour — if it's used any other time, you're returned to the

### Tutor's Guide for **SIXGAM** A business studies game

Ken Randall &  
Alan Greenwood



Pitmansoft

menu and your picture is lost!

I was able to obtain little difference between a "line" and a "thick line", and the colour mix option appeared somewhat hit and miss. Perhaps the sample program could have been used to better advantage if it had been developed as a demonstration program!

Despite these criticisms, I found the program was quite user friendly and offered endless scope for creativity. Many a child will enjoy initialling his masterpiece which can be recreated by other members of the family or class irrespective of age or ability because of the options provided by Jigsaw and Sliding Puzzles.

#### Ratings Table:

	a	b	c
SOUNDS	60%	60%	60%
GRAPHICS	80%	80%	80%
DOCUMENTATION	70%	70%	60%
EDUCATIONAL VALUE	60%	60%	65%
VALUE FOR MONEY	75%	75%	75%
OVERALL	70%	70%	70%

These programs are very well presented and are intended for the home computer market. The accompanying notes are clearly set out and concise, and I particularly liked the use of sample pictures from the actual programs. The enthusiastic prose of which the notes are composed raised my hopes that the tapes might contain something exciting. Unfortunately, the "Please wait" and "Please wait while the main program is loading" on an

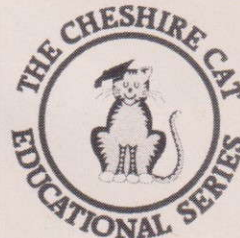
other wise blank screen reminded me of the text books covered with brown paper I remember from my school days — not a very inviting introduction. RETURN has to be pressed twice in order to load the main program — not exactly inspired programming!

Title	Early Reading
Publisher	Ampalsoft
Machine	BBC
Price	£9.95

The two tapes contain programs on four themes: Transport, In My House, Clothes and Building a House. "Each of the first three topics are tackled in four exciting parts that rule out boredom and encourage learning by play: Learn Word — select a word and watch the object being drawn; Word Game — now put the right object to the name required; Big and Little — cars, chairs, hats appear big or little and after a fun hello to the concept the child starts playing the Big/Little game; Lots of — the screen fills with lots of one object.

The final topic, Building a House, is a wonderful adventure where the child builds a home using words and pictures — learning the words roof, walls, window, door without even noticing."

According to the teachers' notes, "All the computer's colour, sound and animation facilities have been skilfully harnessed to bring the pages alive to captivate and intrigue the young user". If you believe that, you'll believe anything. There was little use of imaginative graphics — most of the illustra-



### EARLY READING (AGE 4-6)

ELECTRON

#### Ratings Table:

SOUNDS	10%
GRAPHICS	30%
DOCUMENTATION	90%
EDUCATIONAL VALUE	30%
VALUE FOR MONEY	30%
OVERALL	35%

Title	Sixgam
Publisher	Pitmansoft
Machine	Model B
Price	£25.00 (+ £3.75 VAT)

Sixgam is a disc based business simulation designed to supply a flexible study environment in which to study the workings of between one and six imaginary firms selling wordprocessors in the European market. The pack includes a briefing sheet, Tutor's Guide, a manual specifically aimed at the BBC version of the game and a results sheet. The latter is designed for students to record annual results from their company, if a printer is not available.

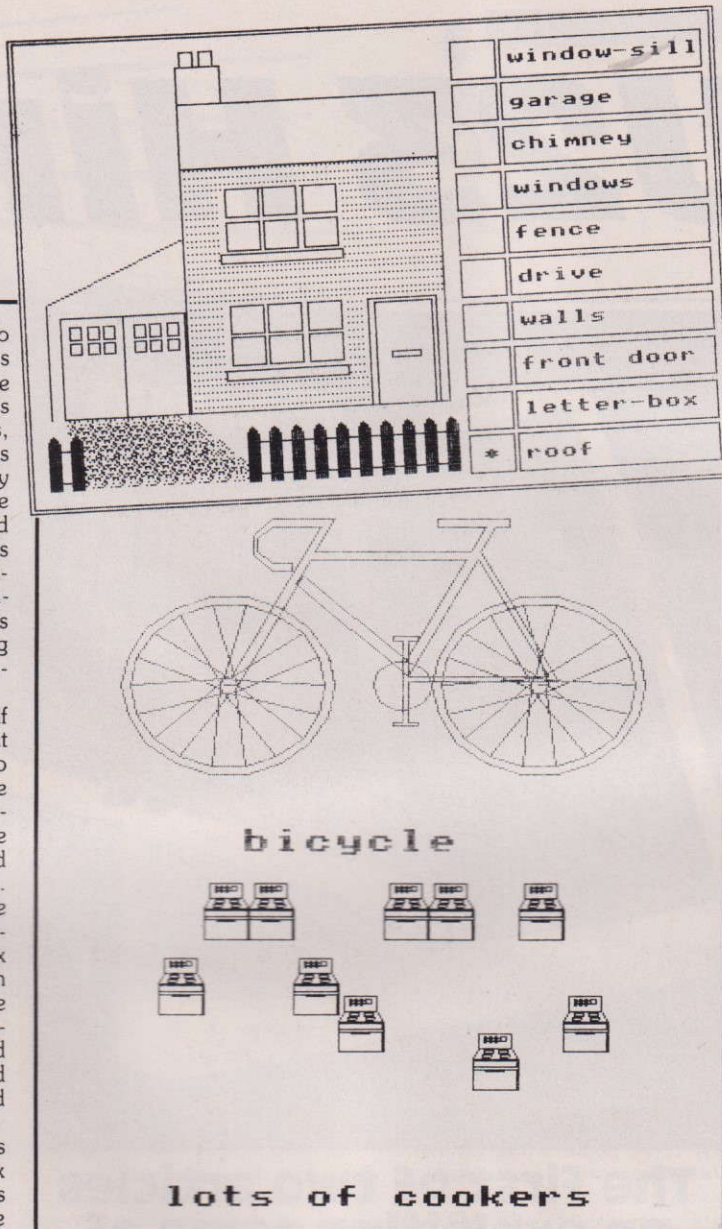
The manual deals with the setting up of the computer and loading of the program as well as detailing the various stages of the game and the input that will be required from those taking part. It

would be possible but pointless to play without studying the notes beforehand. The Tutor's Guide goes further and suggests methods of briefing the players, and some other options such as creating a company hierarchy within a group acting as a single company allocating jobs and responsibilities. This angle results in a multitude of further possibilities to do with the way the company itself operates internally, its methods of keeping and using statistics, its decision making processes and so on.

The computer program itself insists on none of these things, it is just as easy for an individual to play a meaningful game. The simplicity of playing is an important point. There is none of the accounting jargon which could obscure what is really going on. The main decisions to be made involve output, price and advertising. There is also a wage index to be set, starting at 100, each year (cycle of the program) of the game. The documentation supplies the necessary data on fixed (the rent on premises) and variable (materials, updating old at stock) costs.

The imaginary company is selling wordprocessors to six European countries. There has been no market research so we plunge in at the deep end and by a process of trial and error form a business strategy for the individual market zones and the company as a whole. The main decisions are taken on an annual basis and the results displayed for analysis. At this point there is a printer option for the results table. This is nicer than copying from the screen and is a welcome option.

There is a review option available which gives more detailed analysis of the data but it is difficult to access without going round the houses. It is intended for use by the teacher when debriefing but I would have preferred the possibility at least of using it within the game structure. Review supplies tables on sales, pricing and advertising for individual countries and draws some clarifying graphs. It is a real shame that these cannot be dumped to a printer.



Sixgam proved a useful teaching tool and should be a good test of introductory concepts for Economics students on O or A level courses. Even more appropriate for Business/General studies where this sort of program and the associated activities opens up the workings of a company to those without direct contact with the world of business. The documentation includes careful hints on how the teacher might go about making changes in the program and the suggestions for use of the program are inventive and make an excellent starting point.

#### Ratings Table:

SOUNDS/GRAPHICS	80%
DOCUMENTATION	95%
EDUCATIONAL VALUE	90%
VALUE FOR MONEY	70%
OVERALL	85%

<b>Title</b>	<b>Maths Level 1</b>
<b>Publisher</b>	<b>Ampalsoft</b>
<b>Machine</b>	<b>BBC &amp; Electron</b>
<b>Price</b>	<b>£9.95</b>

"A fun packed series of brilliant games cleverly designed to enthrall young children while simply guiding their first steps into the important yet thrilling world of mathematics" — so says the blurb on the package! The two cassettes contain 16 programs which cover many of the mathematical concepts covered by children in their early years of schooling, and the word "exercise" is probably more appropriate than "game".

When the main program is loaded, the user is given the option of sound on or off and whether it is to be run on the BBC or ELECTRON. It then proceeds to a menu, which allows the

user to give the children's names (max. 4), set level of difficulty, number of tries per exercise, display scores, run exercise or end.

Each side of the two cassettes gives the choice of four programs, e.g.

#### Tape 1, Side A:

1. Forming numbers and simple counting
2. Kicking Kangaroo — count the balls
3. Harbour — number recognition and matching
4. Shapes and sets

While I liked the idea of the kangaroo, in all the programs I felt that the graphics were of poor quality, particularly remembering that the programs are intended for 4-6 year olds. The numerals in 1 are too thinly defined and in this, and all the others, the shapes to be counted were too small. Exercise 3 was visually too complicated, and 4 would be done much easier using some large hoops and solid objects. There were some very strange colour combinations, so that at times I had difficulty in reading the information displayed on the screen.

There were a few useful practice exercises among the 16 — missing number sentences, number stories to 5, and the tallest/shortest exercise. The nursery rhyme tunes which introduce each exercise will appeal to a child immediately, but if parents feel they must have this sort of pre-school practice, they might as well pay a visit to a well-known stationers and purchase a few of the maths workbooks on the shelf. Better still, save the money and give the youngsters many of the simple practical experiences that are easily found around the house and neighbourhood, and talk to them!

#### Ratings Table:

SOUNDS	50%
GRAPHICS	30%
DOCUMENTATION	60%
EDUCATIONAL VALUE	40%
VALUE FOR MONEY	30%
OVERALL	40%

# VDU23 Hints

Barry Landsberg

Many of you will by now have taken advantage of the character redefinition facility which has been implemented on the BBC micro as a VDU 23 command. However, if you wish to redefine more than 32 characters extra memory needs to be reserved, and the BBC User Guide gives scant (and even misleading) information on this subject.

In fact there are various pitfalls open to those who boldly go and redefine characters at will, and it is the aim of this article to describe how to avoid these pitfalls and to redefine whichever characters you wish in a way that uses memory as economically as possible. I will also argue that despite the advice given on page 384 of the User Guide it is often better to redefine new characters starting from 128 upwards rather than using characters 232-255 first.

The VDU 23 command is followed by nine bytes as follows:

VDU 23, CH, D1, D2, D3, D4, D5, D6, D7, D8

If the value of CH is zero, then this command will in fact directly program the 6845 CRT Controller Circuit (my article in the next issue will describe this in detail), but otherwise if CH is in the range 32-255 then character number CH is redefined according to the contents of the bytes D1-D8. The User Guide gives an adequate explanation on pages 170-175 as to how this is done, and we shall not dwell upon it any further except to say that the User Guide states that should you wish to redefine more than 32 characters you should 'explode' the character set using a \*FX20,1 command. In fact the number appearing after the comma is equal to the number of pages (1 page = 256 bytes) of extra memory that you need to reserve — for example \*FX20,6 will reserve a maximum of 6 pages which you might wish to do if you redefine every character. The situation is even more complex than this and some surprising results may occur simply by a crafty redefinition of two characters — but read on.

In order to understand what really happens when characters



## The first of two articles on exploiting some of the more subtle characteristics of VDU 23.

are redefined, it is important to be aware that the area of memory between &C00 and &CFF (i.e. page &C) is reserved solely for redefined characters and that on power-up of the micro the contents of each byte is zero. Thus a command like PRINT CHR\$(129) or VDU 129 results in printing a black square. Actually this is not quite true as for some strange unimaginable reason the memory location &C00 contains 255, and so characters 128, 160, 192 or 224 will display a horizontal line. Note that as each character definition takes up eight bytes, page &C may hold a maximum of 32 definitions.

### SESSION ONE

Each part of Session one assumes that the micro has only just been turned on, and the program newly typed in (or loaded) and run. Each program differs only in line 20 which defines a particular character to be a solid square. The rest of the program prints character numbers 33, 65, 97, 129, 161, 193 and 225 separated by spaces, followed on the next line by character 130. This seemingly arbitrary program is in fact designed to demonstrate the effect that defining one character may have on another character. The first part of Ses-

sion one is entirely as expected, and that is all characters below 128 correspond to normal ASCII characters while all undefined characters above 128 result in blank spaces as output. The second part may come as a surprise to some readers — even though only character 129 has been redefined it is evident that characters 161, 193 and 225 also act as if they have been reprogrammed. As the third part shows it doesn't matter which of these four characters gets redefined — the effect is still the same.

What is actually happening (unless an appropriate \*FX20 command has been issued) is that whenever a character redefinition takes place it is stored in page &C and the four sets of characters (128-159, 160-191, 192-223, 224-255) are 'told' to look in page &C to see what they should write to the screen.

The fourth part of Session 1 may come as even more of a surprise! Simply by redefining the letter 'A' (CHR\$65), we also redefine 129, 161, 193 and 225. But that is not all — note that CHR\$130 prints 'B'. What has happened here? Well, 'A' may be regarded as being in the block of 32 characters between 64 and 95, and on redefining any of these characters the definitions for the whole block are written onto page &C. In addition, the redefinition forces all characters 128-255 to use page &C as mentioned above, and thus one VDU23 command has affected 129 different characters!

In order to stop this happening, the following two lines should be typed in before typing the BASIC program:

```
PAGE = PAGE + &600
*FX20,6
```

The \*FX command ensures that 6 extra pages of memory are used to hold all of the definitions, and adding &600 to PAGE ensures that any BASIC program starts at an address higher than that of the extra reserved memory. If you forget to increase PAGE, any redefinition is likely to result in a 'Bad program' message as the poor BASIC program cannot usually handle being overwritten by character defini-



tion bytes. If these two lines are typed in, then no character definition will affect any other character.

Note that pages 389 and 427 of the User Guide contain a wealth of false information. Firstly, it does not matter whether you redefine character 129, 161, 193 or 225, you still get the new character on pressing

SHIFT f1. Secondly, attempting to reduce codes between 32 and 127 will not be ignored (as was demonstrated above) but may still cause problems. Thirdly, there are six different ways of 'exploding' the character set ranging from \*FX20,1 to \*FX20,6 depending on how much memory you need to reserve.

## SESSION TWO

In order to unravel some of the complexities which may occur we turn to Session 2 in which we print out various strings from different 32-byte blocks, and use the results to understand which \*FX20 command is appropriate in any circumstance.

In Session 2, we experiment with combinations of VDU23 commands, and will attempt to

define 'A' as a right-angled triangle, 'a' as a more regular (isosceles) triangle and character 129 as a square. As before, each part assumes the micro has just been powered up. The only differences between each run are firstly the VDU 23 commands and the order in which they are issued, and secondly the \*FX20 and alterations to PAGE commands. Each program prints characters 65-90 (usually the upper case alphabet) on one line, 97-122 (usually the lower case alphabet) on the next, and finally 129-131 on the next.

The first two runs proceed as might be expected, where the redefined character appears according to its reprogramming but characters 128-255 get overwritten as demonstrated in Session one. The next two runs show how one character block may overwrite another. In the third run, redefining character 65 means that the definition for characters 64-95 are stored in page &C, but subsequently redefining character 97 means that the definition of characters 96-127 overwrite the previous contents of page &C. However, as both blocks 64-95 and 96-127 use the contents of page &C for

their screen output, and as page &C contains the definitions for 96-127, then all upper-case letters will appear as lower-case letters. More generally, any character in the range 64-95 will be displayed as the corresponding character in the range 96-127. The fourth run just redefines the two characters in the opposite order, with a corresponding reversal of the situation described above.

In order to fully appreciate the significance of the last three runs in Session two, we should first examine Table 1 which is based on the table on page 427 of the User Guide, but is perhaps not so daunting. If you wish to redefine characters from any one block (even 96-127) no extra memory needs to be reserved provided you do not mind characters 128-255 also containing those redefinitions. However, if you want any block of characters not to be written to page &C, then the corresponding \*FX20 command and increase of PAGE should be issued.

The VDU 23 commands in runs five to eight of Session two are identical, and only the amount of reserved memory is different in each case. In run five,

defining character 97 writes that block into page &C but the subsequent redefinition of character 65 completely overwrites the previous contents. The final definition of character 129 only alters one character in page &C as the other redefinitions are already contained there. Thus the blocks 64-95, 96-127, 128-159, 160-191, 192-223 and 224-255 will all output the same character set to the screen. This result would be identical even if line 40 had defined character 161 (or 193 or 225) instead!

For run six, five pages of memory are set aside, which is enough to hold all redefinitions except those in the block 96-127. Thus the definition of character 97 writes all the characters in that block onto page &C, but the definition of character 65 is written into its own page (probably page &12 for those with cassette-based machines) and does not overwrite, or get overwritten by, any other redefinition. The final definition of character 129 is also written onto page &C and affects character 65 as well. At this stage blocks 96-127 and 128-151 will output the same character set to

**CONTINUED OVER**

For run seven, the maximum of six pages of memory is set aside and each character definition is independent of any other. However, six pages correspond to over 1500 bytes, and this overhead is really very high especially if you want to use the 20K graphics modes. If you are fortunate enough to have a second processor attached to the micro, use of a \*FX20 command does not take up any extra user memory. After this exhausting exposition what have we gained? Certainly a deeper understanding of the problems which might occur if character redefinition is taken too lightly. The final paragraphs of this article will give advice, based on the ideas expressed so far, on how to best conserve memory when defining characters.

No extra memory is needed if you keep to the same block. For reasons stated later it is best to define characters 128-159 (or possibly 160-191) rather than the 224-255 as is suggested in the User Guide and most redefinition articles.

From Table 1 it is evident that you should use the two blocks 128-159 and 160-191, in which case only 1 page of extra memory needs to be allocated. This is, of course, done by increasing PAGE by &100, and issuing a \*FX20, command. If you started from 224-255 and need extra characters you would either have to alter your pro-

The best policy in this case is to start from character 128 and work upwards. Defining 65-96 characters needs two pages of extra memory, and 97-128 characters needs three pages.

Sometimes you may wish to define the space character (32) as an inverse square, or even redefine the numerals (48-57). In this case, no extra memory needs to be allocated as long as no additional characters in the range 128-255 are redefined or used. If you wish, for example, to redefine the numerals *and* some user characters, it is clear from Table 1 that only four extra pages of memory need to be reserved as long as the defined user characters are all in the range 160-255.

You may redefine the complete ASCII set — and up to 96 characters of your own — reserving only five pages of memory. As long as characters 128-159 are neither reprogrammed nor used, you never need to reserve six pages!

```
>RUN
! A a
>
```

```
10 MODE6
30 FOR I=33 TO 255 STEP 32
40 VDU I,32
50 NEXT
60 PRINT
70 VDU 130,10,13
```

4

```
10 MODE6
20 VDU 23,129,255,255,255,255,255,255,255,255
30 FOR I=33 TO 255 STEP 32
40 VDU I,32
50 NEXT
60 PRINT
70 VDU 130,10,13
```

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

>

```
10 MODE6
20 VDU 23,225,255,255,255,255,255,255,255,255
30 FOR I=33 TO 255 STEP 32
40 VDU I,32
50 NEXT
60 PRINT
70 VDU 130,10,13
```

! 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

7

```

10 MODE6
20 VDU 23,65,255;255,255,255,255,255,255,255,255
30 FOR I=33 TO 255 STEP 32
40 VDU I,32
50 NEXT
60 PRINT
70 VDU 130,10,13

```

A gel electrophoresis image showing a single band in the lane labeled 'RUN'. The band is located at the same vertical position as the bands in the 'L' and 'R' lanes, indicating successful amplification of the target DNA.

□

H

## SESSION 2

A second round of experiments at the keyboard

Assume the micro has just been powered up before each separate part.

```
10 MODE6
20 VDU23,65,1,3,7,15,31,63,127,255
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲bcdefghijklmnopqrstuvwxyz
▲BC>
```

```
10 MODE6
20 VDU23,97,0,16,16,56,56,124,124,254
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲bcdefghijklmnopqrstuvwxyz
▲bc>
```

```
10 MODE6
20 VDU23,65,1,3,7,15,31,63,127,255
30 VDU23,97,0,16,16,56,56,124,124,254
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲bcdefghijklmnopqrstuvwxyz
▲bcdefghijklmnopqrstuvwxyz
▲bc>
```

```
10 MODE6
20 VDU23,97,0,16,16,56,56,124,124,254
30 VDU23,65,1,3,7,15,31,63,127,255
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲BC>
```

```
10 MODE6
20 VDU23,97,0,16,16,56,56,124,124,254
30 VDU23,65,1,3,7,15,31,63,127,255
40 VDU23,129,255,255,255,255,255,255,255,255
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲BC>
```

```
PAGE=PAGE+&500
*FX20,5
```

```
10 MODE6
20 VDU23,97,0,16,16,56,56,124,124,254
30 VDU23,65,1,3,7,15,31,63,127,255
40 VDU23,129,255,255,255,255,255,255,255,255
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲bcdefghijklmnopqrstuvwxyz
▲bc>
```

```
PAGE=PAGE+&600
*FX20,6
```

```
10 MODE6
20 VDU23,97,0,16,16,56,56,124,124,254
30 VDU23,65,1,3,7,15,31,63,127,255
40 VDU23,129,255,255,255,255,255,255,255,255
100 PRINT"ABCDEFGHIJKLMNPOQRSTUVWXYZ"
110 PRINT"abcdefghijklmnopqrstuvwxyz"
120 VDU129,130,131
```

```
>RUN
▲BCDEFGHIJKLMNPOQRSTUVWXYZ
▲bcdefghijklmnopqrstuvwxyz
■ >
```

Table 1

Defined character	Extra memory needed	*FX command	Alterations to PAGE
&20-&3F (32-63)	&400	*FX20,4	PAGE = PAGE + &400
&40-&5F (64-95)	&500	*FX20,5	PAGE = PAGE + &500
&60-&7F (96-127)	&600	*FX20,6	PAGE = PAGE + &600
&80-&9F (128-159)	—	—	—
&A0-&BF (160-191)	&100	*FX20,1	PAGE = PAGE + &100
&C0-&DF (192-223)	&200	*FX20,2	PAGE = PAGE + &200
&E0-&FF (224-255)	&300	*FX20,3	PAGE = PAGE + &300

# Regression Analysis

J Bulat



An important statistical technique which one often encounters is the ability to find the "best fit" of a line curve to a set of data points and then to use this curve to provide estimates of one variable from the other. Students of physics and chemistry are often presented with this problem applied to experimental data which invariably have some "scatter". This process of curve fitting is called regression.

The following article describes a curve fitting system for the BBC model B which allows you to enter, edit, view, print and save on tape raw data and provides a variety of regression options. The regression options available are linear, inverse, power, exponential, logarithmic, parabolic and cubic curves. In addition a separate program will produce a graph of the curve and the raw data points at any scale the user cares to specify.

**A program offering a wide range of regression options. It should prove to be of considerable interest and practical use for schools and colleges.**

## OPERATION

Fig.1 shows the flow diagram of the system which can be seen is menu driven. There are two menu's available. The Main Menu allows the entry and manipulation of raw data from

the keyboard or tape. The menu will not allow you to proceed without having first entered data. This condition is indicated by a flashing "NO DATA" message on the menu screen. Any attempt to select any option other than (1) or (2) in this condition will result

in a "Beep" from the machine and redisplay of the menu. Upon completion of any option, with the exception of REGRESSION, the program will return you to the menu.

The second menu in the system displays the Regression options available to you. The options available are as follows:

- (1) Linear curve  $Y = a + b \cdot X$
- (2) Inverse  $Y = a + b/X$
- (3) Exponential  $Y = a \cdot \exp(b \cdot X)$
- (4) Logarithmic  $Y = a + \ln(b \cdot X)$
- (5) Power  $Y = a \cdot X^b$
- (6) Parabolic  
 $Y = a + b \cdot X + c \cdot X^2$
- (7) Cubic  
 $Y = a + b \cdot X + c \cdot X^2 + d \cdot X^3$

In addition to these there are options to end the program, return to the main menu and to produce the graphic plot.

Execution of any of the regression options will cause the

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secti  
not l  
gram  
mess  
ZERO  
S  
tion v  
reco  
file w  
Then  
the  
"REG  
put t  
progr  
as th  
Mode

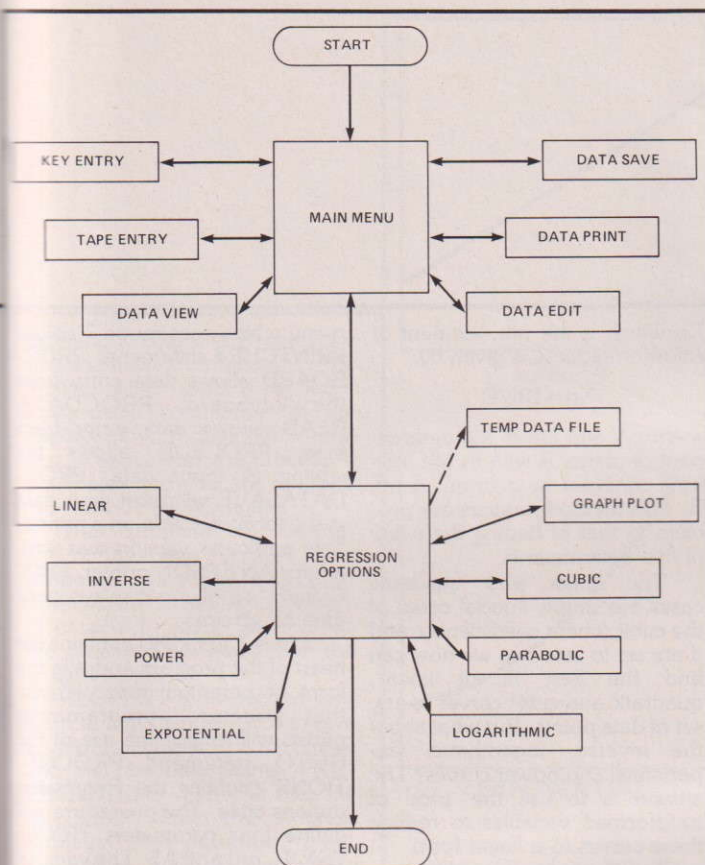


FIG 1. Program Structure

calculation of the regression coefficients  $a, b, c$  &  $d$  shown above and the coefficient of determination which is a measure of the "goodness of fit". This is on a scale from 0 to 1. The best fit being as close as 1 as possible. Execution times are of the order of a few seconds. Thus you can readily compare the goodness of fit of all the options available. You need a minimum of two data points for all options except the parabolic and cubic curves which require three and four data points respectively. These must be different ones! The program will print a message "NO SOLUTION" if the data is insufficient to give a result. Similarly when using any of the logarithmic or inverse transformations (see maths section) the data points should not be zero otherwise the program will stop and display the message "ILLEGAL USE OF ZERO IN DATA".

Selecting the graph plot option will then activate the cassette recorder and a temporary data file will be dumped onto tape. Then the computer will search for the program in listing 2 "REGPLOT". It was necessary to put this option into a separate program due to space problems as the graphing routine uses Mode 4.

REGPLOT will read the temporary data file and display the regression formula used, the regression coefficients  $a, b, c, d$  and the coefficient of determination. The program will then ask if hardcopy is required of the graph. Then you will be asked to enter the graph's "window" i.e. the range of values of  $X$  &  $Y$ . This is defined with six numbers.  $X1$ , and  $Y1$  define the lowest values of  $X$  &  $Y$  respectively.  $X2$  and  $Y2$  define the highest values and  $XINT$  &  $YINT$  define the "tick" interval along the axes. Once these are entered the program will clear the screen and produce a graph of the best-fit curve and plot the data points used. If the hardcopy option was selected then pressing 'space-bar' will cause a printout to be made of the regression formula used, its coefficients, the coefficient of determination, the graphs window parameters and then a bit image output of the graph itself. Any attempt to define the graph window such that  $X1 > X2$  or  $Y1 > Y2$  will be rejected by the program, which will simply reprompt you for these parameters. Similarly defining  $XINT$  or  $YINT$  as zero or as a negative number will give rise to the same response.

Upon completion of the

above pressing 'space-bar' will clear the screen and you will be asked if you want another graph. A yes answer will bring you back to the graph window definition stage. This will enable you to either centre the graph better or allow you to 'zoom-in' on a particular region of interest on the graph. A no answer will activate the cassette and the machine will expect to load "REGRESSION" again.

INPUT	DATA	TABLE	PAGE1
n	X	Y	
1	3039	90	
2	2923	100	
3	2801	110	
4	2687	120	
5	2563	130	
6	2447	140	
7	2333	150	
8	2210	160	
9	2082	170	
10	1960	180	
11	1833	190	
12	1705	200	
13	1586	210	
14	1463	220	
15	1340	230	
16	1206	240	
17	1075	250	
18	950	260	
19	830	270	

FIG. 2.

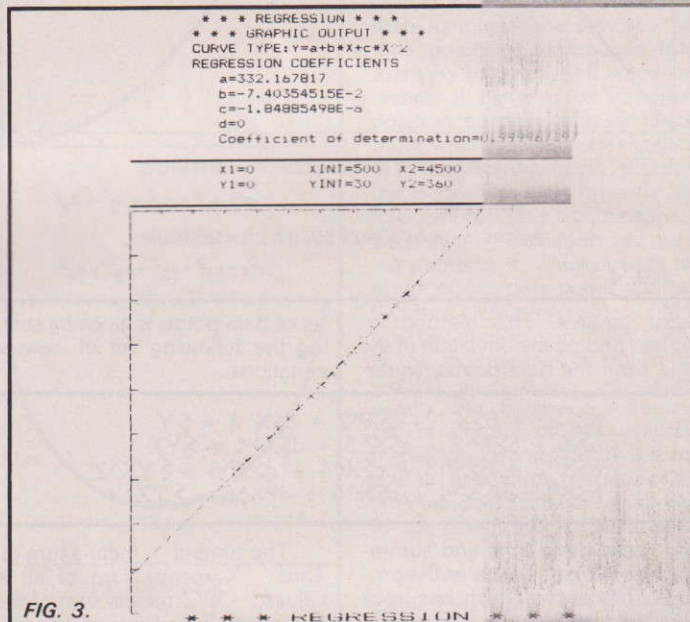


FIG. 3.

## TRICKY

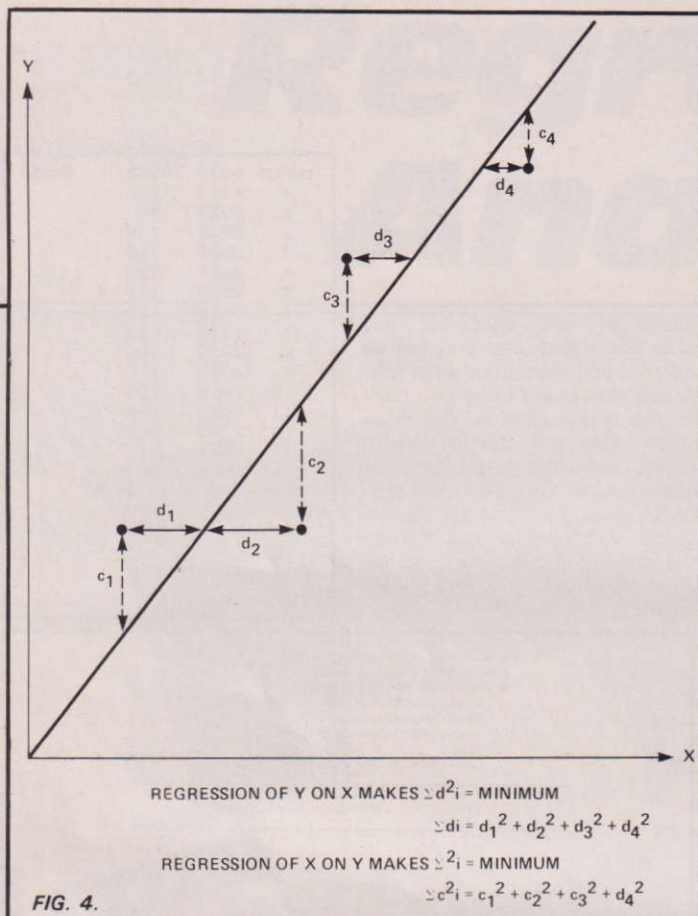
It is clear that all this switching from program to data file to next program is a little tricky for those with only a cassette recorder. This system is best implemented on disc or (as I have) the new Hobbit digital tape system which allow easy file handling. However, with a bit of care it can be used on an ordinary cassette system also. I would recommend having "REGRESSION" and "REGPLOT" on one side of the cassette and the temporary data file on the other so that you don't accidentally overwrite your programs. Similarly it's probably a good idea to store permanent data files on a separate cassette. Fig.2 shows an example of the input data listing and Fig.3 shows an example of the output from "REGPLOT".

Having covered the operational aspects of the system, I intend to delve into the inner workings of the program itself. To do this I'm afraid I have to give a simple resume of the mathematics of regression analysis. What follows is a simplified description of the process. For a more in-depth explanation I would recommend those interested to consult a statistics text book such as Murray R. Spiegel's "Probability and Statistics" in McGraw-Hill's Schaum's Outline series in Mathematics.

## MATHEMATICS OF REGRESSION

The calculation of the best fit curve to a set of data points is achieved using the method of

CONTINUED OVER



least squares. This method involves finding the deviation of the line from the data points, squar-

ing these deviations and summing them. Fig.4 illustrates the process. The curve which has been the least sum of squared deviations is then defined as the least squares fit to the data. A point to remember is that there are always two curves which can be fitted to any data set. This is because we can regress Y onto X where the deviations are calculated along the Y axis and X onto Y where the deviations are calculated along the X axis.

$$\begin{aligned} a n + b \sum X + c \sum X^2 + d \sum X^3 &= \sum Y \\ a \sum X + b \sum X^2 + c \sum X^3 + d \sum X^4 &= \sum XY \\ a \sum X^2 + b \sum X^3 + c \sum X^4 + d \sum X^5 &= \sum X^2 Y \\ a \sum X^3 + b \sum X^4 + c \sum X^5 + d \sum X^6 &= \sum X^3 Y \end{aligned}$$

ing these deviations and summing them. Fig.4 illustrates the process. The curve which has been the least sum of squared deviations is then defined as the least squares fit to the data. A point to remember is that there are always two curves which can be fitted to any data set. This is because we can regress Y onto X where the deviations are calculated along the Y axis and X onto Y where the deviations are calculated along the X axis.

The symbol  $\sum$  means sum of. Thus  $\sum X$  means sum of all X values,  $\sum X^2$  means sum of the square of all X values and so forth, n is the total number of data points. We now solve this system of simultaneous equations to give the regression coefficients a, b, c and d.

Any set of simultaneous equations can be expressed as a matrix equation. Thus our normal equations can be rewritten as the following

$$\begin{bmatrix} n & \sum X & \sum X^2 & \sum X^3 \\ \sum X & \sum X^2 & \sum X^3 & \sum X^4 \\ \sum X^2 & \sum X^3 & \sum X^4 & \sum X^5 \\ \sum X^3 & \sum X^4 & \sum X^5 & \sum X^6 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} \sum Y \\ \sum XY \\ \sum X^2 Y \\ \sum X^3 Y \end{bmatrix}$$

Let's consider the following cubic expression:

$$Y = a + bX + cX^2 + dX^3$$

It can be shown that the least

squares solution of the above to a This matrix equation is of the general form,

$$A \cdot X = B$$

This can be solved using Cramer's rule which states that

$X_n$  which is the nth. element of column matrix X is given by:

$$X_n = D_n / D$$

matrix A and  $D_n$  is the determinant of matrix A with its nth. column replaced by column matrix B. This method reduces our problem to that of finding the value of five determinants.

The linear and quadratic cases are simply special cases of the cubic where coefficients c and d are set to zero. So we now can find the best fit of linear, quadratic and cubic curves to any set of data points. But what about the inverse, logarithmic, exponential and power curves? The answer is to use the 'trick' of transformed variables to reduce these curves to a linear form.

To illustrate the technique let's consider the exponential equation:

$$Y = a \cdot \exp(b \cdot X)$$

taking logarithms on both sides

$$\ln Y = \ln a + b \cdot X$$

if we let  $Y = \ln Y$  and  $a = \ln a$

$$\text{then } Y = a + b \cdot x$$

This is clearly a linear equation. Thus by replacing the values for the Y by their logarithms we can simply use the linear equation again. This technique can reduce all the remaining curves to a linear form.

It remains to present the equation of the coefficient of determination.

$$R^2 = \frac{a \sum Y + b \sum XY + c \sum X^2 Y + d \sum X^3 Y - 1/n(\sum Y)^2}{Y^2 - 1/n(\sum Y)^2}$$

This has of necessity been a brief summary of the mathematics of regression but I hope it gives some insight into the description of the program structure which follows.

## PROGRAM STRUCTURE

Lines 10 to 320 contain the main

menu which uses mode 7 colour PRINTCHR\$ statements. PROCBOARD allows data entry from the keyboard, PROCDATA READ allows data entry from tape. PROCEDIT allows the editing of input data. PROC-DATASAVE will print your data in the form of a table on a printer. This particular version was written for an EPSON printer. PROCVIEW simply re-displays your data on screen.

Lines 330 to 380 contains the heart of the program and is in the form of perpetual loop. I hope that structural programming purists will forgive the use of the GOTO statement! PROCOPTIONS contains the Regression options table. The procedure will define four parameters TRX%, TRY%, ord and AS. The variable ord defines the order of the matrix, i.e. the size of the matrix. TRX% and TRY% are needed for the next procedure in the main loop. AS contains the standard equation of the curve selected. In addition to these tasks PROCGRAPH is accessed on PROCOPTIONS. PROCGRAPH will write a temporary data file REGTEMP to tape and then to chain REGPLOT.

Array F is used to store the raw data. However, it is necessary to transpose the data, as explained previously so that the transposed data is stored in array E. PROTRANS performs this task with the variables TRX%, TRY% which controls the type of transformation selected.

PROCSPLINEFIT is the subroutine that actually performs the polynomial regression on the transposed data contained in array E. First the procedure calculates the array of normal equations discussed in the mathematical section. This is assigned to array B. It then calculates the column matrix and assigns this to array C. It then calls PROCOLMATRIX. This returns the values of the regression formula to the array D.

The next procedure in the loop is PROCCOEFF which calculates the coefficient of determination and assign this to the variable REG. PROCDISPLAY is the routine which displays the

regression coefficients and the coefficient of determination. The procedure will await a keyboard input upon completion of the display. Upon receiving this input (e.g. a space-bar) the procedure terminates and you are returned to PROCOPTIONS again.

That completes the description of the main program. The temporary data file REGTEMP contains the following sequence of data: A\$, REG, array D(4), the variable MM% and then the array (FMM%,2).

REGPLOT is the second program listing. Its purpose is to give a graphical display of the curve and the raw data points. PROCREADTEMP reads the data file REGTEMP. Then the program displays the equation type, regression and determination coefficients. The variable FLAG is used to control procedures that use the printer. PROC-DATADRAW draws both the axes of the graph and plots the data points themselves. PROC-CURVEDRAW uses the EVAL function and the data is B\$(a modified version of A\$) to draw the curve.

## DISCUSSION ON USE

As can be seen this system provides quite a range of regression and data handling options. The system can handle approximately 550 data pairs. There are two broad categories of use for this program. The first category consists of fitting data to a theoretical relation and the second is an empirical fit for the purposes of interpolation or extrapolation.

The first case often occurs in Physics or Chemistry experiments. For example an experiment to find the decay constant of a radioactive element would repeatedly measure the number of radioactive atoms after successive intervals of time. The theoretical relationship for the decay curve is given by:

$$N = N_0 \exp(-T/t)$$

where N is the number of atoms,  $N_0$  is the number of atoms at the start T is time and t is the decay constant.

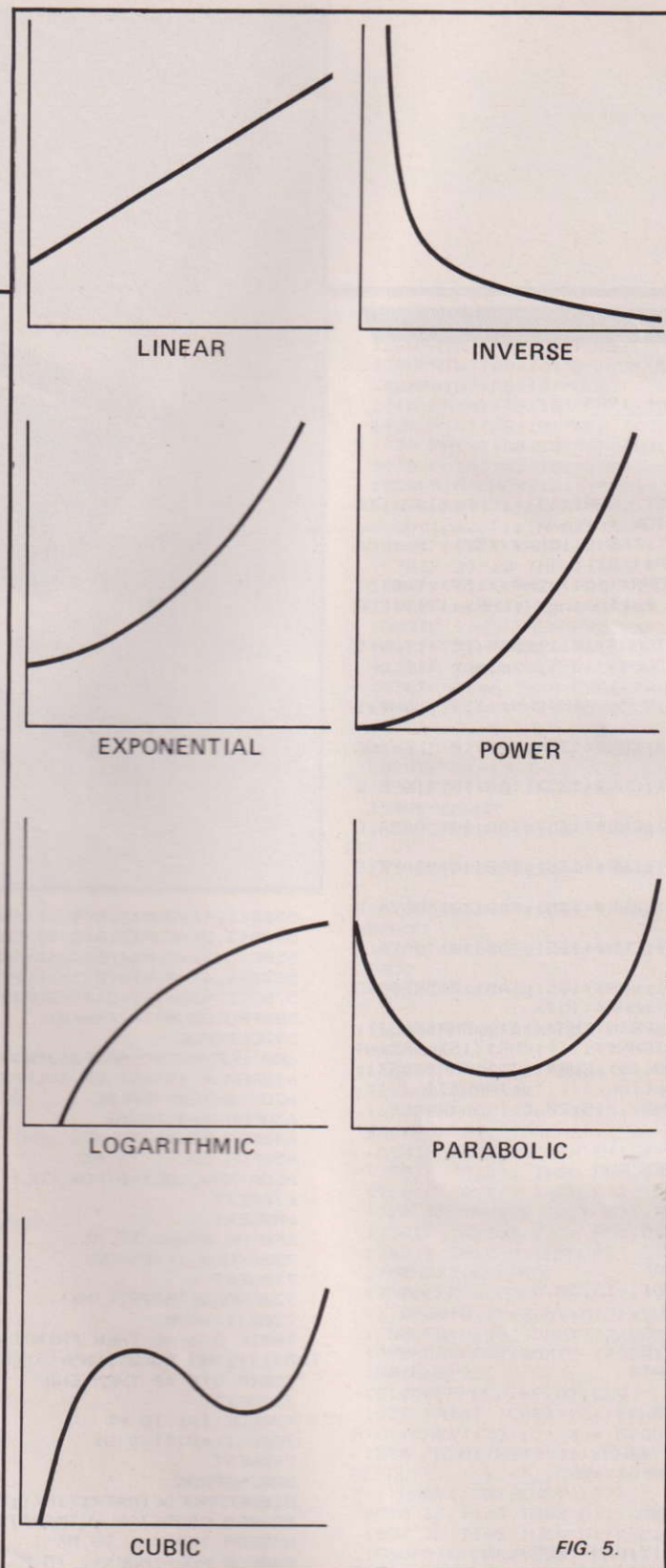


FIG. 5.

This is of the same form as our exponential fit option where the regression coefficients a and b are  $N_0$  and  $-1/t$  respectively. Thus using the regression program we can get an experimental estimate of t.

The second category of use is where we wish to use an em-

pirical fit for extrapolation or interpolation. In this we have no idea of what mathematical relation exists between our chosen data points. For example we may wish to find how long a particular procedure takes to run given a particular size of input parameter. For example this program uses a

procedure PROCDET-MATRIX(M%) which finds the value of the determinant of the array A of order M%. In general the larger M% is the longer it will take to execute PROCDET-MATRIX. Now this isn't reducible to a simple equation. So we could simply time the execution of the procedure for different values of M% and fit the data empirically. Here it is important to ask ourselves whether we wish to interpolate between our data points or extrapolate from them as this may influence our choice of curve to fit. For interpolation purposes the cubic formula will often give an excellent fit to the data. However, it's often the poorest curve to use for extrapolation. This is because a cubic has by definition two turning points in it. Thus outside the range of our data points we may find that increasing values of M% give faster execution times! Clearly the exponential or power fits would give more reasonable results. Fig. 5 gives a schematic set of graphs of the available regression options. Thus it is important to bear the purpose of the fit in mind and not be a total slave to the coefficient of determination!

Other points to remember in using the program are data input range and size. The regression method gives poor results, and may even not give a result if the data range of X values is too restricted. For example our X values may range from 10000 to 10100 would give a poor fit. The problem can be overcome by subtracting 10000 from the data set. A related problem is data size. The BBC machine has frankly a rather limited number range,  $2 \times 10^{38}$  to  $2 \times 10^{-39}$  to be precise. This might seem large but bear in mind that part of the main matrix has the expression  $X^6$  when using the cubic option. Taking our example we are entering data of the order of  $10^4$ . Thus  $X^6$  will be of the order of  $10^{24}$ ! If you have many data points you may well exceed the number range as we are summing numbers of the order of  $10^{24}$ .

CONTINUED OVER

## PROGRAM LISTING 1

```

10 REM * * REGRESSION * *
20 REM
30 REM by Joseph Bulat Sept.1983
40 REM
50 ON ERROR GOTO 2790
60MODE7:FLAG=FALSE
70CLS
80 PRINT "CHR$(131);CHR$(157)CHR$(131);CHR$(157);TA
B(8);CHR$(133);" * * REGRESSION * * "
90 PRINTCHR$(131);CHR$(157);TAB(9);CHR$(132);" * * DA
TA OPTIONS * * ";CHR$(131);CHR$(157);
100 IF FLAG=TRUE THEN PRINTCHR$(131);CHR$(157);TAB(5)
;CHR$(132);"select one of the following";CHR$(131);CHR
$(157);
110 IF FLAG=FALSE THEN PRINTCHR$(131);CHR$(157);TAB(5)
;CHR$(132);CHR$(136)"NO DATA"CHR$(137);"select (1) or
(2)";CHR$(131);CHR$(157);
120PRINTCHR$(131);CHR$(157);" ":PRINTCHR$(129);CHR$(1
57);" "
130 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"KEYBOA
RD ENTRY... (1) "
140 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"TAPE E
NTRY..... (2) "
150 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"DATA E
DIT..... (3) "
160 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"TAPE S
AVE..... (4) "
170 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"DATA P
RINT..... (5) "
180 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"DATA V
IEW..... (6) "
190 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"REGRES
SION..... (7) ";PRINTCHR$(129);CHR$(157);
200PRINTCHR$(131);CHR$(157);PRINTCHR$(131);CHR$(157);
PRINTCHR$(131);CHR$(157);PRINTCHR$(131);CHR$(157);PRINT
CHR$(131);CHR$(157);PRINTTAB(0,18);CHR$(131);CHR$(157);
CHR$(132);TAB(10,18);"Enter option.....";:INPUTII
210 IF II<1 OR II>7 THEN SOUND1,-15,20,5
220IF II<1 THEN 200
230IF II>7 THEN 200
240IF II=1 AND FLAG=TRUE THEN RUN
250 IF II=1 THEN FLAG=TRUE
260 IF II=1 THEN PROCBOARD
270IF II=2 AND FLAG=TRUE THEN RUN
280 IF II=2 THEN FLAG=TRUE
290 IF II=2 THEN PROCDATAREAD
300 IF FLAG=FALSE THEN SOUND1,-15,20,5
310 IF FLAG=FALSE THEN 70
320 IF II=3 THEN PROCEDIT
330 IF II=4 THEN PROCDATASAVE
340 IF II=5 THEN PROCPRINTDATA
350 IF II=6 THEN PROCVIEW
360 IF II=7 THEN 370 ELSE 70
370PROCOPTIONS
380PROCTRANS(TRX%,TRY%)
390PROCSPLINEFIT(MM%,1,MM%,ord)
400PROCCOEF
410PROCDISPLAY
420GOTO370
430DEFFPROCSPLINEFIT(MM%,I1,I2,ord):LOCAL I
440SUMX=0:SUMX2=0:SUMX3=0:SUMX4=0
450SUMX5=0:SUMX6=0:SUMT=0:SUMTX=0:SUMTX2=0
460 SUMTX3=0:SUMN=0:SUMT2=0
470 D(1)=0:D(2)=0:D(3)=0:D(4)=0
480FOR I=I1 TO I2
490PROCFIT(I)
500NEXT
510B(1,1)=SUMN:B(1,2)=SUMX:B(2,1)=SUMX
520B(1,3)=SUMX2:B(3,1)=SUMX2:B(2,2)=SUMX2

```

```

530B(1,4)=SUMX3:B(4,1)=SUMX3:B(2,3)=SUMX3
540B(3,2)=SUMX3:B(2,4)=SUMX4:B(4,2)=SUMX4
550B(3,3)=SUMX4:B(3,4)=SUMX5:B(4,3)=SUMX5
560B(4,4)=SUMX6:C(1)=SUMT:C(2)=SUMTX
570C(3)=SUMTX2:C(4)=SUMTX3
580PROC SOLMATRIX(ord)
590ENDPROC
600 DEFFPROC SOLMATRIX(M%)
610REM * *START OF SOLMATRIX* *
620K=0:ZERO=FALSE
630FOR I=0 TO M%
640FOR ROW=1 TO M%
650FOR COL=1 TO M%
660A(ROW,COL)=B(ROW,COL)
670NEXT
680NEXT
690FOR ROW=1 TO M%
700A(ROW,I)=C(ROW)
710NEXT
720PROC DETMATRIX(M%)
730D(I)=SUM
740IF D(0)=0 THEN PRINTCHR$(131);CHR$(157);CHR$(132);
TAB(12);"NO SOLUTION"
750IF D(0)=0 THEN END
760NEXT
770FOR I=1 TO M%
780D(I)=D(I)/D(0)
790NEXT
800ENDPROC
810DEFFPROC DETMATRIX(M%):LOCAL I
820REM GAUSSIAN ELIMINATION
830FOR INDEX=1 TO M%-1
840FOR ROW=INDEX+1 TO M%
850IF A(INDEX,INDEX)=0 THEN PROCCHANGE COL
860 IF ZERO=TRUE THEN SUM=0
870 IF ZERO=TRUE THEN ENDPROC
880C=-A(ROW,INDEX)/A(INDEX,INDEX)
890FOR T=INDEX TO M%
900A(ROW,T)=A(INDEX,T)*C+A(ROW,T)
910NEXT
920NEXT
930NEXT
940SUM=1
950FOR I=1 TO M%

```





```

1370PRINTTAB(10)"LOGARITHMIC...(4)"
1380PRINTTAB(10)"POWER ....(5)"
1390PRINTTAB(10)"PARABOLIC ....(6)"
1400PRINTTAB(10)"CUBIC ....(7)"
1410 PRINTTAB(10)"
1420PRINTTAB(10)"NEW DATA SET...(8)"
1430 PRINTTAB(10)"GRAPHIC PLOT...(9)"
1440 PRINTTAB(10)"END.....(10)"
1450PRINTCHR$(131);CHR$(157);PRINTCHR$(131);CHR$(157):
PRINTCHR$(131);CHR$(157);PRINTTAB(10,22);CHR$(132);"Enter option..";:INPUTII
1460IF II<1 THEN 1450
1470IF II>10 THEN 1450
1480IF II=1 THEN PROCCLIN
1490IF II=2 THEN PROCINV
1500IF II=3 THEN PROCEXP
1510IF II=4 THEN PROCLOG
1520IF II=5 THEN PROCPOW
1530IF II=6 THEN PROC PARA
1540IF II=7 THEN PROC CUBIC
1550IF II=8 THEN RUN
1560IF II=9 THEN PROCGRAPH
1570IF II=10 THEN CLS
1580IF II=10 THEN END
1590ENDPROC
1600DEFPROCCLIN:A$="Y=a+b*X":ord=2:TRX%=0:TRY%=0:ENDPROC
1610DEFPROCINV:A$="Y=a+b/X":ord=2:TRX%=2:TRY%=0:ENDPROC
1620DEFPROCEXP:A$="Y=a*EXP(b*X)":ord=2:TRX%=0:TRY%=1:ENDPROC
1630DEFPROCLOG:A$="Y=a+b*LN(X)":ord=2:TRX%=1:TRY%=0:ENDPROC
1640DEFPROCPOW:A$="Y=a*X^b":ord=2:TRX%=1:TRY%=1:ENDPROC
1650DEFPROC PARA:A$="Y=a+b*X+c*X^2":ord=3:TRX%=0:TRY%=0:ENDPROC
1660DEFPROC CUBIC:A$="Y=a+b*X+c*X^2+d*X^3":ord=4:TRX%=0:TRY%=0:ENDPROC
1670DEFPROCTRANS(TRX%,TRY%)
1680FOR I=1 TO MM%
1690IF TRX%=0 THEN E(I,1)=F(I,1)
1700IF TRX%=1 THEN E(I,1)=LN(F(I,1))
1710IF TRX%=2 THEN E(I,1)=1/(F(I,1))
1720 IF TRY%=0 THEN E(I,2)=F(I,2)
1730IF TRY%=1 THEN E(I,2)=LN(F(I,2))
1740IF TRY%=2 THEN E(I,2)=1/(F(I,2))
1750NEXT:ENDPROC
1760DEFPROC COEF
1770REG=D(1)*SUMT+D(2)*SUMTX+D(3)*SUMTX2+D(4)*SUMTX3
1780REG=REG-((SUMT)^2/SUMN)
1790REG=REG/(SUMT2-((SUMT)^2/SUMN))
1800ENDPROC
1810DEFPROC DISPLAY:CLS
1820 PRINT "CHR$(131);CHR$(157) 'CHR$(131);CHR$(157);TAB(8);CHR$(133);" * * * REGRESSION * * *"
1830 PRINTCHR$(131);CHR$(157);TAB(9);CHR$(132);" * * RESULTS * * ";CHR$(131);CHR$(157);CHR$(130);CHR$(157);CHR$(130);CHR$(157)
1840 IF II=3 THEN D(1)=EXP(D(1))
1850 IF II=5 THEN D(1)=EXP(D(1))
1860PRINTCHR$(130);CHR$(157);CHR$(131);TAB(10);A$
1870PRINTCHR$(130);CHR$(157);PRINTCHR$(130);CHR$(157);CHR$(131);TAB(10);"Regr. Coef=";REG:PRINTCHR$(130);CHR$(157)
1880IF ord=2 THEN PRINTTAB(10)"a=";D(1)
1890IF ord=2 THEN PRINTTAB(10)"b=";D(2)
1900IF ord=3 THEN PRINTTAB(10)"a=";D(1)
1910IF ord=3 THEN PRINTTAB(10)"b=";D(2)
1920IF ord=3 THEN PRINTTAB(10)"c=";D(3)
1930IF ord=4 THEN PRINTTAB(10)"a=";D(1)

```

CONTINUED OVER

```

960SUM=SUM*A(I,I)
970NEXT
980SUM=SUM*(-1)^K
990ENDPROC
1000DEFPROCCHANGECOL
1010LOCAL ROW,N:N=1
1020REPEAT
1030IF A(INDEX,INDEX+N)=0 THEN N=N+1
1040IF INDEX+N>M% THEN 1070
1050UNTIL A(INDEX,INDEX+N)<>0
1060 ZERO=FALSE
1070IF INDEX+N>M% THEN ZERO=TRUE ELSE 1090
1080ENDPROC
1090FOR ROW=INDEX TO M%
1100NN=A(ROW,INDEX+N)
1110A(ROW,INDEX+N)=A(ROW,INDEX)
1120A(ROW,INDEX)=NN
1130NEXT
1140K=K+1
1150ENDPROC
1160DEFPROC FIT(I)
1170SUMN=SUMN+1
1180SUMX=SUMX+E(I,1):SUMX2=SUMX2+E(I,1)^2
1190SUMX3=SUMX3+E(I,1)^3
1200SUMX4=SUMX4+E(I,1)^4
1210SUMX5=SUMX5+E(I,1)^5
1220SUMX6=SUMX6+E(I,1)^6
1230SUMT=SUMT+E(I,2)
1240SUMTX=SUMTX+E(I,2)*E(I,1)
1250SUMTX2=SUMTX2+E(I,2)*E(I,1)^2
1260SUMTX3=SUMTX3+E(I,2)*E(I,1)^3
1270SUMT2=SUMT2+E(I,2)^2
1280ENDPROC
1290DEFPROC OPTIONS
1300CLS:PRINT
1310 PRINT "CHR$(131);CHR$(157) 'CHR$(131);CHR$(157);TAB(8);CHR$(133);" * * * REGRESSION * * *"
1320 PRINTCHR$(131);CHR$(157);TAB(4);CHR$(132);" * * * REGRESSION OPTIONS * * * ";CHR$(131);CHR$(157)
1330 PRINTCHR$(131);CHR$(157);TAB(5);CHR$(132);"select one of the following";CHR$(131);CHR$(157);
1340PRINTTAB(10)"LINEAR ....(1)"
1350PRINTTAB(10)"INVERSE ....(2)"
1360PRINTTAB(10)"EXPONENTIAL...(3)"

```

```

1940IF ord=4 THEN PRINTTAB(10)"b=";D(2)
1950IF ord=4 THEN PRINTTAB(10)"c=";D(3)
1960IF ord=4 THEN PRINTTAB(10)"d=";D(4)
1970 I=GET:ENDPROC
1980DEFPROC DATA READ
1990PRINTCHR$(131);CHR$(157);TAB(10,20);CHR$(133);"FILE
NAME ";:INPUTI$
2000X=OPENINI$
2010INPUT#X,MM%
2020 DIME(MM%,2),F(MM%,2),A(4,4),B(4,4),C(4),D(4)
2030FOR I=1 TO MM%
2040INPUT#X,F(I,1),F(I,2)
2050NEXT
2060CLOSE#X
2070ENDPROC
2080DEFPROC DATA SAVE
2090PRINTCHR$(131);CHR$(157);TAB(10,19);CHR$(133);"ENTER
FILE NAME ";:INPUTI$
2100X=OPENOUTI$
2110PRINT#X,MM%
2120FOR I=1 TO MM%
2130PRINT#X,F(I,1),F(I,2)
2140NEXT
2150CLOSE#X
2160ENDPROC
2170DEFPROC EDIT:CLS
2180PRINT"TAB(10)"* * DATA EDIT * *"
2190PRINTTAB(12)"Exit with -99"
2200REPEAT
2210 INPUT"Enter data point",I
2220 IF I=-99 THEN 2270
2230IF I>MM% THEN 2210
2240IF I<1 THEN 2210
2250PRINT"PRESENT VALUE OF ";I;" IS ";F(I,1);" ";F(I,2)
)
2260 INPUT "NEW X,Y",F(I,1),F(I,2)
2270UNTIL I=-99
2280 ENDPROC
2290DEFPROC BOARD:CLS
2300PRINT"TAB(8)"* * KEYBOARD ENTRY * *"
2310INPUTTAB(5)"ENTER NUMBER OF DATA INPUTS "MM%
2320DIME(MM%,2),F(MM%,2),A(4,4),B(4,4),C(4),D(4)
2330FOR I=1 TO MM%
2340PRINT"TAB(10)"ENTER X,Y PAIR..";
2350INPUT F(I,1),F(I,2)
2360NEXT
2370ENDPROC
2380DEFPROC VIEW:CLS
2390PRINT"TAB(10)"* * DATA VIEW * *"
2400 I1=1:IF MM%>20THEN I2=20 ELSE I2=MM%
2410 PRINTTAB(3,4);"n";TAB(10,4);"X";TAB(16,4);"Y"
2420FOR I=I1 TO I2
2430PRINTTAB(3,(I MOD 21)+4);I;TAB(10,(I MOD 21)+4);F(
I,1);TAB(16,(I MOD 21)+4);F(I,2)
2440NEXT
2450I1=I2+1
2460IF I2<MM% THEN I2=I2+20
2470IF I2>MM% THEN I2=MM%
2480X=GET:CLS
2490 IF I1=MM%+1 THEN 2510
2500CLS:GOTO 2410
2510ENDPROC
2520FOR COLUMN=1 TO ((MM% MOD 100)DIV 20)
2530DEFPROC PRINT DATA:CLS
2540*FX6,0
2550VDU2:I1=1:IF MM%<35 THEN I2=MM% ELSE I2=I1+34
2560FOR page=1 TO (MM%DIV70)+1
2570 VDU1,27,ASC("@"):VDU1,14
2580PRINT" * * REGRESSION * * *"
2590PRINT"TAB(12);"INPUT DATA TABLE PAGE";page

```

```

2600FOR COLUMN=1 TO 2
2610PRINTTAB(5+20*(COLUMN-1));"n";TAB(9+20*(COLUMN-1));
"X";TAB(16+20*(COLUMN-1));"Y"
2620FOR I=I1 TO I2
2630PRINTTAB(5+20*(COLUMN-1));I;TAB(9+20*(COLUMN-1));F
(I,1);TAB(16+20*(COLUMN-1));F(I,2)
2640NEXT
2650I1=I2+1:I2=I2+35:IF I2>MM% THEN I2=MM%:IF I1>MM% T
HEN 2690
2660FORK=1T036:VDU1,27;ASC("j"),36:NEXT
2670VDU3:CLS:VDU2:NEXT
2680CLS:NEXT
2690 CLS:VDU3:ENDPROC
2700DEFPROC GRAPH
2710X=OPENOUT("REGTEMP")
2720PRINT#X,A$,REG
2730FOR I=1T04:PRINT#X,D(I):NEXT
2740PRINT#X,MM%
2750FOR I=1T0MM%:PRINT#X,F(I,1),F(I,2):NEXT
2760CLOSE#0
2770CHAIN"REGPLOT"
2780ENDPROC
2790 IF ERL=1670 THEN PRINTCHR$(131);CHR$(157);CHR$(13
2);"ILLEGAL USE OF ZERO IN DATA"
2800 IF ERL=1690 THEN PRINTCHR$(131);CHR$(157);CHR$(1
32);"ILLEGAL USE OF ZERO IN DATA"
2810 PRINTCHR$(131);CHR$(157);CHR$(132);TAB(11);"ERL="
ERL;" ERR=";ERR
>

```

## PROGRAM LISTING 2

```

10REM * * REGPLOT * *
20PROC READTEMP
30MODE7:FLAG=FALSE
40 PRINT"CHR$(131);CHR$(157)CHR$(131);CHR$(157);TA
B(8);CHR$(133);" * * REGRESSION * * *"
50 PRINTCHR$(131);CHR$(157);TAB(7);CHR$(132);" * * GR
APHIC DISPLAY * * ";CHR$(131);CHR$(157);CHR$(131);CH
R$(157)
60PRINTCHR$(131);CHR$(157);" ":PRINTCHR$(129);CHR$(1
57);" "
70 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"REGRES
SION FORMULA USED IS"
80 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10);A$
90 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"Reg. Co
ef.=";REG
100 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"a=";D(
1)
110 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"b=";D(
2)
120 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"c=";D(
3)
130 PRINTCHR$(129);CHR$(157);CHR$(135);TAB(10)"d="D(4
)
140PRINTCHR$(131);CHR$(157):PRINTCHR$(131);CHR$(157):
PRINTCHR$(131);CHR$(157):PRINTCHR$(131);CHR$(157):PRINT
CHR$(131);CHR$(157):PRINTTAB(0,18);CHR$(131);CHR$(157):
CHR$(132);TAB(5,18);"Do you want hardcopy";:INPUTI$
150 IF I$<>"Y" AND I$<>"N" THEN SOUND1,-15,20,5
160 IF I$<>"Y" AND I$<>"N" THEN 140 ELSEIF I$="Y" THE
N FLAG=TRUE
170PRINTCHR$(131);CHR$(157);TAB(5,19);CHR$(132);"Ente
r X1,XINT,X2..";:INPUTX1,XINT,X2
175 IF X2<X1 OR XINT<=0 THEN PRINTCHR$(131);CHR$(157)
;TAB(23,19);" "
180 IF X2<X1 OR XINT<=0 THEN 170
190PRINTCHR$(131);CHR$(157);TAB(5,20);CHR$(132);"Ente
r Y1,YINT,Y2..";:INPUTY1,YINT,Y2
195 IF Y2<Y1 OR YINT<=0 THEN PRINTCHR$(131);CHR$(157)
;TAB(23,20);" "

```



```

200 IF Y2<Y1 OR YINT<=0 THEN 190
210MODE4
220 IF FLAG=TRUE THEN PROCHEAD
230PROC DATADRAW
240PROCCURVEDRAW
250 X=GET
260 IF FLAG=TRUE THEN PROCDUMP
270 FLAG=FALSE
280MODE7
290PRINTTAB(10,10);"ANOTHER GRAPH";:INPUTI#
300 IF I#<>"Y" AND I#<>"N" THEN 290ELSEIF I#="Y" THEN
30
310 CHAIN"REGRESSION"
320 END
330DEFPROC READTEMP
340X=OPENIN("@REGTEMP")
350INPUT#X,A#,REG
360DIM D(4)
370FORI=1TO4: INPUT#X,D(I):NEXT
380INPUT#X,MM%
390DIM F(MM%,2)
400 FOR I=1TOMM%: INPUT#X,F(I,1),F(I,2):NEXT
410CLOSE#X
420ENDPROC
430DEFPROC DATADRAW
440MOVE1,1:X=XINT
450REPEAT
460DRAW (1279*(X-X1))/(X2-X1),1
470DRAW (1279*(X-X1))/(X2-X1),20
480MOVE (1279*(X-X1))/(X2-X1),1
490X=X+XINT
500UNTIL X>X2
510MOVE1,1:Y=YINT
520REPEAT
530DRAW 1,(1023*(Y-Y1))/(Y2-Y1)
540DRAW 10,(1023*(Y-Y1))/(Y2-Y1)
550MOVE 1,(1023*(Y-Y1))/(Y2-Y1)
560Y=Y+YINT
570UNTIL Y>Y2
580 FORI=1 TO MM%
590 XD=F(I,1)-X1:YD=F(I,2)-Y1
600PROCDCROSS(1279*XD/(X2-X1),1023*YD/(Y2-Y1))
610NEXT
620ENDPROC
630DEFPROCDCROSS(X,Y)
640MOVE(X-9),(Y+9):DRAW(X+9),(Y-9)
650MOVE(X-9),(Y-9):DRAW(X+9),(Y+9)
660ENDPROC

```

```

670DEFPROC CURVEDRAW
680B#=MID$(A$,3,LEN(A$)-2)
690a=D(1):b=D(2):c=D(3):d=D(4)
700FOR X=X1+((X2-X1)/100)TO X2 STEP (X2-X1)/100
710Y=EVAL(B#)
720 IF X=X1+((X2-X1)/100)THEN 750
730DRAW (1279*(X-X1))/(X2-X1),(1023*(Y-Y1))/(Y2-Y1)
740 GOTO760
750 MOVE (1279*(X-X1))/(X2-X1),(1023*(Y-Y1))/(Y2-Y1)
760NEXT
770ENDPROC
780DEFPROC HEAD
790*FX6,0
800 CLS
810VDU2
820PRINTTAB(8)"* * * REGRESSION * * *"
830PRINTTAB(7)"* * * GRAPHIC OUTPUT * * *"
840PRINTTAB(7)"CURVE TYPE:";A#
850PRINTTAB(7)"REGRESSION COEFFICIENTS"
860PRINTTAB(10)"a=";D(1)
870PRINTTAB(10)"b=";D(2)
880PRINTTAB(10)"c=";D(3)
890PRINTTAB(10)"d=";D(4)
900PRINTTAB(10)"Coefficient of determination=";REG
910PRINT"
920PRINTTAB(10);"X1=";X1;TAB(20);"XINT=";XINT;TAB(30)
;"X2=";X2
930PRINTTAB(10);"Y1=";Y1;TAB(20);"YINT=";YINT;TAB(30)
;"Y2=";Y2
940PRINT"
950VDU3
960CLS:ENDPROC
970DEFPROC DUMP
980*FX6,0
990VDU2
1000VDU1,27,1,65,1,8
1010FORL%=0 TO 39
1020VDU1,27,1,75,1,0,1,1
1030FORT%=31 TO 0 STEP -1
1040FORG%=7 TO 0 STEP -1
1050VDU1,?(HIMEM+T%*320+G%+L%*8)
1060NEXTG%,T%
1070VDU1,13,1,10
1080NEXT L%
1090VDU 1,27,1,50,3
1100ENDPROC

```

# Singalong

Margaret Stanger

Singalong is a program to help children who have just learned to read music or play the recorder.

The chosen song is displayed as written music on the screen, if words are included a red ball bounces above the word and below the note.

There is a choice of three songs from the program data or cassette tape modules can be created and read in.

The program data has the format: 1. The song title 2. The number of notes and silences in the song. 3. and 4. Time signature. 5. A flag to say whether words are included. 6. The pitch of the notes.

Notes A to G have their normal value in the descant recorder range, C' to G' are in the higher octave.

As the program is designed for young children key signatures

**Hum along to the tune of this flexible song player and generator. Children's parties will never be the same again.**



are not used, but there is provision for sharps and flats as accidentals.

If the pitch is 'R' this means a 'Rest' of the chosen duration. 7. The duration of the notes, from semi-demi-quavers to semibreves. The crotchet has a duration of 8, to make the arithmetic easier, and there is no syncopation. 8. The word or syllable belonging to each note. I have included inverted commas only for empty strings or words with leading spaces, as they are not necessary otherwise. When choosing to make a module, items 1, 3, 4 and 5 are entered first, followed by the pitch, duration and word for each note. There is some error trapping to limits, and there is an editing routine if desired.

The tape is written and the song played back before the program returns to the menu.

## HOW IT WORKS

### Integer Variables

B%	Note number in editing routine.
C%	Module flag.
I%	Loop variable.
K%	Horizontal position of note.
L%	Stave position.
N%	Vertical position of note.
Y%	Loop variable when drawing stave.
T%	Time delay factor.

### String Variables

A\$	Pitch letter (A to G).
B\$	Octave flag (' for higher octave).
B\$	Sharp (#) or flat(b).
CLEF\$	The string of user defined characters that make up the treble clef.
DOT\$	User defined character for note.
G\$	Input string variable.
TITLE\$	The title of the song.
T\$	File name of tape module.
W\$	General input string variable.

### Arrays

D%(28)	The duration of each note.
P\$(28)	The pitch of each note.
W\$(28)	The word or syllable for note.
LOOK-UP%(7)	A lookup table with the pitch of A,B,C,D,E,F, and G.

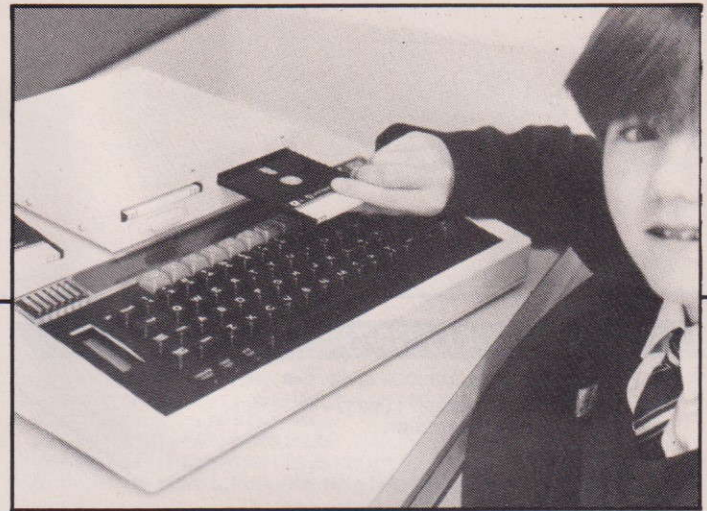
### Numeric Variables

A	Used in PROCLEAR.
B	Number of notes in the song.
D	Duration of bar so far.

G	REPEAT or MENU flag in PROCMESS.
I	Loop variable in PROCBOUNCE.
J	Loop variable.
K	Loop variable.
L	Stave position variable.
M	Loop variable for staves.
N	Vertical position variable.
P	Dummy variable for cassette routines.
Z	Vertical position of dot.
ALONG%	Distance between notes.
ADJUST	Offset for first stave.
BAR	Duration of bar.
BETWEEN	Distance between staves.
CH%	Menu choice.
DUR	Duration of current note.
INC	Distance between lines on stave.
LASTK & LASTN	Last position of bouncing ball.
LOUD	Loudness of the note.
MAX	Maximum number of letters in word.
MET1 & MET 2	Time signature.
NUMBER	Number of staves on the screen.
PITCH	Pitch of the note.
SKILL	Factor for slowing down music 1 is slowest.
WIDE	Number of characters per line.
WORD	TRUE if words are included.
XX & YY	Position of tail of note.

### Main Program

LINE 30	Selects mode and removes cursor.
LINE 40	Accesses Initialisation procedure.
LINE 60	Menu procedure.
LINE 70	Reads data or module.
LINE 80	Displays the music.
LINE 90	Plays the music.



## PROCEDURES

120 **PROCREAD**  
Reads program data. Note the variable RESTORE statement in line 130 when renumbering.

200 **PROSCORE**  
210 Centres title.  
220 Draws the staves.  
230 Accesses the procedures to calculate and display the music.

250 **PROCTUNE**  
260 Calculates the note.  
270 Delays until the sound buffer is empty to synchronise sound and movement.  
280 Sounds the note.  
290 If the song has words, the current word is emphasised by a ball that bounces above the word and below the note.

320 **PROCINIT**  
330 Sets up maximum length string variable.  
340 Initialises variables, dimensions arrays.  
370 Sets each element of the string arrays to maximum length to save the computer allocating more space later.  
380-520 Sets up the user defined characters.  
530 Defines CLEF\$.  
540 Reads the lookup table.  
550 Sets colours.  
580 **PROCSHOW**  
590 Calculates note position.  
600 Prints rest.  
610 Calculates pitch.  
620 Adjusts for upper octave.  
630 Prints note.  
640 Prints tail.  
650 Checks for end of bar.  
660 Prints word if any.  
690 **PROCBAR** Prints bar lines.  
740 **PROCTAIL UP (XX,YY)** Prints tail for lower notes.  
810 **PROCTAILDOWN(XX)** Prints tail for upper notes.  
870 **PROCTITLE** Prints title  
960 **PROCSTAVE**  
970 Sets start of first line.  
980 Draws five lines.  
990 Prints clef and time signature.  
1010 **PROCMENU** Prints menu.  
1090 **PROCLEAR (A,B)** Clears screen from A to B  
1130 **PROCPLAY**  
1140 Decides if note drawing is open or closed.  
1150 Decides if note is 'dotted'.  
1160 Calculates note position, adds duration to total.  
1170 Emphasises first note in bar.  
1180 Checks for silence.  
1190 Calculates the pitch of the note from the position of (ASCII-64) in the lookup table.  
1200,1210 Looks for higher octave, sharps or flats.  
1220 Adjusts for higher octave.  
1230 Adjusts for sharps or flats.  
1260 **PROCMESS** Prints message.  
1290 **PROCBOUNCE**  
1300 Prints ball in last position.  
1310 Moves ball up. As the cursors are joined, the old image is not blanked.  
1330 Blanks round the edges of the new image by printing its complement in the background colour.  
1340 Moves ball down.  
1350 Blanks round edges.  
1360 Updates last position.

1380 **PROCLOAD** Loads module.  
1490 **PROCWRITE** Writes module.  
1600 **PROCWAIT(T%)** Delays for T% microseconds.  
1630 **PROCTAPE** Accesses PROCLOAD or PROCKEY and PROCWRITE.  
1700 **PROCKEY**  
1710,1720 Input and verify title.  
1730-1770 Input and verify time signatures.  
1780 Asks if words are included.  
1800 Further instructions.  
1810 Prints headings.  
1830 Input and verify pitch, the entry is printed in black when complete and correct. The entry is put first into a dummy variable, W\$, to save the computer allocating unnecessary space.  
1840 Checks for end of data.  
1850 Inputs and checks duration.  
1860 Inputs and checks word, if any, using a dummy variable.  
1870 Increase note number.  
1880 If last entry has been made, a space is cleared for editing instructions.  
1890 Accesses editing routine.  
2040 **PROCONSTANTS**. Calculates bar size, and distance between staves, depending on maximum word length.  
2080 **PROCEDIT**  
2090 Prints instructions. Input and check which line is to be edited. Checks for end.  
2100 Input and check pitch.  
2110 Input and check duration.  
2120 Input and check word, if any

## FUNCTIONS

1910 **FNWORDOK** is true if the word has no more than maximum length.  
1940 **FNDUROK** is true if the duration is greater than zero and less than 65.  
1970 **FNPITCHOK** is true if:  
A\$ is R or from A to G  
B\$ is ' or empty  
C\$ is #, b, or empty.

## CONCLUSION

I have written the program in this form hoping to make it easier to type, the display fairly clear, and as many options open as possible. Unfortunately it makes the program too long for many more than 28 items in the arrays.

It is possible to shorten the program using some or all of the

following techniques:

The program can be written in MODE 4, giving a two colour display. The names of the procedures, functions could be shortened, and more advantage taken of integer variables.

If you also remove any procedures that you do not wish to use, you may even save enough space to include a screen dump.

CONTINUED OVER

## PROGRAM LISTING

```

10REM**SINGALONG**
20REM** by M.STANGER (1983)**
30MODE 1: !%FE00=&10200A
40PROCINIT
50REPEAT
60PROCMENU
70IFC% = 1 PROCREAD ELSE PROCTAPE
80PROCCONSTANTS: PROCScore
90REPEAT: PROCTUNE: PROCMess: UNTILG=13: CLS
100UNTILFALSE: END
110:
120DEFPROCREAD
130RESTORE (2120+(40*CH%))
140READTITLE$,B,MET1,MET2,WORD
150FORJ=0TOB-1: READP$(K): NEXT
160FORJ=0TOB-1: READD$(K): NEXT
170IF WORD=TRUE FORK=0TOB-1: READW$(K): NEXT
180ENDPROC
190:
200DEFPROCScore
210VDU4: COLOUR2: PRINTTAB(20-(LEN(TITLE$))/2,0); TITLE$
:VDU5: GCOL0,7
220FORM=NUMBER TO1STEP-1: PROCSTAVE(M): NEXT
230FORJ=0TOB-1: PROCPLAY(J): PROCSHOW(NUMBER-(J DIV ALONG%), (J MOD ALONG%)): NEXT: ENDPROC
240:
250DEFPROCTUNE
260FORJ=0TOB-1: PROCPLAY(J)
270REPEAT: UNTILADVAL(-6)=15
280SOUND1, LOUD, PITCH, DUR*SKILL: SOUND1,0,0,1
290IF WORD=TRUE PROCBounce(4-(J DIV ALONG%), (J MOD ALONG%))
300NEXT: ENDPROC
310:
320DEFPROCINIT
330MAX=5: W$="": FORX=1TOMAX: W$=W$+"X": NEXT
340WIDE=40: ALONG%=WIDE-3 DIV MAX: WORD=TRUE
350LASTK=0: LASTN=0: SKILL=1
360DIMLOOKUP%(7), P$(28), D$(28), W$(28): Y% = 0: INC=24
370FORK=1TO28: P$(K) = "F#": W$(K) = W$: NEXT
380VDU23,227,12,10,9,9,9,9,9,9
390VDU23,228,9,10,12,24,40,40,72,73
400VDU23,229,136,136,136,136,72,72,4,4
410VDU23,230,8,8,8,8,8,8,80,32
420VDU23,231,32,16,16,16,32,64,128,0
430VDU23,232,0,60,126,255,255,126,60,0
440VDU23,233,0,60,66,129,129,66,60,0
450VDU23,234,0,0,0,24,24,0,0,0
460VDU23,235,0,0,24,60,60,60,60,24
470VDU23,236,24,60,60,60,60,24,0,0
480VDU23,237,0,0,30,30,24,24,24,0
490VDU23,238,0,24,60,60,60,60,24,0
500VDU23,239,0,0,0,195,231,255,255,255
510VDU23,240,255,255,231,195,0,0,0,0
520VDU23,255,255,255,255,255,255,255,255,255
530CLEF$=CHR$227+CHR$10+CHR$8+CHR$228+CHR$10+CHR$8+CHR$229+CHR$231+CHR$8+CHR$8+CHR$10+CHR$230
540FOR I=1 TO 7: READ LOOKUP%(I): NEXT I
550VDU19,0,7,0,0,0: VDU19,3,0,0,0,0: VDU19,2,4,0,0,0
560ENDPROC
570:
580DEFPROCSHOW(N,K)
590N% = BETWEEN*N-ADJUST: K% = K*32*MAX+96
600IF LOUD=0 Z=N%+48: MOVE K%,Z: PRINTDOT$: GOTO650
610Z=N%+12*(ASC(A$)-64)-48: IFA$="A" OR A$="B" Z=Z+84
620IFB$=" " Z=Z+84
630MOVE K%,Z: PRINTDOT$: C$
640IF PITCH >=97 PROCTAILDOWN(K%) ELSE PROCTAILUP(K%,Z)

```



```

650D=D+DUR: IFD>=BAR D=0: PROCBAR
660IFWORD=TRUE GCOL0,2: MOVE K%,N%-96: PRINTW$: GCOL0,7
670ENDPROC
680:
690DEFPROCBAR
700MOVEK%+32*MAX-16,N%+96: DRAWK%+32*MAX-16,N%
710IFJ=B-1 MOVEK%+32*MAX,N%+96: DRAWK%+32*MAX,N%
720ENDPROC
730:
740DEFPROCTAILUP(XX,YY)
750IF PITCH=53 MOVEXX-30,Z-10: MOVEXX-30,Z-10: DRAWXX+90,Z-10
760IFDUR>=32 ENDPROC
770MOVEXX+30,Z-10: DRAWXX+30,Z+48: IFDUR>6 ENDPROC
780DRAWXX+64,Z+32: IFDUR>3 ENDPROC
790MOVEXX+30,Z+40: DRAWXX+64,Z+24: ENDPROC
800:
810DEFPROCTAILDOWN(XX)
820IFDUR>=32 ENDPROC
830MOVEXX,Z-15: DRAWXX,Z-64: IFDUR>6 ENDPROC
840DRAWXX+24,Z-48: IFDUR>3 ENDPROC
850MOVEXX,Z-56: DRAWXX+24,Z-40: ENDPROC
860:
870DEFPROCTITLE
880VDU4: !%FE00=&10200A: COLOUR2
890PRINTTAB(13,5); "*****"
900PRINTTAB(13); "# #"
910PRINTTAB(13); "# SINGALONG #"
920PRINTTAB(13); "# #"
930PRINTTAB(13); "*****"
940ENDPROC
950:
960DEFPROCSTAVE(L)
970VDU5: GCOL0,3: Y% = 0: L% = L*BETWEEN-ADJUST
980REPEAT: MOVE 0,L%+Y%: DRAW1279,L%+Y%: Y%=Y%+INC: UNTIL Y%=5*INC
990MOVE 0,L%+(4*INC): PRINTCLEF$: MOVE-240,L%+(3*INC): PRINTMET1: MOVE -240,L%+(2*INC): PRINTMET2: ENDPROC
1000:
1010DEFPROCMENU
1020PROCTITLE: COLOUR1:D=0
1030PRINTTAB(1,18); "DO YOU WISH TO USE ": COLOUR3: PRINT "1. DATA FROM THIS PROGRAM" "2. DATA FROM A MODULE": C
LOUR1: PRINT "PLEASE ENTER 1 OR 2"
1040REPEATC$=GET$: UNTILC$="1" OR C$="2": C%=VAL(C$)
1050PROCLEAR(20,30): ON C% GOTO1060,1080
1060PRINTTAB(1,18); "PLEASE MAKE YOUR CHOICE": COLOUR3: PRINT "1. LONDON'S BURNING" "2. NOW THE DAY IS OVER" "3. PLEASE PORRIDGE": COLOUR1: PRINT "ENTER 1, 2 OR 3"
1070C$=GET$: CH%=VAL(C$): IFCH%<1 OR CH%>3 GOTO1070
1080CLS: ENDPROC
1090DEFPROCLEAR(A,B)
1100FORJ=A TO B: PRINTTAB(0,J); STRING$(39," "): NEXT J
1110ENDPROC
1120:
1130DEFPROCPLAY(J)
1140W$=W$(J): DUR=D$(J): IFDUR>=16 DOT$=CHR$233 ELSE DOT$=CHR$232
1150IFDUR MOD 3=0 DOT$=DOT$+CHR$234
1160B$="": C$="": A$=LEFT$(P$(J),1): D=D+DUR: IFD=BAR D=0
1170IF D=DUR LOUD=-15 ELSE LOUD=-13
1180IFA$="R" DOT$=CHR$237: LOUD=0: ENDPROC
1190PITCH=LOOKUP%(ASC(A$)-64): IFLEN(P$(J))=1 ENDPROC
1200B$=MID$(P$(J),2,1): IFLEN(P$(J))=3 C$=MID$(P$(J),3,1)
1210IFB$<>" " C$=B$: B$=" "
1220PITCH=LOOKUP%(ASC(A$)-64): IFB$=" " PITCH=PITCH+48

```

```

1230IFC$="#" PITCH=PITCH+4:ELSE IFC$="b" PITCH=PITCH-4
1240ENDPROC
1250:
1260DEFFROCMESS
1270GCOL0,1:MOVE64,32:PRINT"Press SPACE to repeat,RETU
RN for menu":REPEAT:G=GET:UNTILG=13 OR G=32:GCOL0,3:END
PROC
1280:
1290DEFFROCBOUNCE(N,K)
1300GCOL0,0:MOVELASTK,LASTN:PRINTCHR$255
1310N%=224*N-28:K%=K*32*MAX+128
1320FORI=0TO3:GCOL0,0:MOVEK%,N%-68+I*4:PRINTCHR$239
1330GCOL0,1:MOVEK%,N%-64+I*4:PRINTCHR$235:NEXT
1340FORI=3TO0STEP-1:GCOL0,0:MOVEK%,N%-56+I*4:PRINTCHR$
240
1350GCOL0,1:MOVEK%,N%-64+I*4:PRINTCHR$236:NEXT
1360LASTK=K%:LASTN=N%-64:GCOL0,3:ENDPROC
1370:
1380DEFFROCLoad
1390CLS:INPUTTAB(1,7)"NAME OF TAPE "G$:T$=G$:PROCLEAR(
7,12)
1400IFLEN(T$)<10ORLEN(T$)>10GOTO1390
1410PRINTTAB(7,15)"PLACE YOUR CASSETTE IN DECK"TAB(14
)"AND PRESS PLAY"
1420X=OPENIN T$
1430INPUT#X,TITLE$,B,MET1,MET2,WORD
1440FORI=0TOB-1:INPUT#X,P$(I%):NEXT
1450FORI=0TOB-1:INPUT#X,D$(I%):NEXT
1460IFWORD FORI=0TOB-1:INPUT#X,W$(I%):NEXT
1470CLOSE#X:PRINTTAB(7,20)"DATA LOADED":PROCWAIT(200):
CLS:ENDPROC
1480:
1490DEFFROCWRIte
1500CLS:INPUTTAB(1,16)"NAME OF TAPE "G$:T$=G$
1510IFLEN(T$)<10ORLEN(T$)>10 GOTO1500
1520PRINTTAB(7,15)"PLACE YOUR CASSETTE IN DECK"TAB(12
)"AND PRESS RECORD"
1530X=OPENOUT T$
1540PRINT#X,TITLE$,B,MET1,MET2,WORD
1550FORI=0TOB-1:PRINT#X,P$(I%):NEXT
1560FORI=0TOB-1:PRINT#X,D$(I%):NEXT
1570IFWORD FORI=0TOB-1:PRINT#X,W$(I%):NEXT
1580CLOSE#X:PRINTTAB(7,20)"DATA SAVED":PROCWAIT(200):P
ROCLEAR(20,20):ENDPROC
1590:
1600DEFFROCPWAit(T%)
1610TIME=0:REPEAT:UNTILTIME>T%:ENDPROC
1620:
1630DEFFROCTAPE
1640CLS:PRINTTAB(3,15)"DO YOU WISH TO MAKE A NEW TAPE
(Y/N)?" :REPEATG$=GET$:UNTILG$="Y"OR G$="N":PROCLEAR(5,6)
1650IF G$="Y"PROCKEY:PROCWRITE:CLS:ENDPROC
1660CLS:PRINTTAB(5,15)"DO YOU WISH TO LOAD A TAPE (Y/N
)?" :REPEATG$=GET$:UNTILG$="Y"OR G$="N"
1670IF G$="N" RUN
1680PROCLOAD:ENDPROC
1690:
1700DEFFROCKEY
1710CLS:PRINTTAB(8,1)"ENTER TUNE"
1720PRINT"TITLE OF TUNE":REPEATINPUTTITLE$:UNTILLEN(T
ITLE$)>0ANDLEN(TITLE$)<40
1730PRINT;TITLE$:CLS:PRINT"TIME SIGNATURE":PRINTTAB(19
,15)" "
1740INPUTTAB(20,14)MET1
1750INPUTTAB(20,17)MET2
1760PRINT"IS THIS CORRECT?":REPEAT:G$=GET$:UNTILG$="Y
"OR G$="N"
1770IF G$="N" GOTO1710
1780PRINT"DO YOU WANT TO INCLUDE WORDS?":REPEATG$=GET
$:UNTILG$="Y"OR G$="N"
1790IF G$="Y" WORD=-1 ELSEWORD=0
1800CLS:PRINTTAB(0,30)"ENTER @ <RETURN> AFTER LAST EN
TRY"
1810PRINTTAB(5,0)"PITCH":PRINTTAB(15,0)"DURATION":IF

```

```

WORD PRINTTAB(25,0)"WORD"
1820B=0:COLOUR3:REPEAT
1830REPEAT:PROCLEAR(B+1,B+1):COLOUR1:PRINTTAB(0,B+1):B
+1:INPUTTAB(5,B+1),W$:UNTILFNPITCHOK:COLOUR3:PRINTTAB(5
,B+1),W$;" " :P$(B)=W$
1840IFP$(B)="#" GOTO1880
1850REPEAT:PRINTTAB(15,B+1);" " :COLOUR1:INPUTTAB(15
,B+1),D$(B):UNTILFNDUROK(B):COLOUR3:PRINTTAB(15,B+1):D$
(B);" "
1860IF WORD REPEAT:PRINTTAB(25,B+1):STRING$(14," "):CO
LOUR1:PRINTTAB(25,B+1);:INPUTLINE,W$:UNTILFNWORDOK:COLO
UR3:PRINTTAB(25,B+1),W$;" " :W$(B)=W$
1870B=B+1
1880UNTILB=28 OR P$(B)="#" :IFP$(B)="#" P$(B)="" :PROCLE
AR(B+1,30)
1890PROCEDIT:ENDPROC
1900:
1910DEFFFNWORDOK
1920IFLEN(W$)>MAX =FALSE ELSE=TRUE
1930:
1940DEFFNDUROK(A%)
1950IFD%(A%)<1 OR D%(A%)>64 =FALSE ELSE=TRUE
1960:
1970DEFFNPITCHOK P=FALSE
1980A$=LEFT$(W$,1)
1990B$="" :C$="" :IFLEN(W$)>1B$=MID$(W$,2,1):IFLEN(W$)=3
C$=MID$(W$,3,1)
2000IF LEN(W$)=2 AND B$<>" " C$=B$:B$="" ELSE C$=""
2010IF (A$="R" OR A$="@" OR (ASC(A$)>64 AND ASC(A$)<72))
AND (B$="" OR B$=" ") AND (C$="b" OR C$="#" OR C$=" ") P=TRU
E ELSE P=FALSE
2020=P
2030:
2040DEFFROCONSTANTS BAR=64*MET1/MET2
2050IF WORD=TRUE BETWEEN=224:ADJUST=32:NUMBER=4:MAX=5
ELSE BETWEEN=160:ADJUST=96:NUMBER=6:MAX=3
2060ALONG%=(WIDE-3) DIV MAX:ENDPROC
2070:
2080DEFFROCPEDIT
2090REPEAT:PRINTTAB(0,29)"WHICH NOTE DO YOU WANT TO E
DIT" "ENTER 0 <RETURN> TO FINISH":INPUTTAB(32,29)W$:B$=
VAL(W$):UNTILB$<B+1 AND B$>-1:PROCLEAR(29,30):IFB$=0 EN
DPROC
2100REPEAT:PROCLEAR(B%,B%):COLOUR1:PRINTTAB(0,B%):B%:
INPUTTAB(5,B%),W$:UNTILFNPITCHOK:COLOUR3:PRINTTAB(5,B%),
W$;" " :P$(B%-1)=W$
2110REPEAT:PRINTTAB(15,B%);" " :COLOUR1:INPUTTAB(15,
B%),D$(B%-1):UNTILFNDUROK(B%-1):COLOUR3:PRINTTAB(15,B%)
:D$(B%-1);" "
2120IF WORD REPEAT:PRINTTAB(25,B%):STRING$(14," "):COL
OUR1:PRINTTAB(25,B%);:INPUTLINE,W$:UNTILFNWORDOK:COLOUR
3:PRINTTAB(25,B%),W$;" " :W$(B%-1)=W$
2130GOTO2090
2140ENDPROC
2150DATA89,97,53,61,69,73,81
2160DATA"LONDON'S BURNING",28,3,4,-1
2170DATAD,D,G,G,D,D,G,G,A,A,B,B,A,A,B,D',D',D',D',
C',B,B,D',C',B,B
2180DATA4,4,8,8,4,4,8,8,4,4,8,8,4,4,8,8,16,8,16,4,4,
8,8,4,4,8,8
2190DATALon,dons,burn,-ing,Lon,dons,burn,-ing,fetch,"
the",en-,gine,fetch," the",en-,gine,Fire,Fire,Fire,Fire
,Pour,on,wa,-ter,pour,on,wa,-ter
2200DATA"NOW THE DAY IS OVER",24,4,4,-1
2210DATAB,B,C',C',D',B,C',C',B,B,A,R,B,B,A,G,C',B,B,B,
A,A,G,R
2220DATA8,8,8,8,16,16,8,8,8,8,24,0,8,8,8,8,16,16,8,8,8
,8,24,8
2230DATANow,the,day,is,o-,ver,Night,is,draw,-ing,nigh,
,"",Shad,-ows,of,the,eve-,ning,Steal," a","cross," the",
sky,""
2240DATA"PEASE PORRIDGE",19,4,4,0
2250DATAG,G,A,B,R,C',C',C',B,R,G,G,A,B,B,B,A,A,G
2260DATA8,4,4,8,8,8,4,4,8,8,8,4,4,4,4,4,8,8,16

```

# Going to Print

Mark Webb

For some time now hardcopy for the BBC Micro system has relied on dot matrix printers along the lines of the well known Epson RX and FX80s. Features and, correspondingly, prices vary over a wide range. Now Epson have expanded their product range into a colour printer—a FX80 lookalike, and four colour plotter and two very interesting developments from all BBC and Electron owners point of view, the P80 thermal transfer, and P40 thermal printers.

Now these printers are primarily designed to compliment Epson products; the P40 sits neatly in a briefcase beside the PX8 portable for instance. However there is no reason why BBC and Electron owners (with their newly acquired printer ports) cannot benefit from the performance and price advantages of buying Epson. The P80 costs £160 + VAT and the P40 just £95 + VAT.

The P80 is a thermal transfer printer which means that it utilises a ribbon to transfer the dot matrix pattern to the paper. Thus you can use ordinary paper with the P80 as well as thermal paper without the ribbon. As you might suspect the P80 has 80 column capability. It prints at a rather leisurely 45 characters per second but that is one of the prices you pay for using thermal technology. The major advantage is the ribbon which is 100mm long and lasts for 40,000 characters! Paper is friction fed and printing styles include Pica and Elite plus the choice of standard, enlarged and condensed type. Both parallel and serial interfaces are to be available and parallel to be preferred for BBC owners who wish to keep the RS423 open for other use. The most striking thing about the P80 is its extraordinary appearance. It's very thin, just over 11cm. This is possible because of the thermal technology and the battery (rechargeable) power source.

The P80 looks like an excellent bet for the user who requires 80 columns but whose budget doesn't run to the currently available dot matrix models.

## A new range of printers introducing new technology.

### TOP END

At the top end of the range Epson have added a £560 + VAT colour printer, the JX-80. It has the same command set as the FX and RX80 printers and can use the same ribbons when defaulting to monochrome. It has all the features of an FX80, such as 160 characters per second print speed, bi-directional and logic seeking print in character mode and proportional spacing.

When colour is required, up to seven are available based upon a four colour cartridge ribbon. All the print styles and character sets naturally remain available but printing speeds decrease proportional to the amount of colours which have to be mixed to pro-

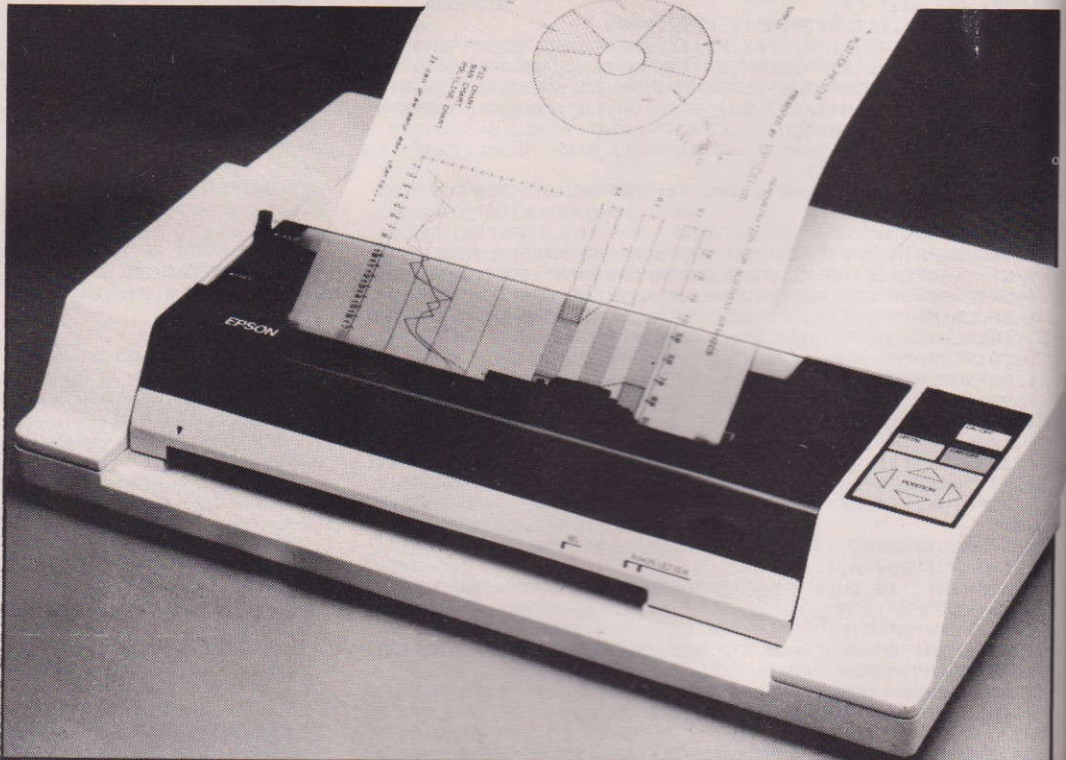
duce the chosen shade. You probably won't have to wait around though since the JX80 has a 2K character buffer. An interesting departure for the printer specialists is the HI-80 colour plotter. The price of £400 + VAT is low enough to attract the business/professional user who requires high quality hard copy to make full use of the business graphics now available through using BBC system Z80. It can also double up for printing text if necessary.

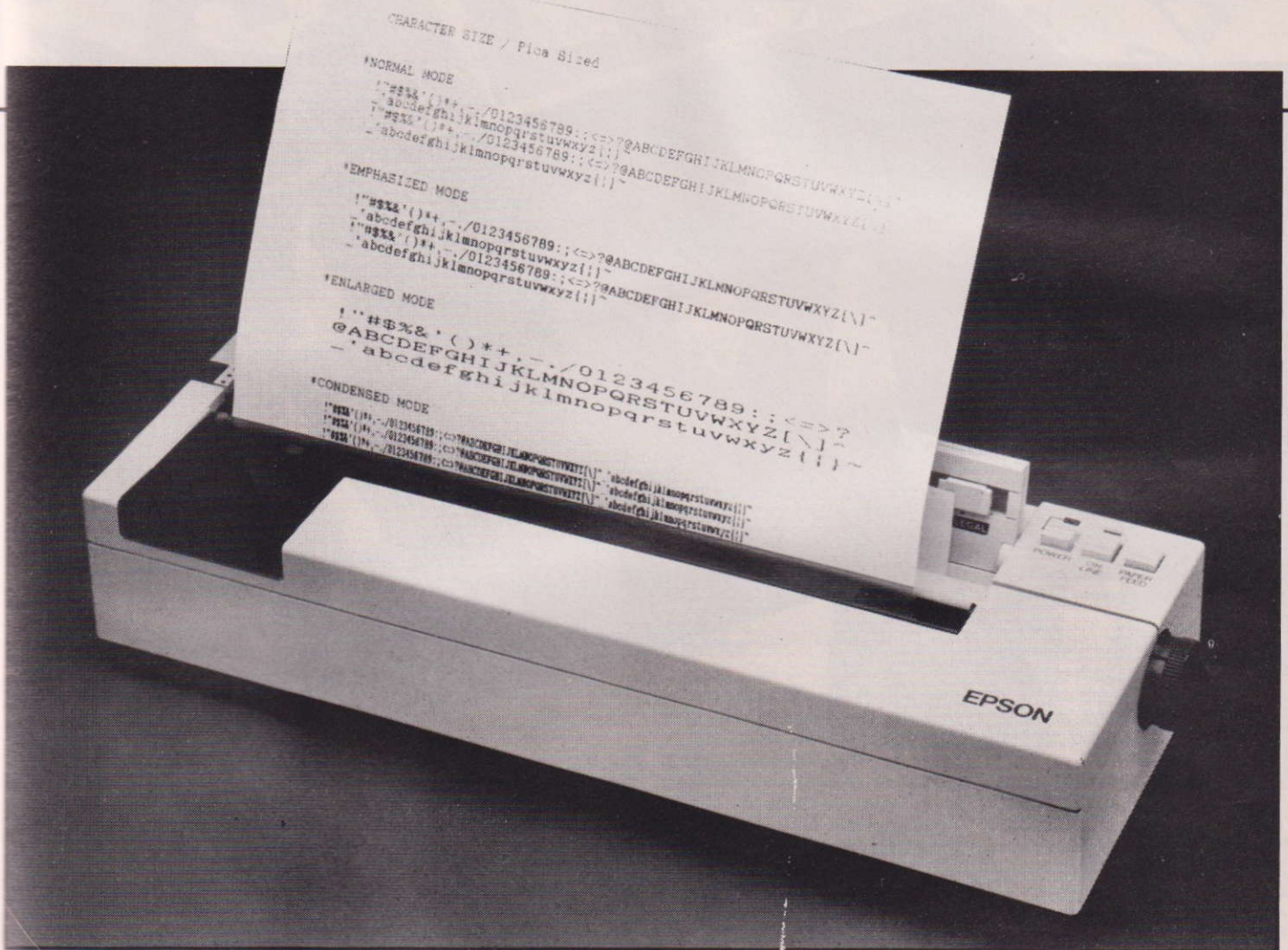
Four pens can be used at any one time from an available selection of eight colours. Epson dealers also provide a choice of water based ball points and fibre

tips or oil based fibre tips for OHP film. Both film and ordinary paper are moved around in one axis while the pens move in the other. The mechanism rattles away, jerkily drawing at 230mm per second. Slower speeds can be specified to produce higher accuracy. The actual movement of the pen is in units of 0.1mm and in 0.1 degrees of rotation.

The plotter is also intelligent, with a number of useful facilities built-in. There are commands to produce pie charts and bar graphs with automatic labelling. The HI-80 commands, including circle and arc drawing and pie chart hatching, are given as one or two letter sequences together with the relevant parameters, such as control codes for a printer. This allows for plotter control from within application programs. The printer commands, which enable text to be drawn, are compatible with Epson dot matrix printer commands so existing software can be made use of. Mixed text and graphics is

The HI-80 four colour plotter





The P40 offers true 80 column performance

a common format for business reports and in the science department. The standard interface is centronics but serial interface boards are optional extras.

## LOW COST

The new low cost alternative printer which Epson have plumped for is the thermal only P40. It is not primarily designed to operate with the BBC or any other home micro but rather with Epson's own portable business computers. The P40 however offers a very low cost option for any BBC owner.

The P40 is a tiny device, a block of cream plastic with a transparent window onto the print head, a paper feed button and an on/off switch. Not too many advanced facilities here, you might think. The back

reveals a row of eight DIP switches and an RS232 port - the printer needs a specially made up cable for connection to the RS423 port on the BBC but there should be no problems with the version with Centronics interface, the best option for BBC and Electron Plus One owners.

The P40 is designed as a portable printer and runs on power from a built-in NiCd battery pack. An AC adapter is provided to recharge the batteries, which last for any reasonable printing time. Since neither the BBC or Electron are portable there is no great advantage in battery power but it does mean one less cable and plug competing for the sockets and contributes to the small size of the printer, enabling it to be put on top of your computer, even the Electron, without ill-effect.

The P40 comes packaged with the AC Adapter, manual and roll of thermal paper. The manual is naturally based around the printer's intended use with Epson computers but the general information still applies and the Epson free pamphlet for BBC users will help out with control codes.

Thermal paper is a coated, bondlike paper with chemicals which react under heat to produce a coloured image. The paper is widely available and inexpensive and does not put up the cost of using a printer, especially since thermal technology does away with the need for ribbons - the most expensive renewable item in dot-matrix printers.

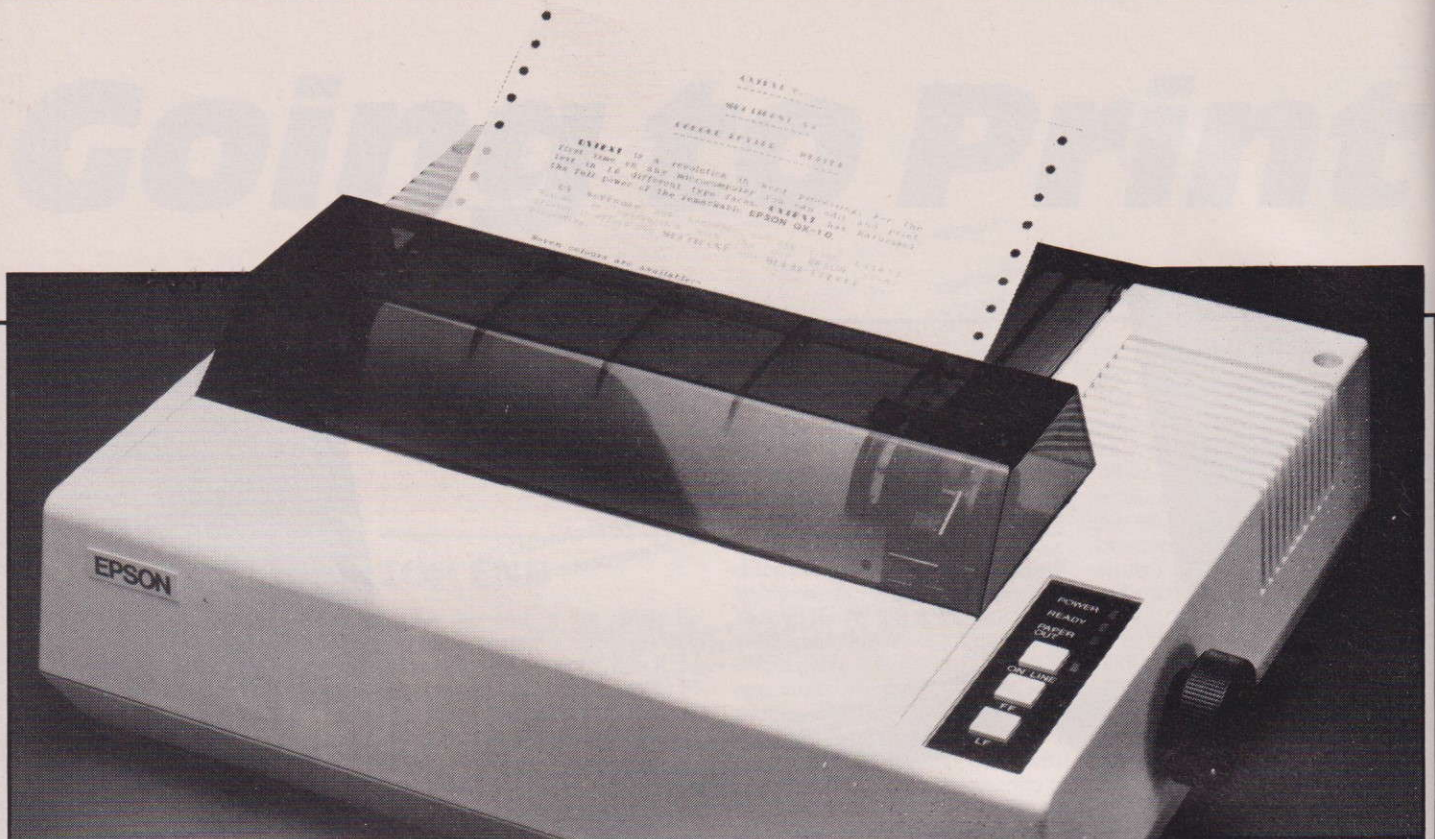
Loading the paper roll into the P40 is entirely straightforward. Just push up the plastic

hatch and lay the roll with the outside surface facing forward. It sits tight in the moulded compartment. The PF switch feeds the paper into the line with the print head. The paper can be quickly torn off along a serrated plastic edge.

Like other Epsoms the P40 has a self-test facility enabled by switching on with the Paper Feed button depressed. This tests the RS232 port as well as the print mechanism. For BBC owners interfacing with the serial port version, the DIP switch five should be set on to indicate a bit rate of 1200 per second. \*FX5,2 and \*FX8,4 do the rest.

The relevant VDU codes can also be sent to the P40 but there are limitations to the styles which can be specified. As well as nor-

**CONTINUED OVER**



*The JX-80 brings colour printout to the BBC*

mal print mode, the P40 offers "enlarged" print, which is double width, and condensed (with either one or two dot spacing). Normal print can also be emphasised.

"Normal" print here means Elite style, 40 characters width. The two versions of condensed result in 80 and 72 characters per line. Enlarged means 20 per line. The full 96 ASCII characters are available and also 10 different international character sets. Normal 40 column mode printing is carried out as 45 characters per second, which can seem a bit slow when compared with a FX80 but we are talking about an under-£100 printer. Emphasised and enlarged printing halves the speed approximately.

The bit image mode can be specified in 256 and 480 dots per line but software for dumping BBC or Electron screens will have to be modified to take into account the P40's restricted facilities. The thermal print is however very sharp indeed and puts some dot-matrix printouts to shame. Character and line spacing is also software controllable.

## APPLICATIONS

Using the printer with application software should be straightforward. Wordprocessors vary in

the codes they send to the printer and usually you can specify your own and the P40 responds to most of the important ones. There is only a two byte buffer on board so at 45 cps it can appear slow but this is not a problem for the non-business user. The P40 is effectively always on-line, the control circuit checking the PF switch to see if the printer is busy.

Epson compatability is well worth having if you are a BBC owner, since many applications include the ability to use Epson type control codes without modification. The P40 does not offer the full formatting facilities or speed required of a printer to be used for business/serious ac-

tivities. However, for the home user with the odd bit of correspondence to deal with, or a listing to be made, this could well be the ideal (and certainly the cheapest) option.

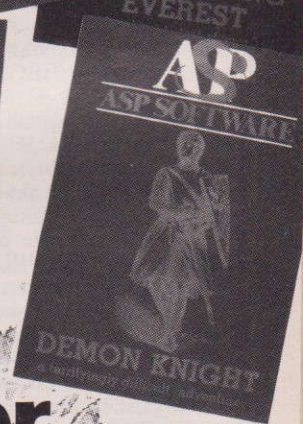
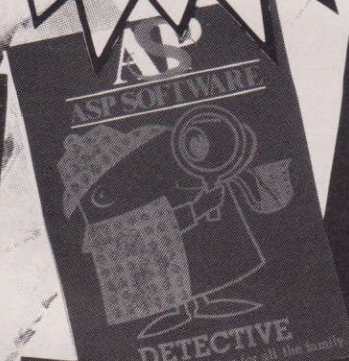
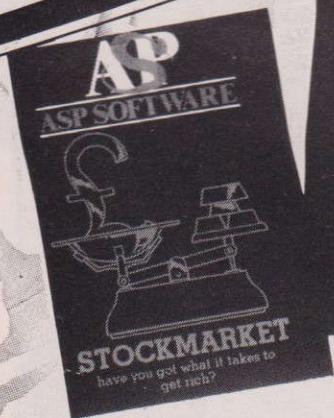
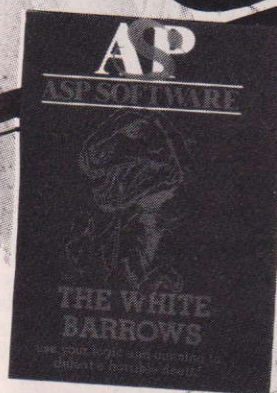
The P80 offers true 80 column printing for those whose printouts need to impress but you can't put a P80 in your pocket! Obviously the portability of the P40 cannot as yet be utilised by Acorn computers but there is no doubting the attractive qualities of Epson performance and thermal technology price which this new printer can offer.



*The P40 brings thermal technology*

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# Star Base

Gordon Taylor

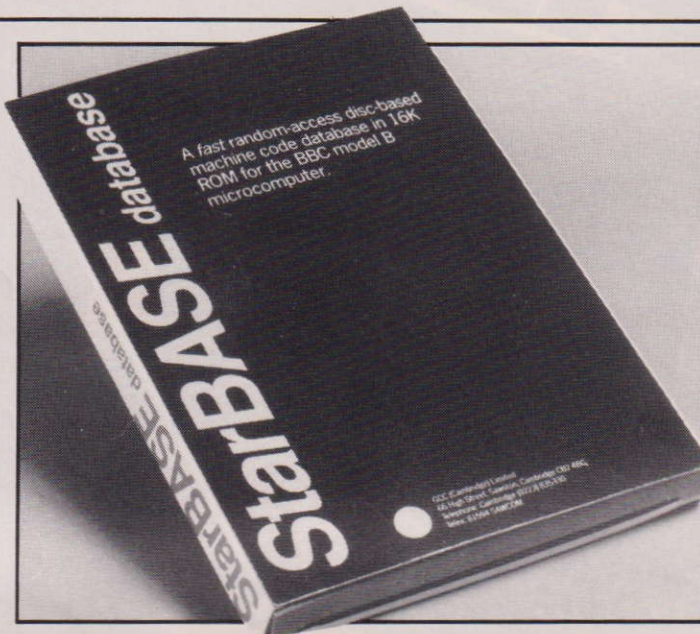
The full potential of the BBC Micro for business is only just beginning to be realised by software houses and users — actual and potential. From its launch in January 1982, the BBC Micro has had the advantage of both an economical (1K) 40-column display and two full, definable-character (16K) 80-column displays. However, the potential for business could not be realised until disc filing systems became available in late 1982 and disc drive prices fell to more affordable levels. Demand for disc systems for the BBC Micro has been enormous — it must account for around half of all disc drives sold in the U.K. — and has long been constrained by availability of both the 8271 disc controller (from a single supplier — Intel) and of Disc Filing Systems ROMs/EPROMs (from both Acorn and other suppliers).

As well as the sheer convenience of speed and automatic operation over cassettes, discs enable true random access. Thus the biggest constraint on the use of the BBC Micro — its limited user RAM — can be effectively removed. This is especially valuable in database operations. Firstly, the total amount of application program that can be made available and — even more importantly — the size of the data file itself, can be increased from less than 32K to approaching the capacity of the disc itself of from 100 to 400K or more.

Hence the user of the BBC Micro can now choose between four levels of database:

The lowest is an in-memory program, usually written in BASIC and costing around £10. (e.g. Flexibase by Alligata — see A&B, issue 6) Clearly the capacity for both program and data is limited to about 27K, even in Mode 7, and this limits such databases to a few hundred records per file.

The second level is the simplest of the random access disc systems — also usually written in BASIC and costing around £20 (e.g. Masterfile from Beebugsoft — although A&B has published such a one in issues 4, 6, 7 & 8!) This overcomes the limitation of both program size (indeed



## Is this the star performer of all BBC databases?

Masterfile holds several of its utilities on a second file) and on data capacity. Thus a wider range of facilities can be offered, but they are slow — noticeably so for searching and sorting — and so such programs are limited in practice to around 1000 records per file.

### STARBASE LEVEL

The third level also uses random access discs but has the core program in machine code and a wide range of utilities, in BASIC. This is the level of StarBASE from GCC Cambridge, which costs £69 including VAT. The machine code program is held in ROM, which has the advantage of immediate availability at switch-on and freedom from corruption of inevitably complex code. Also, thanks to the much higher speed of searching and sorting using the machine code routines, it is practical to increase the data capacity to 4096 records per file. Even with a record length of e.g. 100 characters, it is worth

making the program capable of accessing both sides of a double-sided 80-track disc i.e. 400K. In fact, starBASE allows a maximum record length of nominally 920 characters — this being the capacity of 23 lines of a Mode 7, 40-column screen.

While it might appear possible to offer an 80-column screen with this level, this could only be to the expense of the buffer capacity, which is needed for searching, sorting and moving records. The StarBASE utility programs — for example — are loaded at PAGE=&4800 — well into even the Mode 3 16K screen — in order to leave an adequate buffer size below. Also StarBASE remains capable, even with other filing systems (as well as the DFS itself) in place, such as ECONET — which raises the lowest value of PAGE from say &1900 to &2200.

Hence the top level (of those considered here), using an 80-column screen (which takes 16 or 20K of user RAM memory on the BBC Micro), requires a second processor (or at least an Aries-type separate video-RAM

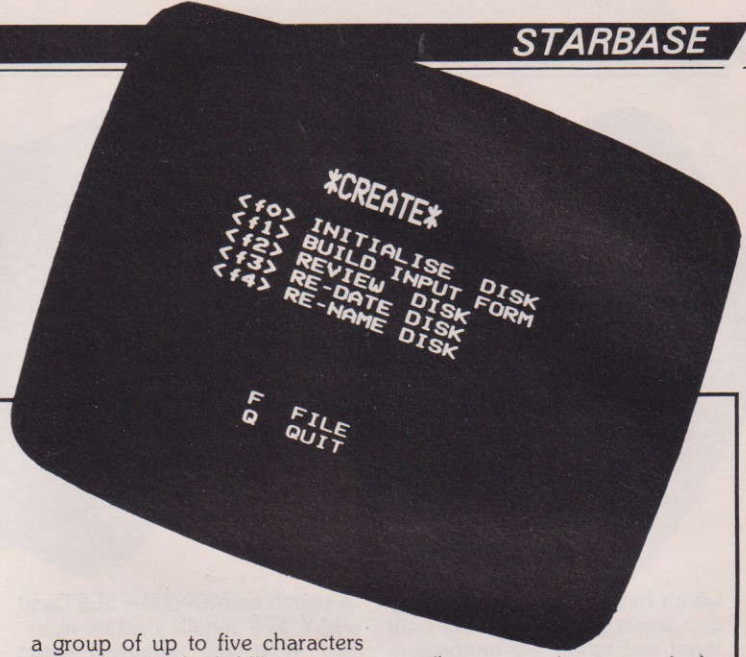
board). In practice, this level is represented by the many programs available for the CP/M operating system, which can be run on the BBC Micro with the Acorn Z80 Second Processor. This, together with the bundled database-related programs Fileplan, Mailplan and Nucleus, cost £300, while other CP/M database programs range from about £200 to nearly £500 by themselves.

Of course, in addition to the general-purpose databases considered here, there are several suites of specialised databases — customised for accounts and/or stock control-available for the BBC Micro (e.g. Acornsoft/Mirle, Gemini, Software for All).

Let us now consider StarBASE in more detail. Its creator — Mike Chalk — has written it to be menu-driven and to make full use of the red function keys. While there are many menus (at least 12 in all), the function key labels are shown at the bottom of the screen — together with messages about what mode you are in (e.g. Insert), why you are waiting (e.g. Sorting) and which record (within a subset) you are looking at.

The main structure of the StarBASE program, with its principal options, is shown as a "road map" in Fig. 1. Such a map can be a valuable guide in the initial stages — although, like navigating on real roads, you soon learn to recognize where you are and which key does what.

StarBASE provides some security through optional use of a password to access the data file. Let us assume that you have some data which you wish to organize as a database file. In my case, I had a product price list, which would be drawn on when preparing various catalogues and possibly during customer enquiries in the future. Many databases require you to decide upon the number, type (string or numeric), size (number of characters) of fields and whether it is a key field, with little possibility of changing later without starting again. Fortunately, StarBASE includes facilities which allow you to change all of these in



the light of experience.

StarBASE allows up to 69 fields (which corresponds to three full columns of 23 lines) and up to 255 characters per field. These parameters give considerable flexibility. Thus, although the "depth" for searching and sorting is limited to five characters per field, this limit can be overcome by using more fields. An example of this is where records are to be sorted by dates. Five digits would not suffice for year, month and day — which, in any case, would have to be entered in that order to sort properly. So use can be made of separate fields for year, month and day — which may then be entered in any order — although they would still have to be sorted in year, month, day priority.

Even this freedom (in respect of the number of fields) must not be abused, since sorting in StarBASE is limited to a maximum of five fields at once for 1000 records, and less — due to limitations of buffer — size as the maximum of 4096 records is approached. However, this limit too can be overcome, by sorting a subset of the record file on just a few fields at a time, in successive operations, if necessary.

StarBASE can test the first five characters of both numeric and string fields for being equal, not equal, greater than or less than a target string. The latter may be shorter than five characters, to give the effect of "wild cards".

StarBASE can also look for

a group of up to five characters "Anywhere in the field" — essentially as does the BASIC INSTR- ing function. This makes it well suited to scanning free text — e.g. for "keywords". A utility program — for merging subsets that have been saved to disc — allows more complex searches. While merging — i.e. adding subsets without duplicating any records — is possible within StarBASE itself, this utility also allows subsets to be subtracted. Thus one subset having a target string "Anywhere in Field" may be subtracted from another to give a subset having the target string "Not anywhere in Field".

Complementing these search facilities is the same ASCII — character-sequence sort (which takes account of up-

per/lower case) as used for numeric fields.

Assuming that the set of fields — which make up a record — can be fitted — with their titles-on 23 lines of a Mode 7 screen, then this is particularly easy to create with StarBASE-using the "paint-a-screen" technique. This uses the cursor keys to move around the screen while you enter the field titles (and tags) and mark out the fields, in any order. (Field tags are the titles used within StarBASE to define searches and sorts and need not be the same as those appearing on the screen record.)

In practice, the maximum record length is reduced (from 920 characters) by the presence on the screen of the field titles —

Fig. 1 STARBASE — "ROAD MAP" OF PRINCIPAL MENUS

STARBASE		Build Input Form		Short Form Menu	
C	Create Menu	f0	Initialize Disc	f0	Finished
		f1	Build Input Form	f1	Select field
		f2	Review Disc	f2	Clear field
		f3	Re-date Disc	Create Subset Menu	
		f4	Re-name Disc	f0	Finished
F	File Menu	f1	Title	f1	All Records in File
		f2	Insert Field	f2	No Records(Clear)
		f3	Delete Field	f3	Record by Keysearch
		Insert Menu		f4	Add to Subs.fr.File
		f0	Finished	f5	Select from Subset
Q	Quit	f2	Save Record	f0	Finished
		Amend/Delete/Browse Menu		f1	Select Subset
		f0	Finished	f2	Save Subset
		f1	Amend/Delete/ (Br.)	f3	Load Subset
		f2	Last Record	Boot Utilities from Drive 0, Drive 1	
A	Sort Menu	f3	Next Record	f0	SBU01 Recover deleted records
		f0	Finished	f1	SBU02 Increment field
		f1	Sort	f2	SBU03 Field statistics
		f2	Add field	f3	SBU04 Configure (for) printer
		f3	Clear sort list	f4	SBU05 Print (out) file review
B				f5	SBU06 Print record cards
					SBU07 Build print format
					SBU08 Print address labels
					SBU09 Print form
					SBU10 Move records
C					SBU11 Calculate
					SBU12 Print ASCII form
					SBU13 Merge subsets

CONTINUED OVER



which help to make the information understandable during both input and screen (as opposed to printed) output. However, this constraint may be eased — and disc storage efficiency increased — by using key words rather than full text. Just four fields of close to the maximum size of 255 characters each, could hold up to about 150 key words — quite enough to characterize most articles or documents.

## BBC FEATURES

StarBASE makes use of the ability of the BBC Micro to provide colour on the Mode 7 screen (through the use of hidden control characters) when designing the record data input form. A particularly effective solution is to use colours (even flashing) for the field titles and white for the data entered. The colours can easily be selected via the function keys in the usual way.

In the main "File" part of the StarBASE program, the key functions change between modes. However, there is a large measure of consistency with f0 to finish, f2 for the last record and f3 for the next record, while f1 is used to initiate actions — Amend, Delete, Sort — each of which have their own sub-menus.

To aid both Inserting and Amending records, StarBASE allows a Short Form to be defined. This causes fields not of current interest to be skipped when jumping from one field to the next on hitting Return. Even then, any field can still be accessed using the cursor keys — with Shifted Cursor for jumping to the start of the adjacent field.

StarBASE has no provision for validating the input data automatically. However, a completed data file could easily be subjected to searches on each field, using appropriate limits, before being used in earnest. e.g.

a search on MONTH = SEPT and DAY > 30 should yield none.

With the relatively large maximum file size (of 4096 records), a multiplicity of related files can be held as one entity, with the separate files defined as subsets. These subsets contain only the addresses of the selected records and so can be saved in very little space — only 8.25K bytes for a subset containing the maximum of 4096 records, of whatever length. Inputting a value for searching on a key field is simple if it is a text string — since these are automatically left-justified on insertion into the data file. However, in the case of a numeric key field, it is necessary to include the correct number of leading spaces. This is to make it match the stored values, which are automatically right-justified on insertion into the data file.

Searching of the data file on the key field is usually fast — thanks to the use of "hash coding" when the records are inserted initially into the file. This ensures that the records are fairly well distributed throughout the available disc space (defined by initialisation) and — even after considerable amendment — records can still be found quite quickly.

For example, when a key field value is known to be unique to a single record (although in StarBASE, it does not have to be), a search on it may be initiated and, as soon as the current subset is seen to contain one record, the search may be terminated, using the Escape key. Typical search times on a string key field (assuming the record to be unique in this respect) vary from 3 to 5 seconds. Search times on numeric key fields may sometimes be much longer — e.g. 60 seconds — due to uneven distribution of the records throughout the available disc space. The obvious lesson is to avoid using a numeric field as the key wherever possible.

Although of course longer, the times for searching on a non-unique, non-key field hardly vary at all — since the whole file must be scanned in any case. The times are of the order of 3 minutes, 25 seconds, for any file spread over a 200K disc surface while looking for a match "Anywhere in the field" takes no longer. StarBASE ignores (upper/lower) case, when searching — though exact matching of cases will speed retrieval on the key field.

## A GOOD SORT

One area where StarBASE performs particularly well is in sorting. As might be expected, the sort times vary with the number of records in the subset (which can be the whole file) and the number of fields sorted on. For example, to pick up and sort 329 records on a single field takes three minutes while a file or subset containing the maximum of 4096 records, sorted on one field, takes about 16 minutes.

However, the times for searching — on both the key and non-key fields — and sorting are also dependent on the Disc Filing System in use. While the times given above are for the standard Acorn 0.90 DFS, they can be at least halved by use of one which is fully Acorn-compatible — and can be obtained from GCC Cambridge. The time for sorting 4096 records — for example — is reduced to an amazing 6 1/2 minutes. This may be compared with 3 1/2 minutes for sorting only 1000 records for the best of the CP/M databases reported in Personal Computer World for January 1984 — while some of these took over two hours! The StarBASE performance is due to using a Shell-Metzner sort which has been efficiently coded. Moreover this can extend to up to five fields and on up to

five characters in each.

StarBASE has been designed — and proved — to work "across the Tube" from a 6502 Second Processor connected to the BBC Micro. Operating with the DFS.NET — as supplied with this Second Processor — has shown that this Acorn (1.2) DFS also achieves these much shorter search and sort times.

Since — in StarBASE — subsets can be saved to disc in their own name and loaded back for later use with the data file, frequently-used searches can be even quicker, by operating only on what are effectively smaller data files. Moreover, the subsets can be previously sorted and saved in that condition.

StarBASE is designed to be fully capable of being used with only a single disc drive — without unduly limiting the length of the data file or requiring excessive shuffling of discs. This is a consequence of the StarBASE core program being located in the Sideways ROM "language" area of the memory map (outside the main user RAM memory). The main user RAM can therefore accommodate a large buffer — which can hold the current subset (or complete records during moves between files) — while any utility program may be loaded above this (at PAGE = &4800). Hence a separate disc can be used to hold any subsets you wish to save and another to hold all the utility programs.

However, StarBASE can still exploit two single drives (or one and a RAM disc) by holding subsets and utilities on Drive 1. Furthermore, using one or two double-sided drives with StarBASE allows the maximum size of data file to be doubled (from 200K to 400K in the case of 80-track drives). This is done on initialization so



that the second disc surface behaves as a continuation of the first.

Until recently, the Solidisk RAM disc (of 100K) could only act as Drive 1 and so could not hold the data file — which must be on Drive 0 (or 0 and 2). Even so, the RAM Disc could hold subsets (temporarily — as it is volatile) for use by StarBASE itself and the utilities — as well as the utilities themselves. This can reduce the need for disc changing. However, the latest issue of Solidisk utilities allow the RAM Disc to be redesignated as Drive 0 while, in future, RAM Discs of 200 and 400K will be available. Both these developments will enhance substantially the operation of StarBASE (and other programs which feature considerable disc access).

StarBASE has also been tested with the Microware Double Density Disc Filing System. While this system does indeed double the recording density, it is derived from the Acorn DFS in the interests of compatibility and creates two "pseudo-surfaces" on each side of the disc. Under the Acorn system, these cannot be bigger than 256K each, so that StarBASE — which only expects to find two contiguous surfaces — can only initialize 512K (less an overhead of about 5K) as the maximum size of data file, even in a double-sided drive. This is however still some 28% more than in 80-track single density and leaves a further 288K for subsets and utilities on the same disc.

## EXTENSIVE UTILITIES

Among the best features of StarBASE is the extensive collection of utilities — both

complete and their constituent procedures. The former cover most standard operations, such as recovering deleted records, moving records, calculating on fields and creating and producing various printed outputs — labels (e.g. for mailing), forms (e.g. invoices) and form letters (e.g. for mails shots).

The StarBASE utilities have been written to avoid the need to have two or more data files open simultaneously. However, certain multiple file operations can be effected with only one file open at once by having a large buffer — and this is the way that SBU10 — Move Records — works. This operates only on fields whose tags are the same (with the new data overwriting the old). Hence, if the master file record includes a transaction field — such as BOUGHT/SOLD — as well as the master field — STOCK, SBU10 Move Records can be used to import these values. The transaction can then be completed by incrementing STOCK by BOUGHT/SOLD, using the SBU02 Increment utility.

With the SBU10 Move Records utility, moves cannot be made conditional on the contents of the field at the time. However, a subset can be created beforehand, using the conditions on the contents of the (source or destination) fields and then that subset used in the Move Records operation.

StarBASE has two powerful utilities for numeric calculation. SBU02 Increment can operate from a single source field to a single destination field (which can be the source field again) with just add and (percent) multiply. However, SBU11, Calculate can carry out any operations that are possible in BASIC from any number of source fields and

put the result in any destination field. These calculating capabilities put StarBASE well ahead of many CP/M databases.

The same power utility — SBU11 Calculate — can also be used for concatenating (adding) strings. This means that search and replace operations can be done on both numeric and string fields, using the standard utilities. Moreover, the results may be viewed on the screen before being written back to the data disc.

## INTEGRATING

StarBASE offers a good choice of output report utilities — all of which operate on a pre-selected subsets. For preparation, there is a simple utility for matching a variety of printer types and paper sizes and another which allows formats to be built for labels and forms. Thus the simplest printed report is of complete record cards while other consist of address labels and forms.

The most versatile output report utility allows text to be prepared on a word processor (such as Wordwise, View or Scribe) and spooled in for incorporation in a form letter or invoice etc. which draws on the data (e.g. name and address etc.) stored in your database files. It even allows the full range of calculations possible in BASIC to be performed on the field values — both numeric and string — before they are printed. This amounts to a very powerful "mail merge" facility and — by itself — could well justify buying StarBASE.

In addition, the constituent procedures of the utilities (in BASIC) are supplied — to allow users to write their own programs. I myself made use of them when writing an

output routine that went beyond the constraints of either the menu-drive or word-processor-linked utilities provided — capable as these are. Furthermore, it should be relatively easy to write routines to import and export sequential data files of almost any format to and from StarBASE files. This could save a great deal of re-keying when changing systems.

Mike Chalk has also written an excellent manual for StarBASE. The 40-odd pages are divided equally between the "Create" and "File" operations and those using the many utilities. Examples of user-designed utility programs are included — as are informative sections on the specification of StarBASE and how it saves data.

With its parameters of up to 4096 records and up to 920 characters, StarBASE could in theory utilize a file of up to 3.7 MB. Since its efficient search and sort routines make such large files practical, it is planned to offer a modified version for use with hard disc systems. This certainly suggests that StarBASE has more than enough power (features) and speed for most users of floppy disc systems.

## CONCLUSIONS

Hence StarBASE represents an excellent balance of price and performance. It and its competitors complement the good choice of ROM-based word processors and spreadsheets now available for the BBC Micro and thus fully justify considering it as a real business machine — even in its single-processor form.

StarBASE is obtainable from dealers, or direct from GCC (Cambridge) Ltd., 66 High Street, Sawston Cambridge CB2 4BG. Tel. Cambridge (0223) 835330.

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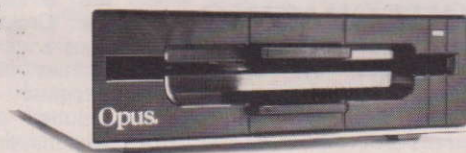
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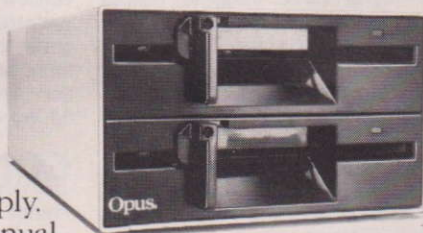
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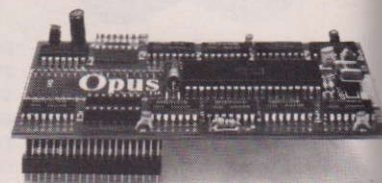
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# Down to Business

## WHAT IS A DATA BASE?

A database is a set of similar records, a computerised card-index. Commonly used to list names, addresses and other details of people or businesses, a database can equally index a library of books or reports, a catalogue of products, an inventory of stocks or even a collection of stamps or butterflies.

A computer database comprises: — the PROGRAM that enables you to create and use it: an electronic filing clerk!

— A master FILE that contains all the information: the equivalent of the complete card index cabinet, made up of a large number of:

— Individual RECORDS: each equivalent to one card, each containing information about just one person, book or product. Each in turn contains a number of:

— data FIELDS, each containing one type of data only, rather like the box in which you write your name or car number or sex on a printed form. Thus in our example of a stock of raw materials, there is a field for the type of material, a field for the size, one for the price, one for the supplier, and so on. Each field has a TITLE that appears on every record, but the field contents will obviously be different and may even be blank.

## WHAT THE PROGRAM SHOULD DO

First the program enables the user to DESIGN the database: select what fields are needed, to hold which kind of data, of what length. Then it provides a means to ENTER the data, and of course to alter or remove incorrect or out-of-date entries. For a piece of information on one card to be found quickly, the cards must be arranged in order; similarly the programme must SORT the records. The user decides how: in our example it could be by size, starting from the smallest or from the largest, or first by material (so that all the brass is kept separate from the

## Business computing often revolves around the database. A&B sorts them out.

CURRENT RAW MATERIAL STOCKS				
CAT NO	DESCRIPTION	SIZE (mm)	MATERIAL	STOCK 1/8/84
101	TUBE	12.5	brass	250
102	TUBE	25	brass	500
103	TUBE	50	brass	500
104	TUBE	75	brass	25
105	PIPE	25	steel	1200
206	PIPE	40	bronze	25
107	BAR	10	brass	430
108	BAR	25	steel	350
109	ROD	5	steel	1020
210	ROD	10	bronze	250

FIG 1 EXAMPLE OF AN EXCELLENT PRINT FORMAT - CARRERA'S DBASEBEEB

steel) and then by size. A good program can sort by several different fields, in sequence: first by supplier, then by price, then by material, then by item and so on.

It should also be possible to SEARCH for a particular item or group of items (sometimes called a SUB-SET) and again it is for the

user to define it: "All the brass tubes less than 50 mm in size, made by GKN" would be a subset. It should find a unique item: a customer rings up asking for "catalogue number 207"; the program should present the full record on the screen: "25mm brass tube, supplied by

Walthams, and we have 2000 metres in stock, so how much would you like Sir?"

Finally some databases will CALCULATE: for example: "work out the total value of the entire current stock".

He may be blissfully unaware of it, but every businessman spends a huge amount of his time handling information. Every time he or she writes a letter or a purchase order, works out a budget, draws an item from stock or charges some expenditure to a contract, he has to find, interpret and reproduce items of data: a lengthy (that means costly) business. How often do workmen stand at a counter while the store clerk fills in a requisition for a 3/4-inch drill? How often do managers hunt through files for the name of "that man at Miller Brothers who rang about the contract to erect their new chimney"? How often have you wished for a list of all the customers for whom you have recently repaired broken gauges because you now have a new, unbreakable gauge to offer them?

The database is the computer's answer: it collects, organises and presents the data economically. However the businessman has another question: "There are dozens advertised; how do I know which one will do my job?"

## SEARCH AND SORT

Buy one and try it! — time consuming and expensive: Elwyn Roberts, self-employed Swansea heating engineer commented:

"I had a shed full of different fittings and never knew what to charge customers for them. So I bought this database and it seemed to be doing fine. After two weeks hard work, my book-keeper had three-quarters of the stock entered. Then we discovered that some of the stock was in metric and the rest in inches. When we fed in the formula to convert from one to the other, we got 'No Room' on the computer screen. In the end we

BEEBUG MASTERFILE			
File name: STOCK - Date created: 21/6/84 - Last updated: 21/6/84			
Listed from record: 1 to 5 - Date Printed: 21/6/84			
Print fields are: 1,2,3,4,7			
Search match list is:			
3 SIZE (mm) 1/2=0 AND 1/2=200			
CATALOGUE NUMBER	ITEM	SIZE (mm)	MATERIAL CURRENT STOCK (m)
320	PIPE	40	bronze 200
207	tube	50	brass 2000
201	tube	20	brass 200
365	BAR	25	steel 500
200	TUBE	12.5	brass 200
1293		147.5	3100
258.6		29.5	820
70.007428		13.6381817	699.714227
Number of records is 5			

FIG 2 EXAMPLE OF AN INADEQUATE PRINT FORMAT - BEEBUG MASTERFILE

There is no choice of format or titles and much unwanted information has been printed.

<b>Name of Database Software House Medium</b>	<b>STARBASE GCC ROM chip + util disc</b>	<b>DBASEBEEB CARRERA tape</b>	<b>BETA-BASE CLARES disc 40/80 track</b>	<b>DATABASE GEMINI disc 40/80 track</b>
<b>Approximate price in £</b>	<b>69.00</b>	<b>9.95</b>	<b>25.00</b>	<b>19.95</b>
<b>File size limited by memory or disc?</b>	<b>disc</b>	<b>memory</b>	<b>disc</b>	<b>memory</b>
<b>EASE OF USE</b>				
Are menus clear?	much jargon	yes	yes	yes
Are screen instructions clear?	not very	not very	reasonable	reasonable
Is handbook easy to understand?	too complex	not very	yes	yes
Is handbook detailed and complete?	very	no: poor	yes	yes
Is handbook durable and pleasing?	yes	no	no	yes
Has handbook a proper index?	no	no	no	no
Is record design flexible?	yes, very	no	no	no
Is it easy to design a record?	yes	yes	yes	yes
Is it simple to alter record layout?	yes	add only	add only	no redesign
Length of field titles limited?	no	10 letters	10 letters	10 letters
Is data entry quick and easy?	very	yes	yes	yes
Can data be easily altered?	yes	yes	yes	yes
Operating command without file loss?	yes	no	some	yes
<b>STANDARD FUNCTIONS</b>				
Will it: Sort numeric/alpha/both?	both	both	both	both
Will it: Sort ascend/descend/both?	both	both	both	ascend
Will it: Sort entries in sequence?	very good	yes	yes	no 2 sorts
Will it: Find small/CAPITAL letters?	yes	no	no	no
Will it: Find uncertain spellings?	yes	no	no	yes
Will it: Find unequal ranges?	yes	yes	yes	yes
Will it: Calculate totals?	yes	yes	yes	yes
Will it: Calculate between entries?	yes	wouldn't	yes	yes
Calculate combined entries/totals?	yes	with 2 calcs	yes	with 2 calcs
<b>PRINTING LISTS AND LABELS</b>				
Can user define print layout?	very good	— to some extent —	—	no
Can entries follow consecutively?	yes	no	yes	no
Will it pause to adjust paper?	yes	no	no	no
Can print width be varied?	yes	yes	yes	no
Can a title be added?	yes	yes	no	no
Can column headings be added?	yes	— field names only —	—	no
Can sub-headings be added?	yes	no	no	no
<b>ACCESS TO OR FROM OTHER PROGRAMS?</b>				
User-written programmes?	yes	no	no	no
Word-processor text?	yes	no	no	no
Special form letters?	yes	no	no	no
Other files of same database?	yes	no	yes	no
<b>ERROR PREVENTION</b>				
Rejects wrong data entry?	no	yes	yes	no
Warns if memory full?	unnecessary	no	unnecessary	yes
Prompts to save data before leaving?	yes	no	unnecessary	no
<b>OTHER FEATURES</b>				
Memory extended by Aries B20?	unnecessary	yes	yes	yes
Templates provided for common uses?	no	no	no	no
Special features	v fast sort		Also on 3" discs	

just threw it out, set up a card index and did it the hard way. I am sure I could get over it but I just have not got the time....."

It is less traumatic to study reviews, but most only describe one product. This article attempts to compare all the databases currently advertised for the BBC. Some are cheap cassettes, others are on floppy discs, others use a ROM ("read only memory") chip that has to be inserted in the computer.

## EASE OF USE

Few business men have time to read lengthy handbooks; nor can office clerks be bothered, so the program must be easy to use, with full and clear instructions on the screen to carry out all but the most complicated processes. All the databases tested used MENUS but screen instructions were often very confusing. MASTERFILE's colours made it difficult to read on a

monochrome screen. Manuals varied widely: GEMINI's was clear and easy to understand but very brief and not indexed; The FILE-PLUS handbook was nicely produced, but extremely difficult to understand; CLARE'S came to pieces as I took it out of the envelope!

Each program allows the user to design his own record but in several cases this is simply a list of fields straight down the screen. The space for the field titles was

often too limited: quite modest titles like "STOCK VALUE IN £" would not fit in. Only STARBASE, DATAFILE, FILE-PLUS and NEL allow flexible design that fills the screen economically. Having once designed the record, several could not be altered but have to be redesigned from scratch; in some cases extra fields could be added

**CONTINUED OVER**

**DATABASE  
PRIMASOFT**  
tape 12.95  
or disc  
15.95  
memory

**FILE PLUS  
WATFORD**  
ROM chip  
+ disc  
49.95  
disc

**NEL  
MERCER MICRO**  
disc  
48.00  
disc

**MASTERFILE  
BEEBUG**  
tape 10.00  
or disc  
19.00  
disc

**CARDIFF  
DATAFILE**  
disc  
40/80 track  
disc

yes  
reasonable  
yes  
no  
no  
no  
no  
yes  
no redesign  
10 letters  
yes  
yes  
no

yes  
reasonable  
no, complex  
yes  
very good  
no  
yes  
no  
yes  
no  
yes  
yes  
yes  
yes

yes  
user alters  
yes  
yes  
excellent  
yes  
yes  
yes  
yes  
no  
no  
yes  
yes  
no

yes  
faint colour  
yes  
yes  
no  
poor  
no  
yes, slow  
yes  
11 letters  
yes  
yes  
yes  
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unnecessary  
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unnecessary  
yes

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unnecessary  
unnecessary

no  
unnecessary  
no

yes  
no  
designed for  
text only

unnecessary  
yes  
own  
language

unnecessary  
no  
counts  
records in a subset

unnecessary  
no

unnecessary  
no

but useless fields could not be removed.

Often several records will be so similar that much time can be saved by copying the first one several times and making small alterations. However only MASTERFILE could do this.

Having loaded the data file and performed searches or

calculations, the user often wants to send a command to the computer's operating system: to switch on a printer or check on a forgotten file name. With many of the databases this was impossible without reloading the program and files: utterly infuriating! CLARE'S and MASTERFILE were the best of the cheap systems for this and the chip-based STARBASE and FILE-PLUS were fully adequate.

## STANDARD TASKS

Most programs would sort either numerically or alphabetically in either ascending or descending order or both. PRIMA SOFT would not cope with decimal numbers and is intended as a low-cost text handling database, not really for handling numbers. Professional databases usually in-

clude a status switch: any record which is dormant, can be switched off but kept on the file, to be revived later. None had this provision. (This can be achieved by including a status field on each record and building in a preliminary sorting sequence but this is hopelessly cumbersome.)

Did you know that well trained secretaries use capital letters for BRISTOL but small letters for Harrow or Somerset? Trivial

**\*STARBASE\***(KEYTEAM SOFTWARE)  
MIKE CHALK (C)1984**PRESS LETTER KEY FOR UTILITY**

(A) SBU01 Recover deleted records  
 (B) SBU02 Increment field  
 (C) SBU03 Field statistics  
 (D) SBU04 Configure printer  
 (E) SBU05 Print file review  
 (F) SBU06 Print record cards  
 (G) SBU07 Build print format  
 (H) SBU08 Print address labels  
 (I) SBU09 Print form  
 (J) SBU10 Move records  
 (K) SBU11 Calculate  
 (L) SBU12 ASCII form print

&lt;S&gt;

&lt;Q&gt;

Fig 3 STARBASE's screen instructions are complex: Few clerks in an office would understand "ASCII", "Configure" or "Increment field"

perhaps, but if your secretary types capitals and you search for "Bristol", the screen may announce: "No records present" when you know that you have a dozen customers there. Only STARBASE, DATAFILE and FILE-PLUS would find them.

## HOW MUCH DATA CAN IT HOLD!

Many programs were limited by the BBC'S 32k memory, much of which is used up by the program, leaving little space for data. DBASEBEEB breaks its program into separate parts which can be loaded separately, to reduce memory usage. If fields lengths range from 10 to 30 characters (average 20), and if there are 20 fields on each record, that is 400 (in practice it works out more like 500) characters per record. If the program occupies 12,000 bytes (most take more) this leaves only 20,000 for data or a mere 40 records. For disc and tape programs this could be virtually doubled by fitting an "ARIES RAM" (reviewed in A&B two issues ago) but this is still insufficient for business use.

"Professional" computers

would calculate the total of a particular field on all the records, (helpful to plan how many more storage racks you need, as well as constantly swap information between the disc and the computer memory. The chip-based packages do this (and use less of the computer's main memory), but of the disc-based programs, only NEL, BETA-BASE, DATAFILE and MASTERFILE manage it. The result is a file five times as large on a 40-track disc, (10 times as big, or 400 records on an 80-track disc). If records are shorter, with fewer fields, the absolute maximum number of records can of course be greater.

STARBASE does even better: it can use both sides of the disc for a single file, so that a double-sided 80-track disc could house 800 such records and they state that it performs well with a "double-density disc interface" to increase this by a further 20%. Its absolute maximum is over 4000 records. (If you need random access to more than this you have to spend £2000 on a "hard disc").

## CALCULATIONS

Most of the databases (but not PRIMA SOFT or DATAFILE)

to advertise "Enough material in stock to reach from London to Glasgow!" Most would also calculate between fields:

"value of an order = order quantity \* Price"

However, not all would automatically combine the two calculations in one:

"Total stock value = stock level \* price, totalled for all items"

The others needed an extra field in which to put a half-way answer (to the first stage of a two stage calculation).

## PRINTING

Every business-heart sinks at the sight of a huge stack of printout in the in-tray. The best remedy is for the user to define exactly what information he wants and nothing more. Individual fields need to be omitted when printing: GEMINI could not even manage this. Fields should print consecutively if required, with standard text inserted where necessary: much more meaningful to read:

100 metres of brass bar

than: 100  
brass  
bar.

Titles, column and sub-headings and text "spooled" from a word-processor need to be added to make a meaningful report. Only STARBASE, NEL and FILE-PLUS could manage this.

Data on its own is meaningless; it needs to be "mailmerged": incorporated in a document. Names and addresses may serve for mailing list labels but also need to be incorporated in letters. The data in our example would be inserted into delivery notes, invoices, purchase orders and budgets. NEL has a limited ability but only STARBASE could really handle this. FILE-PLUS attempts to, by creating a special simple programming language for those who cannot write BASIC, but this fails because it is too limited and difficult to learn and incompatible with word-processors. STAR-

BASE is cleverly broken down into accessible chunks, for which access sequences can be written by the user, as is explained in more detail in Gordon Taylor's article elsewhere in this issue.

## FUTURE RELEASES

Two further sophisticated databases are expected shortly: DATA GEM by Gemini, is delayed by a shortage of components and its published price of £130 seems unreal. DATABASE by Bucon will be compatible with the excellent Merlin Scribe Word-Processor, which is modestly priced and handles disc professionally, so may be worth waiting for.

Alternatively consider whether the BBC B alone is suitable for business use. To equip it with adequate word-processor, database and spreadsheet programmes, and a "ROM-board" to fit them in, you will pay around £200 or more. For not much more, you can buy a "second processor" with a bundle of professional software and much more computing power. Next month we will look at this option and the products available.

## MEMO TO MANAGING DIRECTORS

Before you buy, calculate how many characters you need to store; then double it for future expansion. Can your computer's memory store all this?

— If so, and if you do not need access from other programs, for value at lowest possible cost, buy DBASEBEEB.

— If not (and for serious business use it is almost certainly not):

— For effective access to and from other programs buy STARBASE

— For ease of use buy NEL or, excellent value for money: BETA-BASE

Alternatively wait for imminent releases from Gemini and Merlin or consider purchase of a second processor.

Fig 4 Poor flexibility: Fields listed down the screen; no use of "numeric" or "alphabetic" to prevent data-input errors.

```

Mem-2031  BEEBUG MASTERFILE  Record=1
Field      Data      Filename: STOCK
1 CATALOGUE NK207 >
2 ITEM      <tube      >
3 SIZE (mm) <50       >
4 MATERIAL  <brass     >
5 SUPPLIER  <Walthams  >
6 PRICE/m   <4.06     >
7 CURRENT STD<2000  >
8 ORDER QUANT<500  >
9 ORDER COST <         >
10 STOCK VALUE<     >
  
```

# Ride the Unicorn

Mark Webb

## Can the Torch Unicorn range take your BBC into the future?

house — obvious at a glance — now run through into a purpose built, architecturally hi-tech building. The car park outside is graced with Italian styled sports cars alongside the giant Mercedes vans done out in blue and white Torch livery. These vans deliver the Torch computer range to dealers up and down the country.

The company's own offices utilise Torch equipment to the full and make an excellent show room for the whole range. From the accounts department, through support services, to the research and development departments, all are plugged into a network based around the professional computer range of computers developed at Torch and manufactured in their factory in North Wales.

Communications with this manufacturing division are, of course, through Torch business computers wired up to the telephone lines. The plush reception area has a Torch displaying Prestel. The sales department

utilise their system as a telex machine among other things. Even the boardroom has a full range of Torch products up and running.

The professional business range of general purpose business computers and office workstations, which are finding their way onto the desks of "communicating executives" everywhere, all use the BBC Micro, for the moment at least, as a peripheral controller. This means that BBC BASIC software typed in from this magazine will run on a Torch business computer. If your office has 300 series workstations on Torchnet then you can distribute your favourite game, Snackman perhaps, around the room — in your lunch hour of course.

Also of significance is the fact that Torch can offer the technology they have developed for the business computers to any owner of an ordinary BBC Micro. This in fact they do through a combination of products known as the Unicorn range. This is

what I went to Great Shelford to see.

## GETTING EVERY OUNCE OUT OF THE BBC

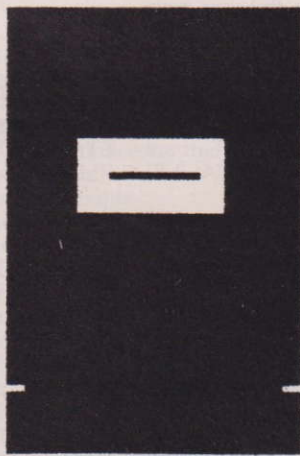
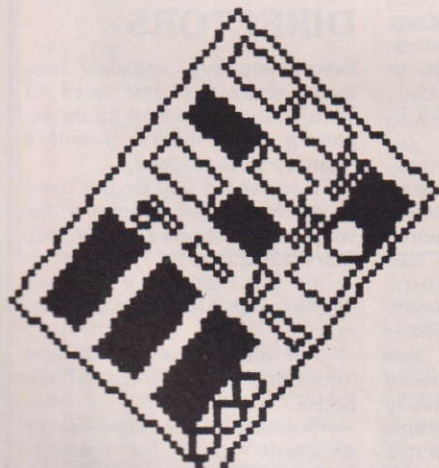
The idea that Torch are thriving on the back of production line BBCs in black metal boxes has never been considered remotely near the truth by those who have close contact with Torch products. You only have to walk around their R&D departments and chat to the staff to get a feel of the commitment in policy and methods of working to get every ounce out of the BBC board and also to add considerably to it. That's what Unicorn is all about.

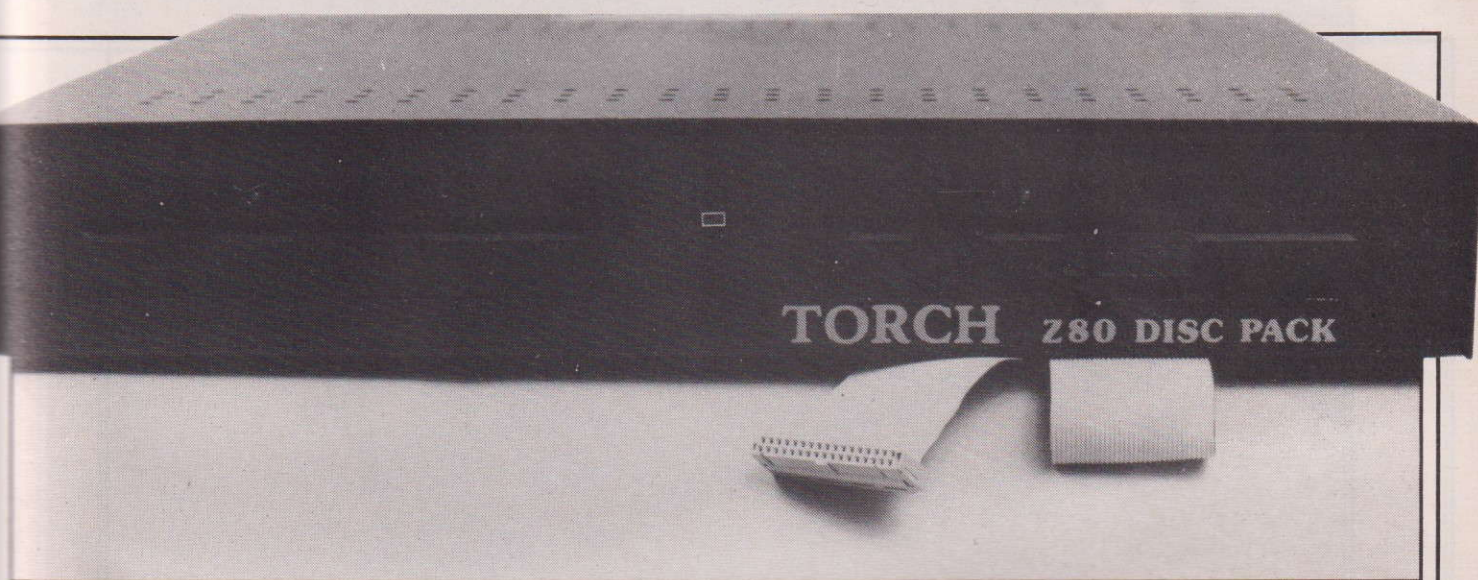
The controlling software for the entire range is packed into a 16K sideways ROM, the Torch MCP, a purpose built 6502 operating system. When on the BBC board, it takes commands from the second processor or the network. The MCP deals with floppy and hard disc filing systems, Torchnet protocols and disc sharing.

Because the software is part

A short car ride from Cambridge city centre is the village of Great Shelford, an infrequently visited stop on the London to Cambridge line. Approaching the village along a tree-lined road, the first building which comes into view is the headquarters of Torch Computers Ltd. Torch may now be a subsidiary in the Acorn empire but they still have their own very individual way of doing things and an up-market image reinforced by their Aberley House headquarters.

The corridors of the original Torch offices, an old school





ZDP240 Z80 Disc Pack

of the BBC, disc "cacheing" techniques can offer improved performance to whichever second processor is being used. The code is all-purpose and all Torch second processors utilise the same firmware in the MCP. This method also allows different operating systems to be implemented, witness CP/M, CPN (Torch's enhanced CP/M), UNIX III, UCSD, and p-System. Tripos and CP/M 68K are currently being worked on.

CPN comes with the Z80 card in ROM (no loading from discs) and takes only just over 1K user memory. It does not require utility programs to achieve FORMAT, COPY, DUPLICATE, INPUT and PRINT commands. They are built-in, along with MODE, FOREGROUND, BASIC and other commands to exploit BBC features. CPN supports networking with discless workstations.

All interfacing to second processors is via the Acorn Tube, through twin 8 bit channels (using a 6522 and a 8255 for the Z80 board and a single equivalent chip, the 2950 for the Z80/68000 combination). One channel is for the second processor to send commands, the other for the 6502 to respond. This means maximum processing speed (80K bytes per second for the Z80 and 160K bytes per second for the 68000).

## INCREASED STORAGE AND SPEED

Since the 8K CPN ROM can be paged out, nearly 63K RAM is available as program area with the Z80 card. Not satisfied? The next step up the ladder is the 68000 board. The 68000 uses sixteen 32 bit registers for data and addresses with external communication along a 16 bit wide data bus. It runs at 8MHz and normally has 256K bytes RAM. A Z80 is supplied alongside the 68000 so that investment in old software need not be written off. The faster memory used on the 68000 means a 50% speed improvement with Z80 software (6MHz). The 68000 board memory can be expanded to 1Mb RAM, reducing disc traffic and making the card more suitable for multi-user, multi-tasking applications.

Hard disc storage becomes a requirement at these high levels of memory and Torch have implemented an hard disc controller and SASI interface card, whose presence is detected by the Torch MCP.

Since Torchnet can be used with any operating system, hard disc storage can be shared around and with the 68000 running UNIX, utilities can be spread around the network.

Torchnet uses the same basic protocols as Econet so there is no problem running the two physically side by side.

Torch are backing UNIX as an operating system for the 68000 and when your HDP 68K 68000 arrives, the box of manuals and discs is almost as big as the box containing the hardware. Torch UNIX System III comes in the form of 24 floppy discs which contain over 200 programs and utilities. There are three huge standard UNIX manuals and descriptions of Torch specific enhancements.

It is at this point that you realise how important the backup support available from Torch dealers really is. These are complex systems and some professional support is necessary. Some dealers run their own introductory courses. All the Unicorn range is available through Torch dealers including the Unicomm package which was originally announced as a mail order only product. Unicomm will not now be available direct from Torch but the price and specification indicate a product which could find its way into the high street.

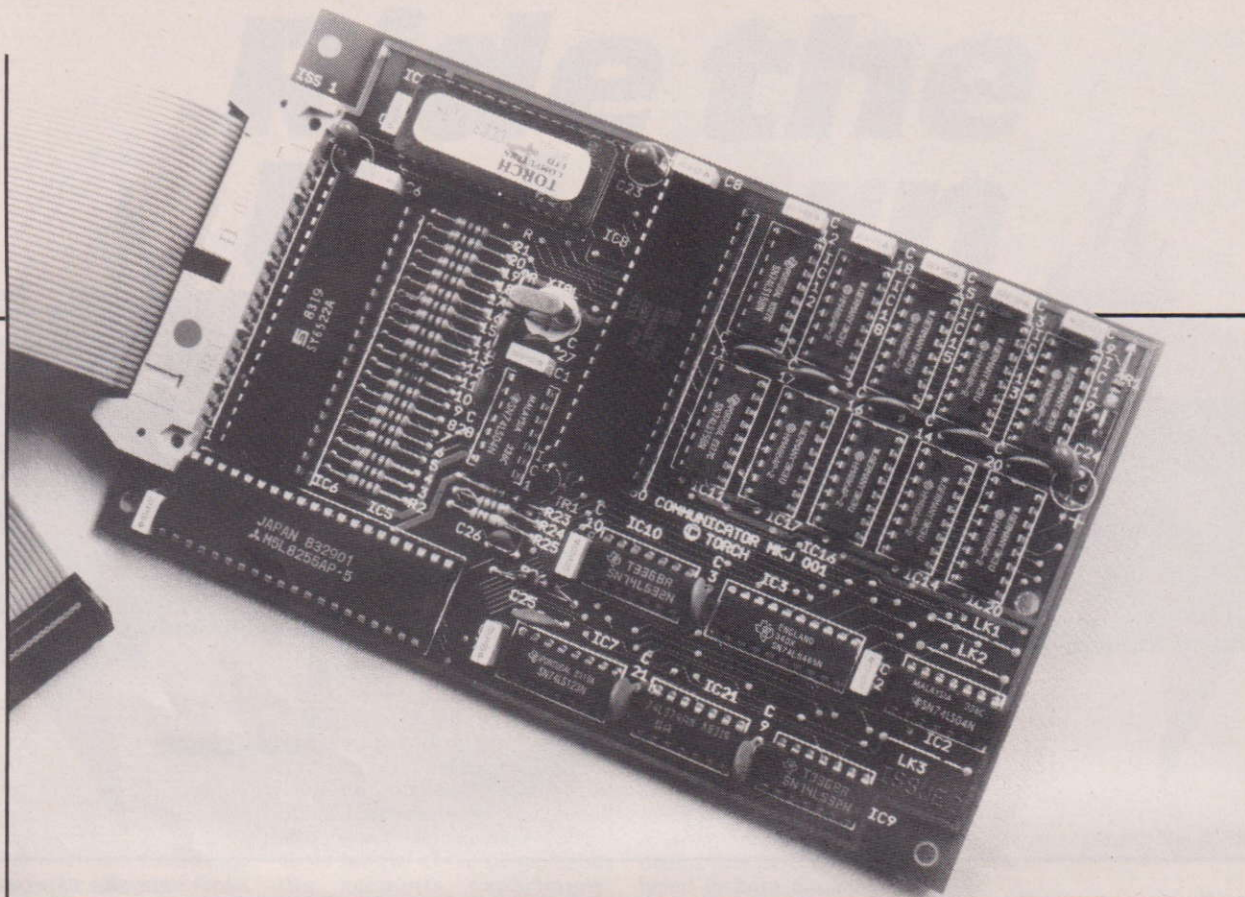
Unicomm will make available a whole user community free of charge. Torchmail, run from Abberley House headquarters, maintains a notice board and a box for detailed

Unicomm enquiries. Unicomm is being developed for the Telemod 2 and Minor Miracles modems. In total Unicomm comprises BT approved modem, UNIMAIL, UNITERM 600, mainframe communications package, UNIVIEW, Prestel compatible Viewdata system and Telesoftware downloading, all for £185. There is something for the comms enthusiast, the business linking into Prestel and the school downloading telesoftware.

## UNIQUE SINGLE PATH

Summing up the place of the Torch Unicorn range in relation to other products for the BBC is difficult because the range is to a great extent a unique single path along which a BBC owner can travel. Once you are in the Torch fold, it pays to stay, especially for the institutional or business user who is investing in a great deal of hardware. Networking means sharing expensive resources — in fact there is no other way of taking anywhere near full advantage of the UNIX hard disc system. With a comms pack, other people's resources become available via the telephone system. At all stages of Unicorn, the idea is to make the optimum

**CONTINUED OVER**



ZEP 100 Z80

amount of information available to the user.

The Torch Z80 disc pack was an opportunistic product which filled a gap in the market but suffered from unclear documentation. The ZDP 240 Z80 disc pack is now a much slimmer, but equally indestructible dual 80 track drive. The disc drive market has moved on in the past year and other 80 track options are available. For those who want to go Z80 but with their own choice of drives, the ZEP 100 Z80 extension is available without strings. The Acorn Z80 is ironically its main competitor.

The respective merits of the packaged software will be discussed in A&B in next month's Down to Business. The ZEP is

however the first step to a networked Z80 based system onto which can be grafted the multitasking abilities of the 68000 processor and UNIX plus the mass storage of Winchester hard disc.

## NEW SOFTWARE ENVIRONMENTS

The Z80 CP/N and 68000 UNIX environments open up to humble BBC owners a whole new world of software. The CP/M treasure trove is well known, including programs for pre-school age children and high powered business software. According to the National Centre for Information Technology, there were

1577 packages available for business alone in May 1984.

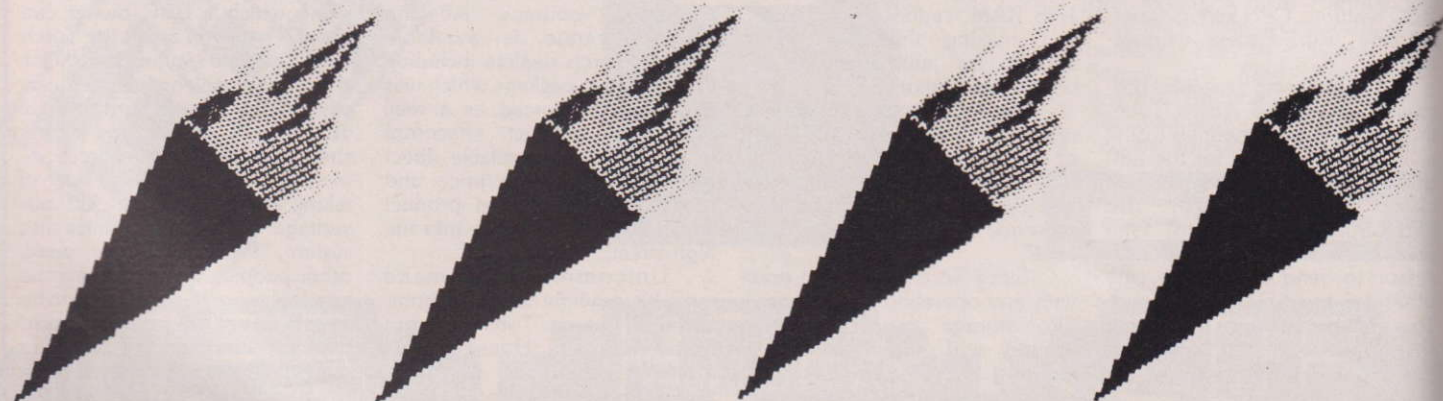
Torch are backing the 68000 and UNIX (though not exclusively — witness the Graduate and MS/DOS on their professional machines). In May there were 243 software packages available in the business field for this operating system. Software from companies like Metamco with LISP and FORTRAN 68000 and REDUCE, the symbolic mathematics package implemented in CAMBRIDGE LISP 68000, are forging ahead into the area of knowledge based systems, the forefront of modern computing.

UNIX was chosen by Torch because its multitasking capabilities take full advantage of

the 68000, the chip behind the power of Apple's Lisa and McIntosh computers. Developed by Bell Laboratories, UNIX is considered tried and tested. The bugs are out. There is no such thing as genuine concurrency but the multitasking facilities of UNIX combined with the 68000 make it seem that way.

There is currently no competitive product this far up-market although separate hard discs are now available at around £1,500 for five megabytes. Acorn's own should be with us soon and is receiving field trials at the moment.

The big customers for the HDP 68K 68000 20Mb hard disc pack are universities and colleges who wish to take the load off the





mainframes and applications can range from library systems to business set-ups. The Z80 plus hard disc is also a formidable ally for those setting up a database system, and with networking through the Econet hardware but with Torch's own firmware, full use is made of resources. Torch systems are used in ITECs for this very reason as well as places like the Dental Institute in London and the training institute of the Bank of Scotland.

## LOOKING TO THE FUTURE

Although these systems are currently for the specialist application they do kick off with a fairly inex-

pensive Z80 pack and a comms package which does not stretch the wallet too far. Torch Computers meanwhile genuinely believe that the developments they are making will find their way into the average home computer system, at the appropriate price, perhaps before the end of the decade. This is heartening news indeed for BBC owners and let's hope they are right and that we are able to handle the computing power it will make available.

Bob Gilkes, Torch's chairman, compared the current position with early mainframe days and predicted that Torch's work in areas such as image processing and voice recognition will eventually find a place in the home

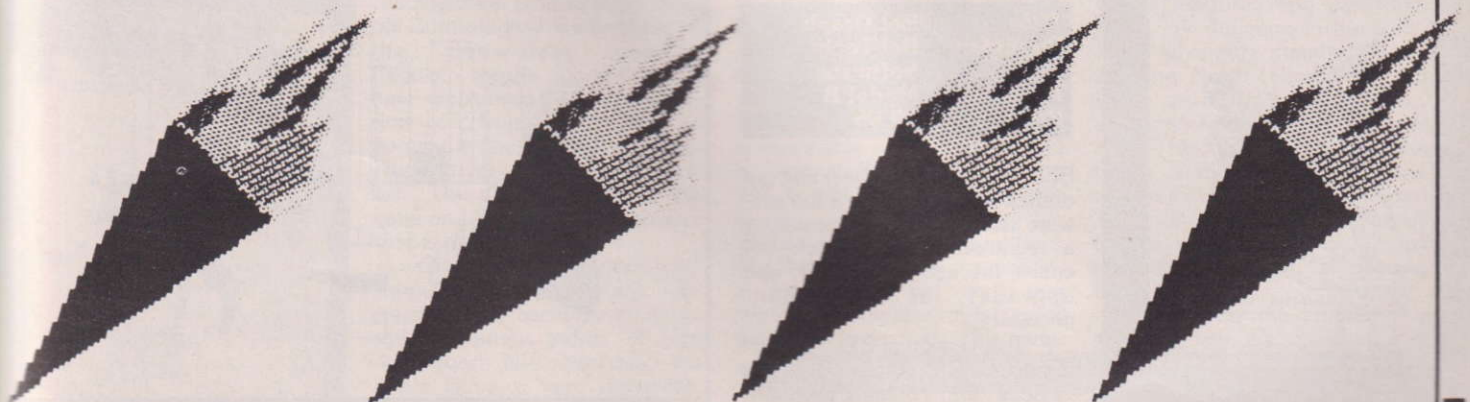
micro system.

He emphasised the staying power that a Torch customer can expect from his computer. The Unicorn Range is for those users who do not wish to be confined to the 6502 processor and built in obsolescence. There seems every reason to bet on Torch and their ability to advance the BBC into areas of undoubted power now becoming available for micros.

Torch like to emphasise the importance of communication (the "communicating executive" is one of their favourites), the linking into centres of information and the sharing of it. Their professional machines have integral modems and the comms pack makes similar software available

to the Unicorn range. The idea is that schools and homes are going to get into databases in a big way, with individual users talking to each other and linking up with private networks. And now that the ball has been set rolling, once people catch on to what is going on, the educating process will be over and we will all start to think in terms which Torch have been thinking in for some time.

In the Information Technology Olympics, held not every four years, but continually rushing on around us, Torch are in a good position to supply the communicating micro in the mind's eye of most personal computer users.



# Software Reviews

**Title**  
**Publisher**  
**Machine**  
**Price**

**Replica II**  
**Clares**  
**Model B/DFS**  
**£9.95**

Bootling up into Replica II is apparently a very controversial thing to do although it didn't feel like it. To the BBC owner newly converted to disc and with a hard won collection of favourite software on cassette, it seemed the most natural thing in the world to transfer those programs to disc, especially since most of them were not available in that format.

Obviously software companies face the problem of piracy but Replica II does seem to be one way of providing the transfer facility without this risk, since the disc itself, on which the transferred programs reside, is protected. Nor will Replica II copy the most vigorously protected programs, if the software house really feels strongly about it.

Replica II certainly avoids all that note taking about where programs are loaded, where they begin and so on. All the housekeeping duties are taken care of. You just answer a few simple questions and press a couple of keys. You need both tape recorder and disc set up and Replica controls the rest.

When the programs have been transferred they are placed in a menu (A-P) from which you can easily choose the required ti-

tle. The heart of the program allows you to load a new program, delete the last loaded, and to change the code storage for the last program — in case the default method is unsuccessful.

Necessarily there is little comment in the single sheet documentation about how Replica II goes about its work and you are therefore very much at its mercy. If it doesn't work then bad luck. You can't go and brew up while the transfer takes place either just in case the program is locked. In this case Replica requires you to rewind the tape.

Some programs can take a fair time to be interpreted and set in action which to some extent makes the transfer to disc a waste of time, others transfer without change and provide the usual access speed. It is also necessary in some cases to make use of a write protect tab just in case a program tries to write to Replica, which would be fatal. Pace/AMCOM and Watford DFS are supported, but there are complications. These are dealt with in the documentation.

Replica II does a difficult and controversial job well, although there are a fair few exceptions to the rules it follows. You are limited to the disc capacity. Still if you want those favourite games on your shiny new discs, the temptation may prove too great.

## Ratings Table:

SOUND/GRAPHICS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	70%

**Title**  
**Publisher**  
**Machine**  
**Price**

**Bel Graph**  
**Bel Tech**  
**Software**  
**Model B**  
**£9.95**

BEL TECH seem to be going out of their way to provide a full software service, including providing a registration card, which will enable the user to get help, and upgrades, as and when, necessary.

This version of BEL GRAPH for the BBC B comes on disc or cassette, and contains programs

for plotting line graphs, bar charts, pie charts, combined vertically stacked bar charts, and combined bar and pie charts.

Entry of the relevant data, is stored in four fields, named X,Y,Z and T, which can be changed to suit your requirements. Up to fifty two items of data may be inputted, in one of three ways; 1) Via the Keyboard 2) From a Data file 3) By inputting an equation.

The program will accept any BASIC expressions, and will then plot it by calling the built-in Epsom dump routine, although provision is made for you to load in one of your own dump routines.

The quality of the graphical representation is good, as is the dump routine. One niggle though, it will not accept negative data, and indeed the program will allow you to enter 52 pieces of negative data without even telling you that it's illegal!

A good graphical display package, offering a good (in theory) backup service. It's a shame about some of the error trapping, and the bad screen layout regarding the error messages, apart from that well worth adding to your collection.

## Ratings Table:

SOUNDS	N/A
GRAPHICS	80%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	85%

**Title**  
**Publisher**  
**Machine**  
**Price**

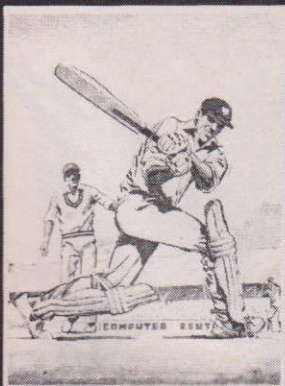
**Test Match**  
**CRL**  
**Model B**  
**£6.95**

The first thing that has to be said about this game is that the instructions should not have been written in black on blue background. It just is not cricket if you have to screw your eyes up to read how to play the game. The first line of the program contains the offending VDU 19 statement so I suggest that anyone buying the tape ESCAPE and amend the line to something more sensible. It is OK if you have just gone out and blown £300 on a new monitor but the standard television does not distinguish an awful lot between blue and black.

The theme of Test Match is that you can enjoy the thrills of our national summer sport without leaving the armchair — which is what most of us do anyway! Still in the CRL version you can play at being David Gower or if you prefer, and I would, Clive Lloyd, marshalling your forces out on the field.

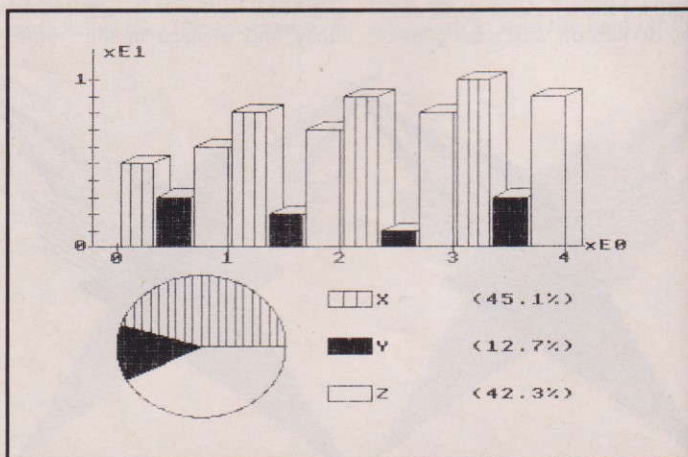
Test Match scores as a game because of the variety which can be introduced into the play. For a start the tape contains both Test Match and World Cup cricket games plus a Team Selector program which allows you to include a favourite county player in your side, or perhaps you fancy your local side against the West Indians? The two main programs

## TEST MATCH



**CRL**

For the BBC Model B



are followed by character definitions, graphic and team data.

All the elements of proper cricket are incorporated, following on, declaration and the ability as captain to choose the type of bowler or batsman you wish to use at a particular juncture of the match, attacking, normal or defensive. The test match is played over two innings with a maximum of 450 overs and the World Cup game over one innings and a number of overs specified at the start of the game, so you can simulate any of the one-day games.

There are nine possible combinations of style and these determine the run-rate, the wicket-rate and the field placings. When you first enter the game a choice of preset teams is offered. Your choices are then loaded in from tape, and displayed with their skill levels — which we won't go into for the moment since it is a matter of personal judgement and you can redefine the whole team if you want.

When in play the style of your chosen batsman or bowler has to be specified each over. I'm sure the algorithms used in the game took a lot of sorting out but Tavaré with a defensive style hitting an attacking Marshall for 25 off the first two overs takes a bit of believing. I think a computer cricket game is always going to need revving up a bit if it is not to be boring!

Overall Test Match is the best of the BBC cricket games currently available with a fair balance struck between complexity and number of key strokes needed to get some action.

The actual graphical display in Test Match is secondary to the tactical element and rightly so. There is little or no variation in the bowlers run-up but each separate stroke is plotted to its destination. Test Match does not quite match up to its cricketing software rivals in this department but the overall game is superior. It certainly beats throwing dice and keeping score manually like in the old days. Such a game might even stimulate interest in the finer points of cricket but must be primarily for the enthusiast.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	60%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	85%

Title	Pengi
Publisher	Visions
Machine	Model B
Price	£6.95

Poor old Pengi is locked up in the freezer. Your job is to try and line up the three special "Ice-diamond" blocks without being killed by the "Snow-Bees" waiting for you at every turn. One way to kill them off is to kick the blue ice block at them or alternatively you can entice them on to the fence and electrify them by giving the fence a hefty kick then running them over to finish them off! Bonus is given for finishing off the "Snow-Bees" quickly. Regular arcade goers should have recognised that this is a version of "Pengo" which was so popular in the arcades last year. This is a very good implementation. The characters are all the same and the catchy background tune is also there.

Graphics is very good and animation is particularly impressive. The background music and the various noises are also very good and generally the whole game is very enjoyable.

Most of the features available on good games such as a neat title page, redefinable keys, freeze, sound on/off etc. together with a rather rare practice mode are included but unfortunately the lack of a high score table lets it down somewhat. The inclusion of the practice mode which allows you to get used to the feel of the game without getting killed off in five seconds was a very good idea though.

This game is very enjoyable and is probably the closest version of "Pengo" you're likely to get on any micro.

#### Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	86%

Title	Screwball
Publisher	MRM Software
Machine	Model B
Price	£5.95

Arcade freaks may enjoy this one for a while, but not too long I suspect. You have to move a little man over a grid of diagonally arranged squares changing their colour as you go. The idea is to change them all within 60 seconds while avoiding four bugs which chase you. The only way of killing the bugs is by drilling a hole for them to fall through — the graphic and sound effects for this are quite fun. Drilling does waste valuable time, however, and you cannot step back on to a square with a hole in it. When you clear a screen, the only difference appears to be that some gaps appear between the squares making navigation more difficult.

The controls are good. There is no joystick option which is reasonable since all movement is diagonal. The keys chosen — A, Z, \* and ? are logical and easy to use, with the space bar available for drilling operations. The Return key launches you into hyperspace, but since you often die in the process this is for last resort use only. The game

also has two features which should be standard on all arcade games — the options to freeze play and to switch off sound — and the usual hall of fame.

There is nothing really wrong with the game, in that documentation, graphics and sound are all adequate for their intended purpose. The problem is that it is too simple, with little variety, and will not hold most people's interest for very long. In truth, it is not very much above the standard of games that can be copied from magazines these days, and I wouldn't really recommend parting with your hard earned cash for this one.

#### Ratings Table:

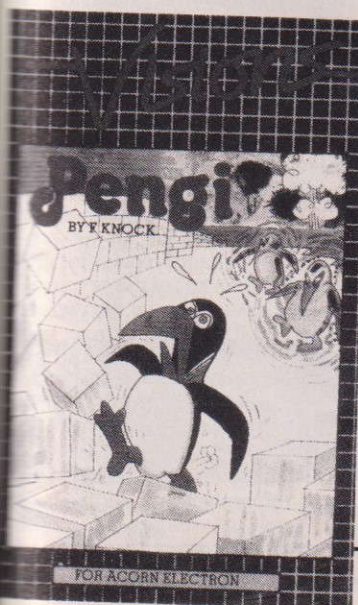
SOUNDS	65%
GRAPHICS	75%
DOCUMENTATION	60%
VALUE FOR MONEY	60%
OVERALL	60%

Title	Monsters and Magic
Publisher	ISP
Machine	Model B
Price	£7.95

"Monsters and Magic" is described as a fantasy adventure game that involves both hard thinking and quick reflexes.

You start at home base. When you have completed the dungeon where all the adventures take place, you must return there in order to sell your treasure and finish the game, although you may also return during the course of the game to recover from combat, regain lost spells or to sell treasure. You can roam about the dungeon in the traditional adventure manner, i.e. by entering North, South etc. but when you meet a hostile being, you enter combat which is in real time. This means that if you miss your chance to strike, the monster will probably kill you! There are many difficult puzzles to solve and also numerous monsters to defeat, all in real time.

The great thing about this game is that it's modular and



CONTINUED OVER

there are two types of data for the dungeons. This effectively means that you have two games. Also, as well as a predefined character, you can define your own character i.e. increase intelligence, dexterity etc either to make the game more difficult or easier.

This game is very different from any adventure or strategy games and is truly challenging. The ability to change the characteristics means that you can set the difficulty of the game in a unique way. Unless you are a total arcade game freak, you should find "Monsters and Magic" very enjoyable.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	100%
VALUE FOR MONEY	70%
OVERALL	85%

<b>Title</b>	<b>The Fall of Rome</b>
<b>Publisher</b>	<b>ASP Software</b>
<b>Machine</b>	<b>BBC Model B</b>
<b>Price</b>	<b>£6.99</b>

Well, the fall of the Roman Empire was never more speedily accomplished than under the control of myself, my Beeb and this cassette from ASP. It isn't that the program is exactly hard, but my talent for making the wrong decisions at the right time, or the right

decisions at the wrong time have never been so amply provided for!

The basic idea is one of strategy, attempting to move various units of one's forces around a map of the Roman world in order to put off the inevitable result of the struggle for survival. There is plenty of time at one's disposal, with the game moving through twelve turns each representing a five year phase, starting in 395AD. During each phase, there are three distinct parts, each with the opportunity to make a hash of things! The first, dealing with financial decisions, requires the player to decide within limitations how the money should be moved around. Each province produces an income, although this varies, and the player may wish to make adjustments before the second part of the turn, the Movement phase. This obviously allows forces to be moved about, after which the unfriendly computer moves its various forces to counter the moves made. The third phase, Combat, allows the player to attack an enemy force in a province. The outcome is decided by formulae which are given with the game.

Despite the hints given in the cassette inlay, I was seldom able to reach great heights of glory. Perhaps this was because of my own undoubted talent for failure. I prefer to believe it was because of the complicated and intricate nature of the simulation. I do know that I have kept going back to this program again and again; it is that sort of program.

#### Ratings Table:

SOUNDS	65%
GRAPHICS	70%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	80%

<b>Title</b>	<b>Heathrow Air Traffic Control</b>
<b>Publisher</b>	<b>Hewson Consultants</b>
<b>Machine</b>	<b>BBC Model B or Electron</b>
<b>Price</b>	<b>£6.95</b>

SURNAME FIRST NAMES  
DOCTOR SOFT

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BN14 9HX

TELEPHONE NUMBER  
0903 206076

NOTES  
ONE DISC HOME OFFICE

FIND LETTER PRINT FILE NEW

UPDATED @ 28th Feb 84

Having spent many hours on this program over the last couple of weeks, I am still not at all sure whether I am enjoying the challenge or not; it's one of those programs you have to try just once more to see if you can do any better at it!

I have already reviewed Airline, in which I ran an airline company, and the Salamander 737 Flight simulator. Those were both very interesting in their way, and the theme continues with this very complex and involved program. In it, there is a very realistic simulation of an Air Traffic Controller's job, and what a job it is! There are various levels at which it is possible to play this simulation, and also a demonstration phase in which all goes smoothly. I jumped in at the deep end, and tried to handle an option with emergency traffic, and very soon I have problems — and aeroplanes — stacking up all over the place. I read through the very comprehensive notes again, and tried again at a more realistic level, and a glimmering of how to achieve a success began to appear. More practice, and some planes even began to land successfully!

Yet it is one of those programs which it is necessary to keep trying at, and at each harder level, there are additional problems to content with. The simulation will not appeal if you need to zap a number of aliens each day, but for a really tough

test of your reflexes, skill, memory and commonsense, it takes some beating!

#### Ratings Table:

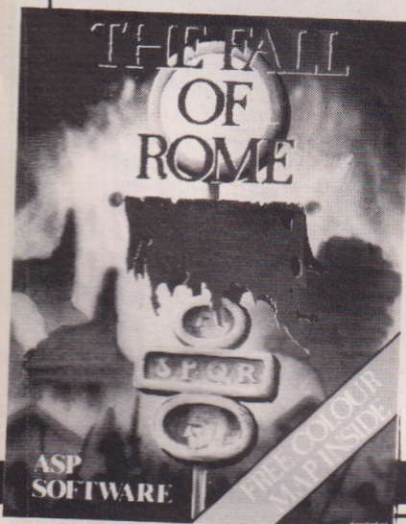
SOUNDS	70%
GRAPHICS	85%
DOCUMENTATION	100%
VALUE FOR MONEY	90%
OVERALL	90%

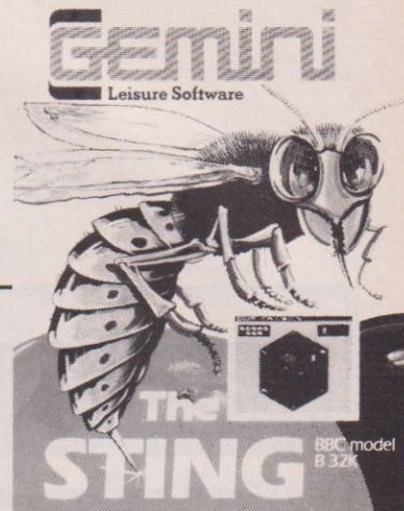
<b>Title</b>	<b>One Disc Home Office</b>
<b>Publisher</b>	<b>Doctor Soft</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£15.95</b>

This program, complete with a very clever title, is probably one of the best ideas I think that I have seen in a long time.

It is a fully integrated, multi-purpose package, containing a word processor, a letter writer, a small financial spreadsheet, a calendar, and a pre-defined names and addresses database.

The main principle of the package is that all of the programs are inter-linked, for instance at the start of the program, you are asked to enter the current date, and if you don't know, you just type in "?" and a calendar will be displayed! After returning to the main menu and entering the correct date, let's just assume you want to write a business letter to your Bank Manager, but you can't remember this address, so go into the database, called





Directory, search for his name, or any piece of relevant information, then when you have found it, go into the letter write mode, and the screen prompts give you the option of a business letter (where the recipients address is printed in the top left of the letter) and away you go.

On letter, having altered the relevant lines according to the instructions, your address is always printed in the top right, and if needed your name at the foot of the letter. Four function keys have been programmed to print out commonly used statements: "Yours Sincerely", "With best wishes", "Yours faithfully", and "Thank you for your letter of".

The word processor program, although not very sophisticated, is extremely comprehensive, having all the major functions of other commercial word-pro's, including word count, print, and review features.

The final program on the disc is called Calculate, and is a small spreadsheet program, small, but like all of the other programs, very powerful. It enables figures to be manipulated to get totals, and sub totals; it can calculate VAT, work out the average, and give a grand total; for either columns, or for the rows, or indeed both. And, like all the other programs, it can be inter-mixed into the wordpro.

As I said at the beginning, one of the best packages I have seen, definitely out in a class of its own, and something other software houses should be working towards, total integration, therefore giving exceptional value for money.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	75%
DOCUMENTATION	85%
VALUE FOR MONEY	90%
OVERALL	85%

<b>Title</b>	<b>Bed Bugs</b>
<b>Publisher</b>	<b>Optima Software</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£7.95</b>

Bed Bugs is an unusual type of arcade game. It loads in four

parts, the last two loading while soothing(?) lullabies are played to you.

The game can be played using the keys Z,X for left and right respectively, and:./ for up and down. Alternatively joysticks can be used.

The idea of the game is to kill the fleas which jump around on your bed trying to bite your feet. This can be done, by either swatting them with a jam sandwich, or crunching them with your false teeth! The fleas move very quickly around the bed and the sandwich sometimes leaves jam on the bed, which provides an extra obstacle for the sandwich to avoid. These obstacles can be removed by the use of a sponge. A telephone is available to call for help, but sometimes the telephone is not answered. If however the telephone is answered points are gained. Each flea that you kill is worth 100 points but after you have been bitten eight times you lose one of three lives available to you. If you hit your feet instead of the flea yet another life is lost. If you manage to kill all the fleas (something which I could not achieve) you are then attacked by Bed Bugs. You have to kill these bugs before they bite you, for every bite is a fatal one. For each Bed Bug killed you gain 1000 points. An added dimension to this game is that you must always remember to stay on the bed or a life is lost.

The instructions in the introduction to the game are quite brief with just the weapons and the bugs displayed, along with instructions for which keys to use. There is a page giving more information (scores, further instructions, etc.) and it is on this page that you can change the speed of the game. It is unfortunate that on the program that I used one could only get to this page after playing the game. There is the by now usual Hall of Fame page for the top eight scores.

The graphics for the weapons are quite good but it is difficult to actually know when the fleas were directly beneath the sandwich. The rest of the graphics are quite straight forward with no outstanding

qualities.

The music in the introduction left something to be desired. At times it sounded more like a dirge than a lullaby.

I found the game very difficult to play and very low points were scored whilst the program was under review. As a consequence the game became very infuriating. In comparison to other games on the market at the same price, I was very disappointed with this game.

#### Ratings Table:

SOUNDS	55%
GRAPHICS	60%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	60%

<b>Title</b>	<b>The Sting</b>
<b>Publisher</b>	<b>Gemini</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£9.95</b>

The first challenge of any Gemini game is to get the cassette out of the tight fit plastic packaging — excellent though it is — in order to load the software.

Simon William's game starts off with an instruction screen (with impressive Teletext graphics of a bee) and a 'favourite key' option. The player is invited to press his or her favourite key for up, down, left and right. There is no opportunity to edit this choice so make sure you get it right first time!

To join the ranks of the 'Best Bee Beaters' and get on the high score table, you have to control the bear, Bruno, around an arena, a parallelogram with increasing number of sides the further you get. In each corner of the arena is a piece of fruit. Above the arena is the 'Picking order'. You have to control Bruno to pick up the fruit in the correct order to complete the screen. Sometimes an aerosol is available for Bruno to pick up. This briefly disables the wasp.

When the screen has been cleared there is a bonus game. This involves tackling a maze, again with Bruno being harried

by the wasp. This time there are also mushrooms shooting about which can be fatal. Bruno has to reach Teddy the cub at the far end of the maze to gain his bonus. As the screens get more difficult and more laden with fruit, there appear some obstacles for Bruno to hide behind. The game however is not easy at this level with the correct order to establish as well as having to watch out for the wasp.

The sound for this game is unfortunately rather unimaginative. The start of each game is heralded by the first bars of that favourite computer tune (more at home with Pool or Snooker), the Entertainer. When the 'Game Over' comes up it completes the phrase. Nothing special and in fact rather out of place. Worse is the attempt at the wasp's buzzing. This sounds more like a hair dryer than a wasp.

The graphics are fair with some nicely defined fruit and Bruno, who looks a bit like a bear at least. The wasp is good but the Sting of the title is not in much evidence. The game employs a variety of contrasting colours and some 'false' three dimensional lettering but overall is not stunning to look at. A nice game feature is the way Bruno walks out of his box and into the arena for each life. In fact playing the game is far more enjoyable than looking at it and I suppose that's what it is all about. Fortunately there is an option for turning the sound off and so no reason why you shouldn't enjoy a fairly standard game.

#### Ratings Table:

SOUNDS	50%
GRAPHICS	75%
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	70%

CONTINUED OVER

<b>Title</b>	<b>Missile Control</b>
<b>Publisher</b>	<b>Gemini</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£9.95</b>

Missile Control, many games fans will be pleased to hear, is now available on the BBC. And what a great version it is, very close to the original arcade game and using all the BBC's graphics and sound armoury to good purpose.

The game allows between one and four players, in turn, to defend their cities from wave after wave of missile attack. It looks like a November fifth firework display as the player returns fire from the four missile bases, aiming to stop the oncoming missiles in their tracks before they can get through and destroy the cities or the bases themselves. The missiles burst in midair forming shimmering clouds (there is some clever use of flash rate here) and the enemy missiles leave red streamers across the sky.

Now and again an aircraft or satellite comes into view and can be destroyed for extra points. Scores are displayed at the top of the screen. If you make it to the high score table with your efforts then a tuneful little routine tells you about it and invites you to put down your gamer's nickname.

There's a demonstration mode to keep the eyes watering while you recover your concentration for another bash at the keyboard or if you prefer, joystick. The game displays no subtlety in its use of sound but that won't matter to anyone playing the game, I just pity all those families down the street watching their television or having a quiet evening in.

Every action in the game is accompanied by loud sound effects, firing, missiles bursting, direct hits, everything. Even when the game informs you of your current status as far as cities goes at the end of each screen, it does it with the clatter associated with a rusty old typewriter. When the game is complete and you have lost (how negative can you

get) 'The End' shimmers into the screen and out again accompanied by a yet more calamitous array of sound.

Missile Control is an exceptional game, simple in concept but impressively presented with flashing colours all over the place, exciting sound effects and non-stop action. Explosive clouds mushroom as craters appear and cities vapourise. It's the usual space fight fantasy brilliantly done.

#### Ratings Table:

SOUNDS	100%
GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	85%
OVERALL	95%

<b>Title</b>	<b>Guardian</b>
<b>Publisher</b>	<b>Alligata</b>
<b>Machine</b>	<b>Model B/Electron</b>
<b>Price</b>	<b>£7.95</b>

No this is not a game about publishing a left of centre quality daily newspaper, but a fast action kill everything in sight game. It's the classic Defender game, bearing a marked resemblance to Acornsoft's Planetoids, and it's very good.

The sideways scrolling is remarkably smooth and the action without respite. You pilot your space fighter back and forth across the landscape desperately trying to stop the landers (green bulbous creatures) from getting to the planet surface and carrying off the humanoids — which look nothing like the humans I know.

The score and number of spaceships left (three per game) plus the number of smart bombs left (three per go) are displayed above the action. Also above the game action itself is the space scanner which gives a wider view of your own position and that of the landers, flying pods, swarms, alien bombers and deadly baiters. It's fairly difficult to distinguish which is which but these particular nasties are fast around the screen and preferably

avoided. This is where the scanner can help but keeping an eye on the main screen is difficult enough.

Keyboard controls are probably the optimum combination but it is a shame that joystick control is not a feature of the game. Even commercial joystick converters don't seem to work, presumably being overwritten by the game code. It is an art in itself juggling with thrust, reverse, fire, smart bombs and so on. Still I suppose the addicts have been at it long enough by now with other similar games and it's part of the challenge to the newcomer. Electron owners will be especially pleased that such an excellent game runs fast and true on their machine.

The graphics are not stunning in detail but this is a sacrifice which allows for increased speed and smoothness of action. Sound is excellently used. I don't know how programmers manage to come up with so many variations on the laser gun 'noise' but here is another convincing version. Guardian is a version of a classic game classically implemented. If you haven't already got something like it then Alligata's polished version will provide you with many happy hours polishing off the alien landers.

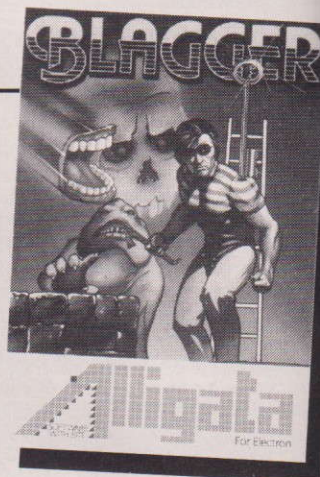
#### Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	80%
VALUE FOR MONEY	85%
OVERALL	90%

<b>Title</b>	<b>Blogger</b>
<b>Publisher</b>	<b>Alligata</b>
<b>Machine</b>	<b>Model B/Electron</b>
<b>Price</b>	<b>£7.95</b>

Blogger is the justifiably popular arcade game, in the maze genre. The game progresses from screen to screen as the criminal hero, a sort of Raffles of the RAM, rifles the safes of various respectable organisations.

Roger the Dodger, as our red-headed hero is called, possesses the ability to leap fairly prolifically around the screen and



this is his main weapon against the various alarm systems and obstacles which gyrate and flash all over the screen.

There are also some wonderfully weird watchmen achieved through some clever sprite definition, an Astronaut-type spaceship, a train complete with smoking stack, an angry lavatory seat! Some luscious red lips conceal sharp teeth and there are ladders and conveyor belts and some more dubious bits of architecture.

The layout of each building is done in good old red brick in a graphics window about two thirds of the mode 2 screen. Beneath this are current score, high-score, level and number of lives. The programming is sufficiently good to keep the character flicker of even many coloured Roger to a minimum.

The Electron version is in no way inferior to that of the BBC. One slight programming anomaly concerns Roger's ability to stand in mid-air without anything untoward occurring. This sort of thing is not of the slightest advantage when you are standing at the top of a floor, unable to jump anywhere but in the most difficult direction.

It's not the easiest start to any game I have played but like other similar games like Ghouls, Killer Gorilla and so on, the correct combination of leaps and bounds, once learned, can be repeated fairly easily until the next problem area occurs.

Roger's purpose on all levels is to get round the screen to pick up the gold keys which are secreted about the place and then to open the safe, then onto the

next building. Roger is also up against a time limit for each screen. The seconds are counted off and displayed on screen.

Blogger proved a game which lasted the course, immediately attractive and entertaining, a difficult enough challenge to hold interest and fun to watch. You have to do well or everyone else wants a game.

#### Ratings Table:

SOUNDS	75%
GRAPHICS	85%
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	80%

<b>Title</b>	<b>Savage Pond</b>
<b>Publisher</b>	<b>Starcade</b>
<b>Machine</b>	<b>Model</b>
<b>Price</b>	<b>B/Electron</b>
	<b>£8.95</b>

The worlds of Pacman and the Space Invaders are far removed from everyday experience, while although frogs do cross roads, it is not usually via five lanes of speeding traffic in order to reach a polluted river! This program, however, is very much set down to earth, in fact in the depths of your local pond. Many of us collected frogspawn in our youth, and scarcely imagined the awful deathly struggle which those tadpoles would have faced.

Yes, the hero of this game is the humble tadpole of the Common Frog (*Rana Temporaria*),

which faces an uphill struggle to survive and eventually become a frog. It is perhaps a good job that you came along to help in this desperate fight. There are many foes, including hydra, dragonflies, jellyfish and even mutant bumble-bees! However, all is not gloom as there are plentiful quantities of a variety of goodies to eat, including amoeba, dragonfly larvae and (yum, yum) bloodworms. As these appear in, or drop through the water, you can assist the tadpole by the standard Z,X,?, \* configuration of keys. Movement in one direction continues until another key is pressed, which makes for very smooth movements.

As one screen of amoeba is devoured, more and more problems appear to haunt poor tadpole, including ferocious dragonfly nymphs, jellyfish and even radioactive waste from a dumper truck! Yes, how true to life this program might be....

Survival as a tadpole brings its own reward, as there would be no tadpoles if the frogs didn't celebrate! C'est la vie.....

#### Ratings Table:

SOUNDS	65%
GRAPHICS	85%
DOCUMENTATION	95%
VALUE FOR MONEY	80%
OVERALL	80%

<b>Title</b>	<b>Brainstorm</b>
<b>Publisher</b>	<b>Virgin Games</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£7.95</b>

This program, written entirely in BASIC, gets high marks for originality. I like what the author is trying to do, even though the end result leaves something to be desired. It is a graphic strategy game, but unusually only for two players to play against each other, and not a copy of an existing board game. It is very much a product of the author's somewhat fevered and certainly complicated imagination. It came as no surprise to read in the Virgin blurb that he is a mathematics student. What he is

doing, in effect, is to create an environment for a two player game which would not be possible without the aid of a computer.

The blurb also describes it as a unique game...of the brain versus brain type — in more ways than one. Each player has to try and kill his opponent's brain. Is vicarious violence so endemic to the world of computer games that a strategy game needs to be presented thus? I hate to think how a modern software house would market chess if they had just invented the game. Anyway, the object is to fire 'lasers' across a grid which has prisms at various locations, some provided initially by the program and some placed by the players. If the laser enters the opponents 'brain' — drawn with happily vague graphics — the game is over. The complication is that each prism has a deflection factor. The prisms drawn at the start have random deflection factors which you can only discover by hitting one with a laser beam. The ones you place yourself have a deflection factor defined by the player. Each direction has a number. If the ray enters from the east (1) and the deflection factor is 4 then it will exist to the west (5) and so on. If you want to convert a direction 60 to a 3 you have to enter factor of 5 because totals over 8 reduce by 8. Confused? You will be. I had to reload the instruction program three times when I first tried to play this one. Mind you when you master it you need never fear BBC BASIC's MOD function again.

Modular arithmetic aside, it is fairly complicated and the documentation was not thorough enough to avoid the time consuming bore of reloading a separate instruction program. One also has a number of options to choose, on the difficulty of the starting position and the length of time the laser beam remains visible — the longer it stays, the easier it is to figure out what is going on. Unfortunately, as a strategy game it is marred by far too great an influence of chance. It is quite easy to hit the opponents brain — or your own —

by shots which deflect from the wholly unpredictable behaviour of the program supplied prisms.

Personally, as a chess player, I dislike games with strong chance elements, especially when (unlike the better card games) they can't really be incorporated as calculated risks in one's strategy. However, this game is certainly different and those wishing to cool their joysticks and engage their brains may get quite a lot of fun out of this one.

#### Ratings Table:

SOUNDS	65%
GRAPHICS	65%
DOCUMENTATION	60%
VALUE FOR MONEY	70%
OVERALL	70%

<b>Title</b>	<b>Rubble Trouble</b>
<b>Publisher</b>	<b>Program Power</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£7.95</b>

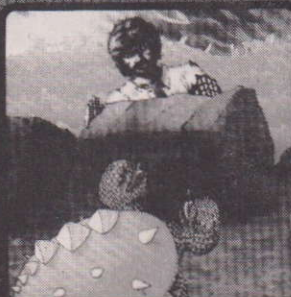
This one is a long loader, mostly because the instruction program, which precedes the main game, is a substantial effort in its own right. Say 'yes' to instructions and they scroll slowly up between a stage curtain surround to the accompaniment of one of the most impressive demonstrations of the Beeb's musical facilities that I have heard. A whole medley of tunes using a variety of instruments are included, some with percussion effects on the noise channel. A peek at the BASIC part of the program reveals the use of all 16 possible Envelope commands with a further four patched in and out by a procedure!

After this the game itself is almost an anti-climax, though it is actually quite good and the use of music and sound effects well above average. The play is a bit like copies of Penguin, since you move about among blocks and knock them against nasty things that would like to kill you. If you miss, however, the block is likely to rebound and flatten you. You can also score points by crumbling special marked blocks,



CONTINUED OVER

**MICRO  
POWER  
BBC MODEL B  
RUBBLE TROUBLE**



or blow yourself up by hitting ones which are pulsing. The scenario for the game is entirely different from Penguin and the source of my only real complaint about the game. It is set in a post World War III world. The monsters are 'mutated turtle like creatures whose only diet is that of human flesh' and the time limit is described as a need to avoid dying of radiation sickness. I suppose today's generation of kids raised on video nasties will think nothing of this, but I personally find this sort of hype tasteless and quite unnecessary.

The graphics are good, though by no means spectacular, and the animation very smooth. There is some use of colour mixing to provide an unusual hue for the blocks. Extra interest is added by the option of a 'hayfield' screen with dummy blocks disguising the presence of the real ones — these soon get cleared away as your hero, or the ghastly turtles move around. There is also an option where the blocks remain invisible except for a few seconds after crumbling one of the special blocks, which remain in view. There is not much variety produced by clearing a screen, though — just more turtles after your flesh. Finally, the controls are good, allowing two sets of keys or joysticks, and pause and sound off options. In summary, a very professionally presented game, with an outstanding instruction sequence.

**Ratings Table:**

SOUNDS	95%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	80%

<b>Title</b>	<b>Q-Man</b>
<b>Publisher</b>	<b>MRM</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£5.95</b>

Q-Man is a fairly faithful version of the arcade game Q\*Bert, with a couple of added extras. For those of you who have never discovered Q\*Bert in your local, here is a quick run-down on the idea for the game:

You control a Barry Manilow look-alike, known as the Q-Man, who has to jump around a pyramid made of cubes. These are drawn using 3D graphics, but the game itself is not in 3D. The object of the game is to change the colour of the top face of each cube by treading on it. Your efforts are hindered by bouncing balls which descend on you for the top of the pyramid, and "Jake the Snake", who appears on the third screen, and bounces up and down the pyramid chasing after you. You can also get killed by falling off the edge of the pyramid (obviously a silly thing to do!). Either side of the pyramid there are transport discs, which, when jumped on, take you to the top of the pyramid.

In my opinion, one of the best features of the arcade game was the quality of the colour. I feel that this could be improved upon in this version, using colour mixing of the same sort as games such as Gunsmoke. There also seems to be a delay between you pressing the key, and the Q-Man actually moving, but you soon get used to this. The program includes some features not present on the original, including hyperspace, which bounces you all over the pyramid (and occasionally off it) before dropping you at a random position, and smart-bomb, which destroys all the video nasties on the pyramid at that time. When you hit the

smart bomb, your first reaction will probably be that your TV has gone on the blink: the screen wobbles frantically from side to side. Do not be alarmed, however, because the program makes use of the 6845 video chip's 13th register, which controls the position of the extreme left hand character (see page 370 of the Advanced User Guide).

This program provides quite a good version of the game, and compares well to Superior Software's Q\*Bert. The graphics are quite good, and the sound average. A good buy for all Q\*Bert enthusiasts, but there are better games available.

**Ratings Table:**

SOUNDS	65%
GRAPHICS	75%
DOCUMENTATION	N/A
VALUE FOR MONEY	70%
OVERALL	70%

<b>Title</b>	<b>Plunder</b>
<b>Publisher</b>	<b>Cases</b>
<b>Machine</b>	<b>Computer</b>
<b>Price</b>	<b>Simulations</b>
	<b>Model B</b>
	<b>£6.95</b>

In the inlay card, the loading instruction is as follows: "The procedure for loading your program into your Spectrum is given in your manual." I ignored this and proceeded to load the game. The game loads accompanied by the message "No room". Oh dear, I forgot to reset PAGE, but surely the program should do that for you? Undaunted I loaded the game to be greeted by a huge copyright message. Then the game starts.

Apparently, you are the captain of a British galleon. You have been commissioned by Her Majesty to stop Spaniards running gold from the New Lands to Spain. To earn a knighthood you must stop a fixed number of gold pieces which depends on the skill level you choose.

Your ship is represented by a little red blob and it can be moved about on the high resolution map via the cursor keys. When you encounter a Spanish ship, you must decide whether to attack or not. If you decide to at-

tack, whether to fire cannons or board the enemy vessel. The battle is enacted graphically. It is conducted over a number of rounds but it seems to be totally random and all you do is sit and watch as the two graphic characters blast each other to smithereens. Dotted around on the map are several ports. On entering the location of a port, the screen clears and red ships are dotted randomly around the screen. You must control a black ship to negotiate these in order to get to the harbour, a process that's even easier than clearing the first screen of Space Invaders.

Generally, the game is monotonous and I never actually bothered to finish a game since I found it so unchallenging and totally boring. There are many other simulation/strategy games available and they are much better.

**Ratings Table:**

SOUNDS	20%
GRAPHICS	50%
DOCUMENTATION	80%
VALUE FOR MONEY	50%
OVERALL	50%

<b>Title</b>	<b>3D Tank Zone</b>
<b>Publisher</b>	<b>Dynabyte</b>
<b>Machine</b>	<b>Software</b>
<b>Price</b>	<b>Model B</b>
	<b>£8.95</b>

"3D-Tank Zone" by Dynabyte Software is a derivative of the vector graphics tank simulation "Battle Zone" found in the arcades. Let me quote from the inlay card: "As weapons commander you must, with the aid of radar, scan the terrain surrounding the city and missile silos for marauding enemy tanks and destroy them before they get you. Watch out too for waves of incoming jets and helicopters on the horizon. To aid you in your task, you have at your disposal a direct fire anti-aircraft cannon and an anti-tank missile launcher..."

"3D-Tank Zone" differs from its arcade cousin in that you can not move about. Instead you just rotate left or right and shoot at the enemies. You have to control



the sights for the two weapons. The whole thing is monochrome (green on black), just as in the arcade game but the animation is simply excellent. When you blow up an enemy it actually explodes instead of just disappearing as in many games. The game gets progressively harder as more enemies appear on the screen at once and when you finally get blown up, the windscreen cracks and the screen is slowly cleared to leave a totally red screen!

The usual features such as sound on/off, freeze are present but unfortunately, there is no high score table. Meticulous attention to detail such as the rotating rotors of the helicopters and planes makes this game a joy to watch as well as play. Overall, a very enjoyable game.

#### Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	60%
VALUE FOR MONEY	80%
OVERALL	80%

<b>Title</b>	<b>Frenzy</b>
<b>Publisher</b>	<b>Micropower</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£7.95</b>

"Frenzy" is a version of the arcade smash, "Qix". The storyline has been rewritten for "Frenzy", so let me explain: Deadly subatomic particles are running free in a scientific research centre. It is

your job to trap the darting Leptons using a robot craft before your time runs out.

As you move your craft across the screen, a green iron-tail, is dragged along behind. When you reach the edge again, the smaller area confined by the iron-tail is filled in. A Lepton is captured if it is trapped in this area or if 95% of the screen is filled in. As you progress through the screens, the number of Leptons increase and another type of nasty called "Chaser" is introduced. Difficulty arises from the fact that one life is lost if a Lepton hits your iron-tail before it as been filled in or if a Chaser hits you. The graphics are simple but effective and the smooth animation is excellent. The craft responds immediately to the controls and the impressive sound effects boost up the enjoyment a lot too.

The game has been transported onto the Beeb well and the presentation is well up to the very high standard set by other Micro Power games. The usual features such as a neat title page, sound on/off option, high score table are all there.

Micro Power has recently become very prolific but that has not lowered the quality of their games; if anything, it has gone up! In fact, many of their games are just as good as Acornsoft's and they are cheaper. If you liked the arcade game "Qix" or you're just fed up with traditional shoot 'em-up' games, buy "Frenzy". You won't be disappointed.

#### Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	80%
VALUE FOR MONEY	85%
OVERALL	86%

<b>Title</b>	<b>Castle Assault</b>
<b>Publisher</b>	<b>MRM Software</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£5.70</b>

A glittering reward await the intrepid atop the heavily defended towering turrets of this forbidding fortress. On your quest for gold, you will be assailed by a menacing menagerie of meanies, name-

ly crabs, snakes, lobsters, spiders, bugs and beetles. Watch out for the deadly flying Duck and avoid the falling rocks, scale the ladders and negotiate moving platforms. Collect various different fruits for bonus points on your way... and so goes on the preamble on the inlay card. Unlike many similar blurbs, this one actually depicts the game rather well.

Basically, you control a very well defined, incredibly well animated figure to jump over the bouncing crabs, lobsters what have you, then climb the ladder to jump onto a moving platforms to go to the top of the screen whilst avoiding the falling rocks and of course, the flying duck. The most striking thing about this game is its sprite like characters, the way in which they are animated and the sounds that accompany them. The sight of the flying duck, quacking as he leisurely crosses the screen is so funny that you lose your concentration. Features such as sound on/off option, freeze, High score table, neat title page etc. are all there.

The professional presentation, impressive graphics/sound and the addictive quality makes this a top quality game. As with all MRM games it costs only £5.70. It's almost irresistible.

#### Ratings Table:

SOUNDS	85%
GRAPHICS	100%
DOCUMENTATION	80%
VALUE FOR MONEY	95%
OVERALL	90%

<b>Title</b>	<b>Darts</b>
<b>Publisher</b>	<b>MRM Software</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£5.95</b>

When I received "Darts" for review, I thought to myself, what's so difficult about placing a dart in the right place and releasing it? and proceeded to load the game.

When the game loads you're given the option of playing three popular dart games; 501, Round the board and Cricket. In case

you are unfamiliar with them as I was, let me explain. 501 is the game you see on telly. Each player has three darts in turn to try and score as many as possible. To win the game, you must finish with a Double. In "Round the Board", each player works his way round the board finishing with the semi-bull and the bull. In "Cricket", player one starts by trying to score as many "Runs" as possible whilst player two aims for the bull and semi-bull which counts as two wickets and one wicket respectively. Player one continues to score until player two take 10 wickets. The roles are then reversed. The player with the most "Runs" wins.

Difficulty in all these games arises because the dart — represented as a white cross — shakes rather wildly as if you were totally drunk and your controls can only guide the dart in the general direction. You have to choose just the right moment to release you dart. Surprisingly, it turns out to be a very addictive game probably because you're trying to beat your opponent and you end up having "Just-one-more-go" as with all good games. Since it's an MRM game it's relatively cheap as well. If you are looking for a two player game, have a look at "Darts".

#### Ratings Table:

SOUNDS	50%
GRAPHICS	70%
DOCUMENTATION	100%
VALUE FOR MONEY	90%
OVERALL	78%

<b>Title</b>	<b>Adventure</b>
<b>Publisher</b>	<b>Virgin Games</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£7.95</b>

The blurb of the inlay card sets the scene: You were sailing in the South seas when your catamaran was holed by Killer Whales. You manage to launch a life-boat and are now adrift somewhere at sea. Your task is to return home to England. Your journey back to England will take you to strange islands, pirate ships, ghost ships,

CONTINUED OVER

storms, sea creatures and a whole lot more. It also says that this unusual game is an adventure with a difference. It combines both graphics and text. Graphical adventures aren't new but for the Beeb, the choice is rather limited and they are always welcome.

This particular adventure has a vocabulary of only 10 words which can be entered by the function keys. You might already be thinking that this is a simple adventure but you'd be wrong. Experienced adventurers will instinctively bash away at the keyboard to input various commands but to no avail. The ten commands assigned to the functions keys — North, South, East, West, Up, Down, Pick up object, Inventory, Drop object, Use object — are the only words that can be used. In many places I knew what I would have done in a normal adventure but couldn't because the word wasn't available! It was a totally new challenge. Even if you're not an adventure fan, you will find the MODE7 pictures fun to watch. Some of them are even animated! Now that's something new.

I think that this will appeal to all but the most hardened adventure nuts and the arcade only freaks.



#### Ratings Table:

SOUNDS	50%
GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	80%

<b>Title:</b>	<b>Proteanse</b>
<b>Publisher:</b>	<b>DK'Tronics</b>
<b>Machine:</b>	<b>B.B.C. Model B</b>
<b>Price:</b>	<b>£6.95</b>

This game is original, I'll give it that. You control a laser base at the bottom of the screen. At the top (randomly positioned) are 20 meanies. They descend slowly, dropping deadly bombs all the time. When they reach the bottom they ascend to the top and begin descending again. The more you shoot the faster they move up and down the screen (the last one being the hardest to hit). On the first sheet hitting a meanie scores 3 points, on the second 6, on the third 9, and so on.

The publishers claim there are 9 different sheets. I cannot say they are wrong as I only made it onto sheet 6. On all the sheets I progressed onto the meanies looked different to any other meanies I had seen before. I spent a long time disputing with my brother what they are meant to look like and neither of us can really tell. I think some look like eyes, others like mouths, others like parcels, and others like mushrooms.

How DK'tronics can claim fantastic sonics and dazzling graphics I just don't know. I think the meanies and the laser base are a bit on the small side. The sound is good though, I must admit, but not dazzling.

There are a few features I especially like, namely the way the laser base materialises and disintegrates, the way the whole screen scrolls down when you have lost your three lives to show your score and position on the high score table, and when you enter your name in the high score table for every letter you enter

you receive an accompanying 'blip'. I am amazed by the speed of the meanies especially the last one on every sheet. I do not like the position of the keys for the game; C moves left, B moves right and SHIFT fires.

To sum it up, Proteanse is an overrated game which has a few nice features and is mildly addictive.

#### Ratings Table:

SOUNDS	80%
GRAPHICS	50%
DOCUMENTATION	60%
VALUE FOR MONEY	60%
OVERALL	65%

<b>Title:</b>	<b>Carousel</b>
<b>Publisher:</b>	<b>Acornsoft</b>
<b>Machine:</b>	<b>Model B/ Electron</b>
<b>Price:</b>	<b>£9.95/£9.20</b>

Carousel is a screenful of action: owls, rabbits, letters and ducks march across the screen in both directions; the carousel arms whirl round in the background; bonus scores come and go and your supply of bullets steadily decreases.

The game is simple to play, employing only the favourite Z,X, Return combination, and the idea is to high-score by shooting as many objects as possible and hitting as many bonuses as you can, before your supply of bullets is finally used up. Extra points can be gained by hitting the BONUS letters in the correct order. Positive and negative results can result from hitting the two boxes in the top left and right hand corners of the screen. They also make extra bullets available from time to time.

Watch out for the ducks. More often than one would choose, the yellow ducks change their appearance (they actually look quite friendly as they cross the screen) and fly down to deprive you of your bullets. They dodge about pretty effectively but if you latch onto them quickly, no more duck. It certainly gets the adrenalin going dodging about after two or three ducks at a time,

especially as only one bullet is allowed on screen at one time and you know that a wasted shot could be fatal.

If by this stage the carousel music accompaniment is disturbing the concentration, then you can make use of one of the nice features of Carousel. By shooting out a switch which is graphically displayed on the left hand side of the screen the sound is toggled on and off. When the animal characters have been shot away, with or without the help of extra boxes of bullets, further points are scored by hitting caged ducks (revenge) and a Polar Bear which scuttles backwards and forwards across the screen for as long as you can keep up with it.

There is nothing stunningly original in this game but so much is going on, there are so many options and combinations, that it remains addictive and enjoyable, as far as I know, forever. Good colour, excellent sound, great fun.

#### Ratings Table:

SOUNDS	90%
GRAPHICS	85%
DOCUMENTATION	90%
VALUE FOR MONEY	80%
OVERALL	90%

<b>Title:</b>	<b>Golf</b>
<b>Publisher:</b>	<b>Computersmith</b>
<b>Machine:</b>	<b>Model B</b>
<b>Price:</b>	<b>£5.50</b>

This decidedly boring game has little or nothing to recommend it. After a title page which consists of nothing more than a white blob sitting on a green square, we are presented with the first page. This page asks us the question "What is your weakness?". To which we must reply with a number corresponding to one of the four options, which are Slicing (1), Bunker Shots (2), Putting (3) and Rough Shots (4). Later we realise, there seems to be no point in answering this question as we feel that the outcome is the same for all the options. Anyway having answered this, we get to the first hole.

# WARRI SOFTWARE

## Q-MAN



FOR THE BBC 32K

A graphical display of the first and all the subsequent holes, of which there are only nine, is shown on the top two thirds of the next and each of the following pages. Also at the top of each of these pages is the hole number that you are on, and the length, and the par of that hole. We are shown below this, a plan view of the hole with a mess of coloured graphics along the side of a fairway with a bunker somewhere about the middle. There is, therefore, little change to the layout of each of these pages.

The bottom third of these pages is devoted to the input and output of text information. We are asked to select a club, which we give by a number 3 to 9 followed by the letter 'I' for 'Irons', and 2 to 6 followed by 'W' for 'Woods'.

Having chosen our club we must then give a percentage of how hard we wish to hit the ball. After each stroke we are told how far we now stand from the hole and what has happened to the ball, and at the end of each hole we are told the par for the round so far. The purpose of the game is to get as low as possible a score for the round.

Finally we are shown our score card, this gives the yardage, par, and our score for each hole. It also poses the question "Would you like the same round again?", and personally I couldn't

take another hole let alone another round.

All in all the game has little resemblance to the game of golf, and offers nothing to hold the interest of the player, with no use being made of the BBC's sound capabilities. The only animation is a thin black line moving across the screen.

### Ratings Table:

SOUNDS	N/A
GRAPHICS	10%
DOCUMENTATION	N/A
VALUE FOR MONEY	5%
OVERALL	15%

<b>Title</b>	<b>Stockmarket</b>
<b>Publisher</b>	<b>A.S.P.</b>
<b>Machine</b>	<b>BBC Model B</b>
<b>Price</b>	<b>£6.99</b>

Many people like me dream of making a fortune by investing money on the Stock Exchange, but lack the money and/or the courage to do it for real. This game provides a satisfactory alternative, with thousands being made or lost on your television screen. There are four commodities, Lead, Tin, Zin, and Gold, each of which begin with a certain share value, although this does vary considerably during the game. Shares may be bought or sold at each turn, although trading might be suspended occasionally, and there are unexpected newsflashes concerning tax demands, refunds of cash, or even bankruptcies.

I found this to be the kind of game that Monopoly players might enjoy, best played with a group (the program accepts up to six names). The actual idea is to turn an initial thousand pounds into a million, but the game can be terminated after any complete round, in which case the profit made by each player is displayed.

The display makes sensible but imaginative use of colour, although I did find that some of the prices of the shares took on very strange values occasionally. I found it a compulsive and interesting game, totally different from zapping Invaders.

### Ratings Table:

SOUNDS	60%
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	75%

<b>Title:</b>	<b>Music Editor</b>
<b>Publisher:</b>	<b>SYSTEM</b>
<b>Machine:</b>	<b>Software</b>
<b>Price:</b>	<b>Model B</b>
	<b>£9.00</b>

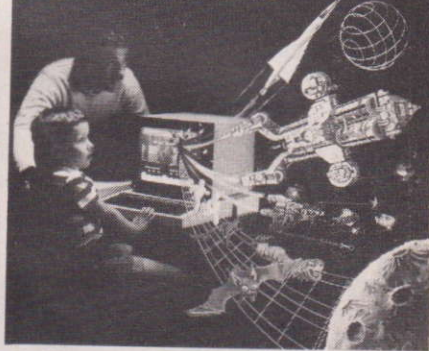
From a musical point of view it is difficult to envisage a program that could more fully utilise the sound capabilities of the BBC Microcomputer. There are facilities which allow any tune to be entered (up to 1100 note compositions on tape, 800 on disc), displayed graphically, altered in any of the three possible parts and played back from any point. The 16 predefined ENVELOPES can be edited and the whole lot safely stored away onto whatever media you are using. Tunes can then be recalled to the Editor or tagged on to your own program using a routine supplied in an Appendix of the excellent manual.

As with all such utilities, it is necessary to become familiar with a number of commands before you can smoothly enter and 'debug' your tune. A series of prompts asks you to make a number of choices about key signatures, number of voices (channels 1 to 3) and tempo. These options are all well documented and you will need the manual until the parameters become well known.

The heart of the program is Edit mode. Here the stave is displayed along with a clear display of duration, amplitude and envelope. The cursor keys position the note on the stave (and this makes the editor an excellent early learning teaching aid as well) and various keys make the selection of type of note, e.g. sharp or rest.

Other keys select levels for duration and amplitude envelope. All the changes are clearly indicated by the display (a

# GEMINI Leisure Software



## Missile Control

BBC model B 32K

series of cyan boxes which change colour to indicate the current level). The program allows the positioning of bar lines to make reading your composition easier and a marker can be placed in the music to indicate from where a section is to be repeated. Playback can take various forms, from one note at a time to the last 256 or the whole tune. Each voice is dealt with in turn and facilities are available to check on the exact specification of any individual note in the tune.

Loading and saving is achieved with all the necessary reminders displayed on screen and there are plenty of backup instructions in the manual. For an extra quid you can purchase a very entertaining demonstration tape with tunes featuring Joplin, Bach and the Beatles. It won't be long however before you are copying in your own tunes (accompaniment to yourself perhaps) of composing original pieces. The Music Editor has not really got the versatility to be called a musical instrument (only six tempos for instance) but it is the nearest you can hope to achieve on the BBC.

### Ratings Table:

SOUNDS	95%
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	90%

# The Cube at

Mark Webb

The outward looking design of the BBC Micro has enabled it to become popular as a flexible starting point for all kinds of system, even if it is only a couple of joysticks. At the other end of the range you can add on processors for personal use and for business. And Control Universal of Cambridge, for one, have not forgotten the world of industry. They see the BBC as the hub of their own efforts in this field.

Control Universal, as a company, have been around longer than the BBC Micro but quickly realised its potential for the sort of industrial control applications which they intended to develop. As an Acorn dealer, supplying all sorts of hardware and software, Control Universal have shared in the success of the BBC Micro. Selling BBCs results in contacts for Control Universal products and vice versa.

The "Cambridge effect" means that the firm will have to expand further out of its offices and workshops near the centre of the city, but they value their current geographical position and the positive effect they feel it has

## Control Universal supply the BBC solution to industry.

on customers. At the same time they remain a small operation compared with Acorn and this has proved an attraction for key staff.

As mentioned, Control Universal supply a whole range of peripheral products but unique to them is the CUBE range. CUBE is at the heart of the complete systems they supply to industrial users and encompasses processor boards, CMOS and DRAM memory, Teletext and hires video, analogue, digital, serial and high-voltage I/O. It also takes in EPROM programming, floppy disc controllers and disc drives. These are essential, even integral, parts of industrial systems. EPROM programming is the final stage of program development which CUBE is designed to assist. The variety of separate component cards provides flexibility of

choice to the industrial consumer who will have a particular task to perform and will require a tailored hardware solution.

### BUILDING BLOCKS

The bases of the CUBE systems are two independent processor cards, the EuroCUBE 6502 and CUBE BeebFLEX 6809. Each can run alongside an ordinary BBC Micro as a second processor or stand alone as the heart of an independent rack-mounted system.

At the heart of EuroBEEB is the £167.00 6502 card. This is not a true second processor in the way that the Acorn 6502 is, since all communication with the host BBC Micro is at 9600 baud via the RS423/422. The RS422 is



implemented on EuroCUBE 65 because of its extended range, more suited to an industrial environment, where units may have to talk to each other across a factory floor. Also on board is a 6522 VIA (Versatile Interface Adaptor) providing 16 digital input/output channels, four control lines and two timers.

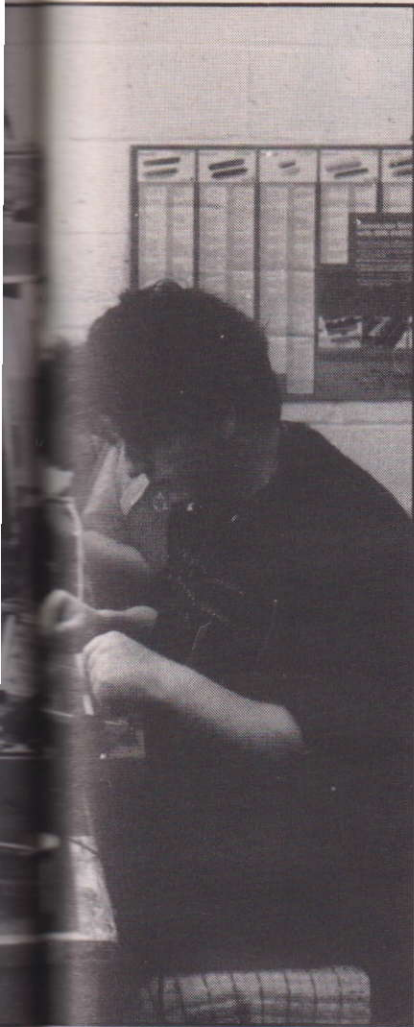
EuroCUBE 65 turns into EuroBEEB-2, 3M, and 3C with, in turn, the addition of teletext video, high resolution monochrome and high resolution colour. The most important option for the industrial user is the addition to the card of 8kB of battery backed up CMOS RAM. The CMOS RAM can interpret all the relevant OS and VDU calls from the host BBC Micro and can drive the teletext or the high-resolution colour video, CUGRAPH. Alternatively the card can be fitted with a BBC BASIC interpreter of its own and any other sideways ROMs such as disassemblers, languages and utilities.

The EuroBEEB begins to take on the look of an independent system and the real advan-

*Knowledgeable sales staff*



# Cambridge



*In the workshop*

tages of using the BBC software environment become apparent if you imagine a BBC Micro system developing software alongside a EuroBEEB which can then go away and become an independent processor. The four memory sockets on the EuroCUBE-65 can handle either RAM or ROM up to 16kB each so the user's options are open. Battery backup and a real time clock are two important features if you are intending to collect information from external instruments, which is a routine job for industrially based computers.

## STAND ALONE

As a stand-alone unit the EuroBEEB cards are mounted into a robust racking system with independent power supply. A simple piece of software performs an automatic power-up and run. The great advantage of using the EuroBEEB system includes a well-known software environment, which means both easy development of new programs and the availability of a wide range of utilities. The firm which

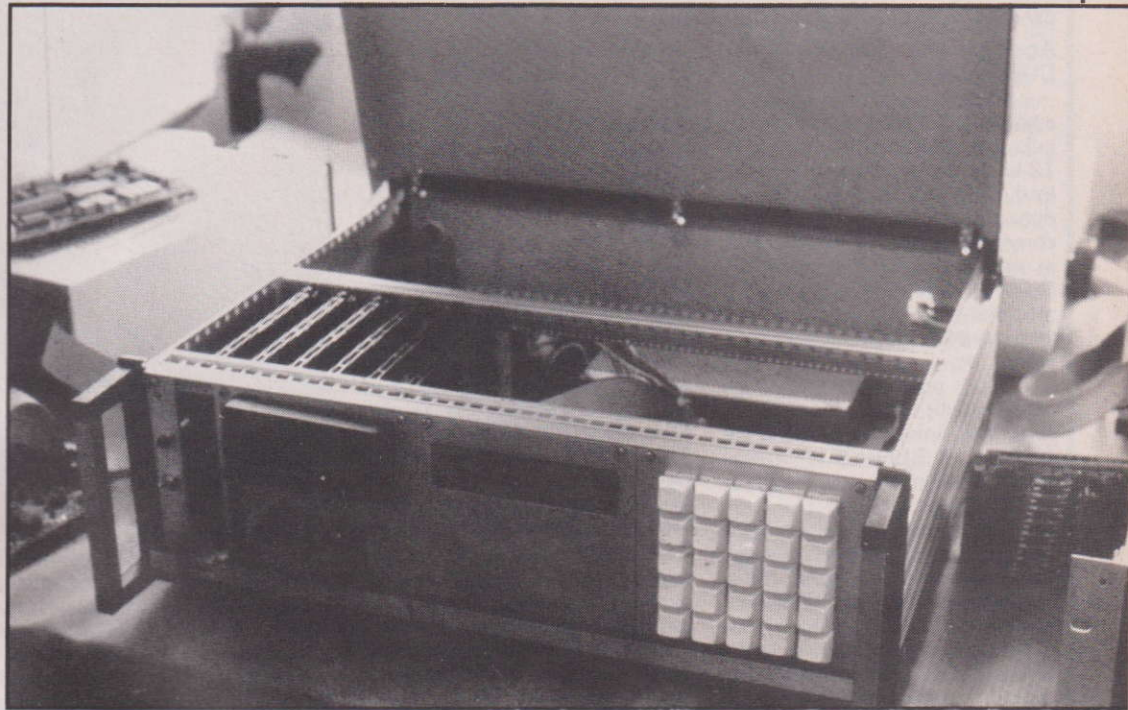
uses Control Universal products for its engineering applications could just as easily use the host BBC Micro to do its accounts. It might also go home at weekends for the children.

The CUBE user can also take advantage of expensive peripherals during development work but have a cost-effective solution at the end of the day. The CUBE mini-racks are purpose built and do not present the problems of bulk and vulnerability to knocks and dirt which BBC Micros do. Most would agree that

one of Control Universal's mini-racks. Control Universal have written software to allow the BBC disc operating system to mesh with FLEX. FLEX allows programs which obey its rules to run on any 6809 machine. It is an especially useful language for developing code with cross-assemblers available for most processors. Programs can be compiled from languages such as Pascal and PL/9. FLEX also provides a path into a large quantity of support software. The BeebFLEX system comes with a built-in text

containing the software already developed for a target system. At the same time it retains control over data as RAM in the host system. CUBE ICE, or In Circuit Emulator, can be used to develop for 6809 target systems.

As with EuroBEEB, BeebFLEX can move away from the host BBC system and stand alone, using a CUBE keyboard. The BeebFLEX package will cost you £358 ex VAT and the FLEX operating system on disc, plus manual, a further £65 ex VAT. BeebFLEX is once again targeted



*Racking system with programmable keys*

the BBC is at home in the lounge or office but most industrial climates are distinctly hostile to plastic casings and keyboards.

## FLEXING YOUR BEEB

The Control Universal 6809 second processor, the CU-NINE CPU card, connects via the Tube interface, and forms the heart of CUBE BeebFLEX. The CPU card is accompanied by the Tube interfacing and a CU-DRAM 64kB memory card, all housed in

editor and machine code assembler. All such FLEX programs come in specially formatted FLEX discs. This necessitates the presence of configuration parameters in a sideways ROM in the host BBC. The BeebFLEX system leaves 48kB free to work with, even in high resolution modes.

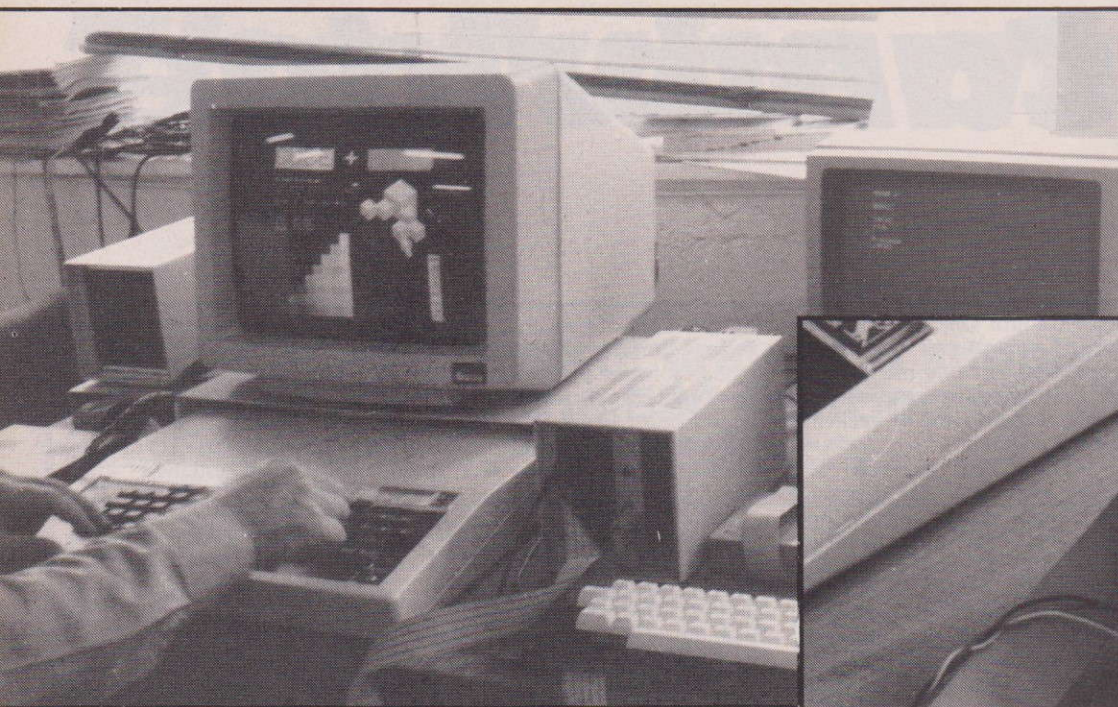
With BeebFLEX the four slot mini-rack allows for the addition of analogue or digital I/O, video output or, most interestingly, EPROM programming. The CUBE ROMULATOR can emulate a 4kB ROM or EPROM

at industrial users for developing systems for electronic control and monitoring. However, for the enthusiast who would like to program in C on his/her BBC, then BeebFLEX makes it possible.

## OPTIONAL EXTRAS

One of the other options necessarily available for a system intended for use in the analogue world of engineering is the 12-bit

**CONTINUED OVER**



**CU-GRAPH, EURO-BEEB and CUBE keyboard all in evidence**

Analog Data Capture Unit, CUBE ADCU.

This consists of CUBAN, eight 12-bit analogue input channels with options for up to four 12-bit analogue output channels, and CU-DRAM, the 64kB dynamic RAM card. The unit can convert and store 30,000 values in approximately four seconds. Control Universal supply a machine-code driver program for incorporation into the user's software.

The relevant cards can operate with stand alone CUBE systems or link to the BBC via the 1 Mhz port. BEEBEX, a general purpose extension unit, provides the power.

Also available for use with BEEBEX are CUBAN-8, an eight bit analogue interface, CUBIO, 80 channels of digital I/O, INDIO and the CUBE Delegate Industrial Interface, offering opto-isolated heavy duty switching.

\*I/O, the control ROM can be used in conjunction with BEEBEX. This simplifies the procedure for transferring data via BBC. BEEBEX can also be driven by EuroBEEB in the role of BBC. An economy BEEBEX starts at less than £70 and offers a solid launching pad into the world of CUBE.

## HIGH PERFORMANCE VIDEO

Perhaps the most instantly attractive, and certainly the most ex-

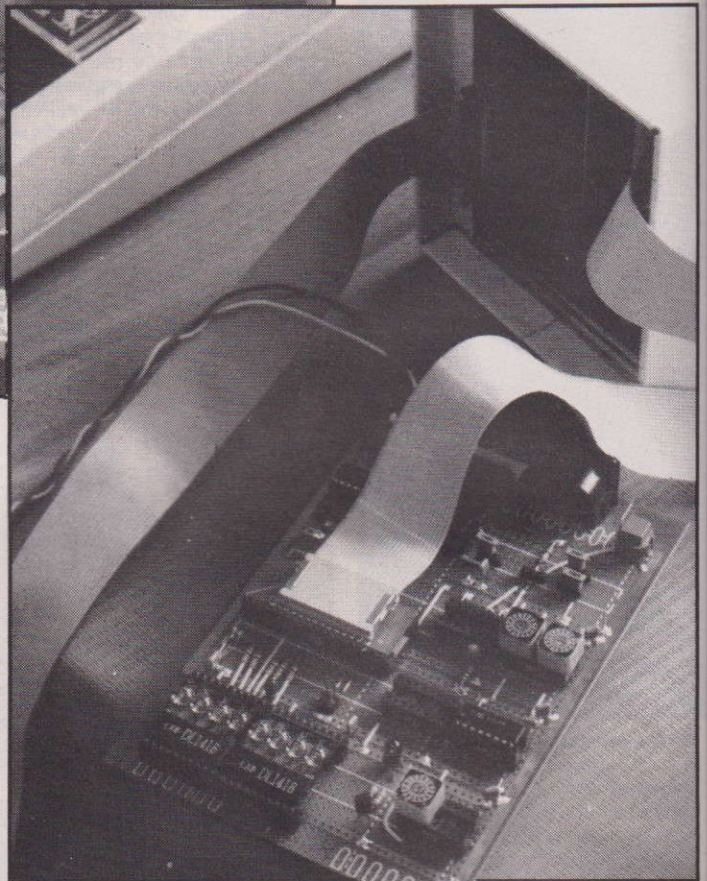
pensive!, CUBE unit is the hi-res colour graphics intelligent display terminal, CU-GRAPH. The terminal consists of EuroCUBE-65 and the CU-GRAPH graphics module. It receives serial data via the RS423 and drives a colour monitor. Effectively you get Mode 0 resolution with Mode 2 colours (not flashing). Actual resolution is 512 by 256 but the pseudo matrix of 1024 by 1024 applies to BBC graphics commands, all of which are supported.

The graphics controller chip used in CU-GRAPH is the Thompson EF9366 which has its own built-in character set. This can be manipulated to produce enlarged, vertical and italic script. CU-GRAPH is a most impressive addition to a BBC system and, perhaps surprisingly at a price of around £650, is a popular option with Control Universal's industrial customers. The CUBE system is completed by CUBE disc packs available in a variety of formats and storage capacities with double density controller if required.

Control Universal plainly find that their customers want to buy a complete system, selecting the units relevant to their particular need but unwilling to shop around for peripherals. This is where, on price especially, the BBC based system scores.

## SPECIALISTS

Control Universal work in a very specialist corner of the microcomputer world but have successfully brought the BBC Micro into it. It appears that the BBC based



**CUBE card: this one is Romulator**

systems which they supply can provide solutions for a variety of industrial applications for small, medium and large firms. Hardware built in Control Universal's workshops finds its way into factory units, engineering works and into more experimental projects involving controlled manufacturing processes. A recent example of the wide ranging applications of this technology came in the form of a customer who wanted to monitor conditions on board a giant oil tanker.

Control Universal are fairly unique in combining the design, manufacture, sales and support of their products. Naturally with this sort of technology, sales and support staff have to be highly trained. Documentation has to be of the highest standard and informed advice easily available. The Control Universal team have put together a package which includes all these aspects.

The BBC Micro connection is a most important aspect of Control Universal's business, and in all likelihood will remain so for a considerable time in the future. Plans for development of a networking system and for IEEE communication seem right down the BBC's street. Networking would allow central control of, say, measuring devices around a factory. IEEE is the standard means of communication between many industrially based instruments and micros. Later there may be a move towards developing a 68000 card, bringing faster processing to bear. It looks like the CUBE range is set to expand further, offering yet more choice to those who already own a BBC and would like to make further use of it in an industrial situation and to those whose requirements are met by a BBC/CUBE system provided by Control Universal.

# Drive with Care

H. A. J. Pattinson

While developing disc-based business software for the BBC the authors came across a number of problems in using disc drives on the BBC model B, in which A&B readers may well be interested.

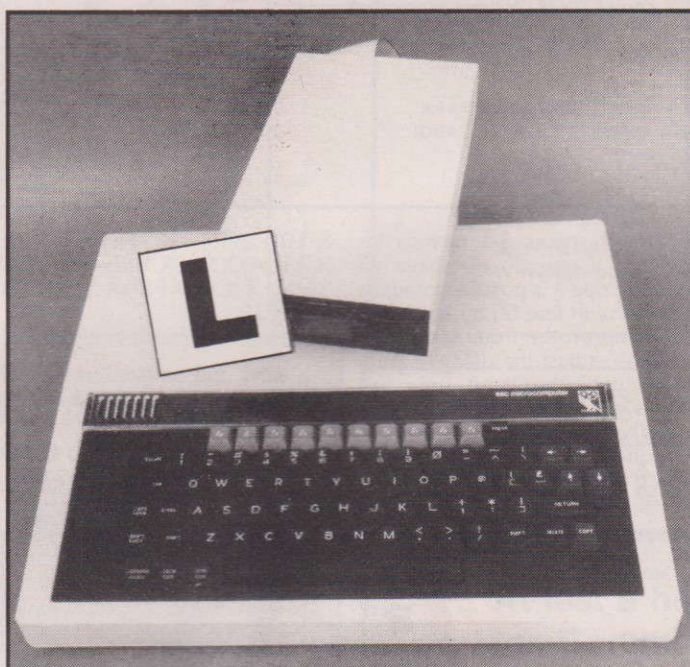
## FAULT FINDING

The most serious fault occurs in the older-style belt-driven drives (which take a long time to start up) as a corruption of the format, so that the sector affected cannot be written or read until the disc is re-formatted. It also occurs in modern direct-drive units as a CRC error in a sector, which cannot be corrected by re-reading it; in this case the beginning of the sector will be correct, then there will be a confused area, then the rest of the block can be correct, but will often show a 'bit-shift' in the date (i.e. the correct bytes 05H/44/H/27H might become 15H/10H/BCH). This fault appears only when a disc write operation is started on a stopped drive (although it may be detected only after a future access of the sector), so that the disc must come up to speed before the operation starts.

To work correctly with the BBC any drive connected to it must be ready for transfers as soon as it sends the BBC the second index pulse after the motor starts up. Belt-driven units take a long time to start up, and may not be running at full speed by the second index pulse; this causes writing to occur at low speed so that the sector is written too early, scribbling over the track formatting. Many modern direct-drive units start to load the read/write heads when they see the second index pulse after start-up, so that the head may still be loading as the transfer starts; as the heads load they tend to bounce apart again, producing the 'head-skipping' that causes the CRC error in the sector — single-sided drives tend to be less of a problem as the pressure pad which is used to push the disc against the single head is often soft, and therefore does not bounce in the same way that two (rather hard!) disc heads meeting do.

In the BBC there is a 'disc-

## Susurrus Business Systems take us through some of the finer points of disc driving with the BBC Micro system.



ready' timer circuit which apparently should allow transfer one full revolution of the disc (0.2 seconds) after the first revolution that takes less than 0.26 seconds (giving three index pulses as a minimum), but the counter at IC85 continues to run after the drive is deselected and half the time only two index pulses are needed to set the 'disc-ready' on pin 32 (drives 0 and 2) or pin 5 (drives 1 and 3) of the floppy disc controller (type B271 at IC78 in the BBC).

To test for this fault, check for a drive-generated 'drive-ready' signal — this will often be on pin 34 of the signal cable between the drive and the computer, and a 220-ohm resistor should be connected between this signal and the +5 volt power supply on the BBC; then connect channel 1 of two-channel oscilloscope to the BBC 'drive-ready'

signal (pin 32 of the 8271 FDC for drive 0) and the second channel to the drive-generated signal, with the scope trigger set for a falling edge on channel 1. Check the falling edge on channel 2, and if it occurs more than a few milliseconds after channel 1 when a '\*CAT' is requested you may have a potential problem since the BBC will be saying that the drive is ready before the drive itself says so! Because the BBC sometimes responds to two and sometimes to three index pulses, it is necessary to try this 20 or 30 times, waiting a second or two after the drive lamp goes out before each new attempt. On a direct-drive unit which shows this fault you can usually expect 50% of these attempts to work correctly, and 50% to have an incompatible 200 millisecond delay (note that it is generally the drive suppliers that claim compatibility

with the BBC computer, not the reverse, so that burden would seem to be on them to ensure compatibility).

Many individual drives work in spite of the above, particularly direct-drive single-sided drives. This is not guaranteed by the design, but if you get a unit which gives you problems of this nature the manufacturer will generally keep swapping it for you (if you make enough fuss) until you strike it lucky. You can reduce the problem on some drives by reading the old contents of the sector from the disc and throwing the data away (to start it up) immediately before you write the new data to the sector, but this is not always easy to implement, the most reliable fix is to block the index pulses to the BBC while the drive-generated 'drive-ready' is not set. See Figure 1 for details of a circuit which can be installed in the drive signal cable of many offending direct-drive units; wires 7, 8, 33 and 34 in the cable should be cut to patch this in (the circuit assumes that pin 34 carries the 'drive-ready' signal). It is possible to put a fixed delay in a home-made DFS of your own, provided you are sure of the worst-case delay you will need to provide for your disc. Also, you may find that cutting pin 12 of IC86 in the BBC computer and linking it instead to IC85 pin 3 might improve the situation, although it is not a complete cure. This problem is often blamed on the BBC computer DFS chip by drive suppliers, and on the disc drives by Acorn.

## DUAL PROBLEM

Some dual-drive 800kB 40/80-track switchable units from one particular manufacturer may display a fault in 80-track mode only, where error 18 is displayed while trying to read a sector when the disc drive motor has been previously stopped. The fault report on the screen is preceded by a 'rr-rr-rr' sound from the disc as it attempts to find the correct track. This is caused by the stepper adapter board in the unit occasionally causing the

**CONTINUED OVER**

drive to step one track without the BBC computer being aware of it. The recovery procedures in the BBC cannot always recover from this fault, and this is when we get the crash. The data on the disc is still valid, and can be read by doing a '\*CAT' (which forces the 8271 floppy disc controller) to reposition itself over track 0). This was apparently caused by an early-revision stepper adapter board being shipped in error and can be fixed by the manufacturer.

The BBC computer (DFS 0.90) occasionally locks up when using the floppy disc drive, and the only exit is by using the 'BREAK' key. The 8271 floppy disc controller (FDC) will turn the selected drive off three seconds after the last time the disc was accessed. If a new disc command is issued by the FDC simultaneously with this event then the 8271 will lock up with SELECT (pin 2) asserted and LOAD (pin 38) deasserted. The timing window for the crash is quite narrow, but the following program can bring up the fault (use a freshly-formatted disc).

```
F% = OPENOUT("TEST")
PRINT # F%, I% : PTR # F% = 256:PRINT # F%, I%
CLOSE # F%
REM THE ABOVE SETS UP A FILE TO USE!
```

```
50K% = 11000
120F% = OPENIN("TEST")
200PTR # F% = 0:INPUT # F%, J%:PTR # F% = 256:INPUT # F%, J%
300FOR I% = 0 TO K%:NEXT I%
400GOTO 200
```

RUN

... stop the program, with the 'BREAK' key, then type 'OLD' to bring the program back to change line 50.

Attach an oscilloscope to pin 38 of the 8271 FDC. Start with a freshly-formatted disc, and adjust line 50 from a large value downwards until pin 38 is low for (ONLY JUST!) about 100 microseconds. The crash will soon occur, and the attached

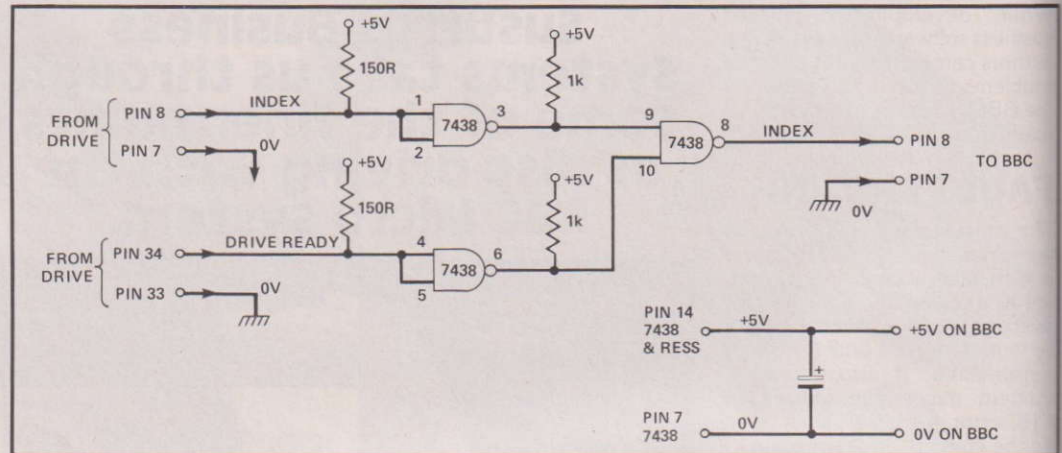


Figure 2 shows the timings involved. If you do not have an oscilloscope it is possible to adjust the delay in line 50 by observing the lamp on the front of the disc drive — adjust the delay in large steps until the lamp only just blinks off before the drive starts up, then adjust the delay down by one until the crash occurs; when you hit the right value the crash should occur within 10 pro-

```
&100:A%=&7F:X%<0:
X%!=CO%:X%!=&OCOD
3505:X%!=F80A:X%USR
(&FFF1)
```

... and the original mode of operation can be restored by...

```
30X%<B0%:Y%<B0%:DIV
&100:A%=&7F:X%?10=&E8:X%<USR(&FFF1)
```

another file. If you start with a freshly-formatted disc and carry out the following this can be readily seen. . . .

NEW

100 REM Put in about 160 characters (40 lines on the screen) in this line . . . . .

... . . . . .

```
SAVE "T1"
F% = OPENOUT("T2")
CLOSE # F%
```

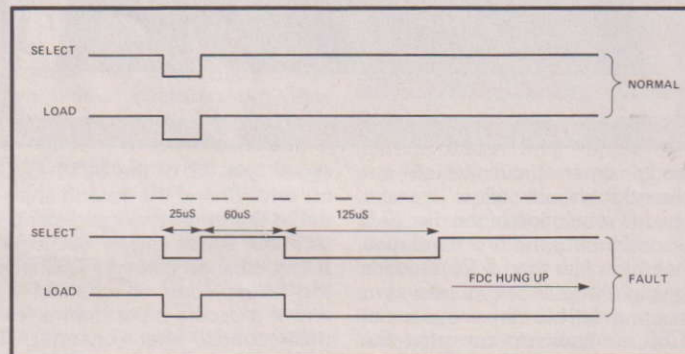
200 REM Put in another 160 characters here . . . . .

... . . . . .

```
SAVE "T1"
* COMPACT
SAVE "T3"
LOAD "T1"
```

... you can see more of what is happening by doing a '\*INFO \*' at each step. The result of the final statement is usually a bad program. To avoid the problem do not create zero-length files; or if you do, delete them immediately; or if you don't delete them, don't '\*COMPACT' the disc; or if you do '\*COMPACT' the disc, delete the zero length file and all fields it has corrupted. This is rather a sneaky fault in that such files can lie round on your disc for a long time before being detected, setting you up for the crash of a lifetime!

There are one or two other problems with the use of discs on the BBC computer, but these are minor compared with the above.



gram loops. This fault usually occurs when using the disc and the printer at the same time, since the printer can slow disc accesses down to one every three seconds. The simplest cure is to re-program the 8271 so that it never turns the drive off while the print operation is in progress. The following seems to work for a system which has the disc-timing links on the keyboard PCB removed (standard configuration) on OS1.2, 1982 BASIC. . .

```
10DIM B0% 20, CO% 20
20X%<B0%:Y%<B0%:DIV
```

If a file has a length of zero bytes (as can happen if a file is opened by an 'OPENOUT', then closed without 'PRINT'-ing anything to the file) in DFS 0.90, then a '\*COMPACT' will compact files that have a length greater than zero, but leave zero-length files alone. As a result, a zero-length file can end up in the middle of another file, which does not cause an immediate problem, but can be a problem if more data is saved on the disc. In this case the data can be written from the 'end' of the zero-length file, which is the middle of



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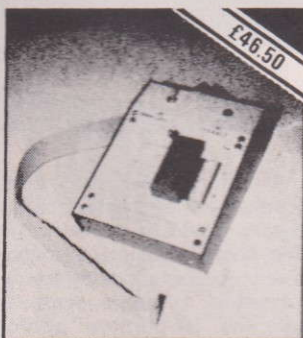


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# Sweet Talker

Mark Webb

The new Cheetah speech synthesis system for the BBC Micro is a unique product for this particular computer. Unlike the other "installed" speech synthesis system, that of Acorn itself, it is based upon the use of allophones. It is a tried and tested technique involving the use of a dictionary of sounds found in human speech, coded numerically for the sake of the number-crunching computer.

Sounds and pauses are grouped together as DATA and sent serially to the single chip for processing. There are a variety of sounds and silences with varying duration and it is an educational exercise sorting them all out.

## TIDIER

There are other such systems available for the BBC but they are "plug-in" devices involving a black box/speaker housing and ribbon cable. Individual owners can argue the merits and demerits of having speech synthesis permanently installed beneath the lid but I personally prefer this tidier option. It leaves an I/O port free and makes use of the internal speaker — no black boxes to cart around. However, some would say, a better quality speaker would not be a bad thing. The Cheetah system leaves you free to install such a speaker rather than imposing a similarly tinny one.

As with all such products, the manufacturers make installation sound easier than it really is. On an issue 3 BBC, an early type of socket would not hold the pins of the Sweet Talker board firmly in place. It wobbled about and no good connection could be made. On latest issue 7 boards, there is a particularly rigid connector to the keyboard which makes it a tight squeeze for the matchbox-sized Sweet Talker. Another issue 7 board I tried it on proved hardly any problem. It is difficult to give advice on installation because of the differences between individual BBCs but it is a shame that Cheetah have shied away from the problem in their documentation.

There is also a slight soft-

## Lend an ear as Sweet Talker gives your BBC a voice.



Compact solution

ware anomaly with issue 3 and earlier which Cheetah have taken into account in their demonstration programs, on tape and in the general instructions. The demo program "Beebtalk" gives a fair idea of what can be achieved and when studied in conjunction with the supplied allophone set, forms the basis for your fortune programming.

## STRINGING SOUNDS TOGETHER

It is very straightforward and great fun stringing together combinations of sound to form words and sentences. There is no point pretending it sounds anything like human speech — if anyone does sound like this they ought to report to the nearest doctor's surgery — but it adds another dimension to any program you might be writing.

Writing the software piecemeal for every new or old program would of course prove rather onerous. Since computers are very good at accessing tabular information it makes sense to create an all-purpose speech routine. The allophone set is essentially a table of sounds and number equivalents. The Cheetah list gives a letter of the alphabet, the various sounds associated with it, the numerical data required by the chip and some words with examples of the sound which will result.

The all-purpose routine is the solution Cheetah supply themselves in the example tape and the procedure which does all the work can easily be \*SPOOLED as an ASCII file and tagged on to the end of any existing program with \*EXEC. Each item of text which then requires speech output can be sent to the PROC as a string argument.

Each word is analysed and the allophone equivalent looked up. The allophone equivalent for "Cheetah", for instance, is 50, 19, 13, 15, 15, 0. The final zero is a 10ms silence. The allophone number is placed into the location &FE41 and a delay instituted so that us humans can hear the result. Poking direct into location &FE41 with the ? indirection operator is the easiest way to achieve the above but Cheetah have sensibly set the whole routine in a simple bit of assembler. This example should be followed so that programs will automatically adapt to second processors.

## SOFT WHERE?

Try making an adventure sound scathing as it comes back "I do not understand *that word*". Text only games can come alive. There is a limited amount of room for speech amongst the zap, pow, bang of arcade games but a fanfare followed by a run-down of the top ten high scores makes a dull screen an exciting event. At the moment you will have to write all these games yourself because there isn't much software support for any of the available speech synthesis systems including Sweet Talker.

The haphazard way in which games often get into software houses' catalogues means that any off-beat computer systems are simply not catered for. I would like to see Cheetah commissioning a really ace game or three just to get the ball rolling. We will have to wait and see. Perhaps it is in the hands of A&B Computing programmers to come up with the goods.

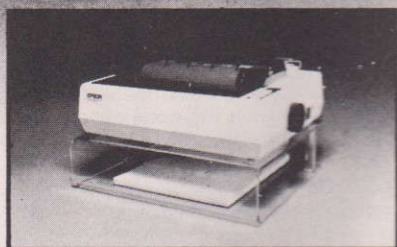
Cheetah's Sweet Talker speech synthesis is good value, employing an easy to use and infinitely flexible means of programming speech and a compact solution to installing the hardware. Sweet Talker comes with fair documentation on paper and tape although there should be more advice on installation. Programmers can get down to work. Those who like to buy in their software may have to wait a while to take full advantage of the Cheetah in their chip.

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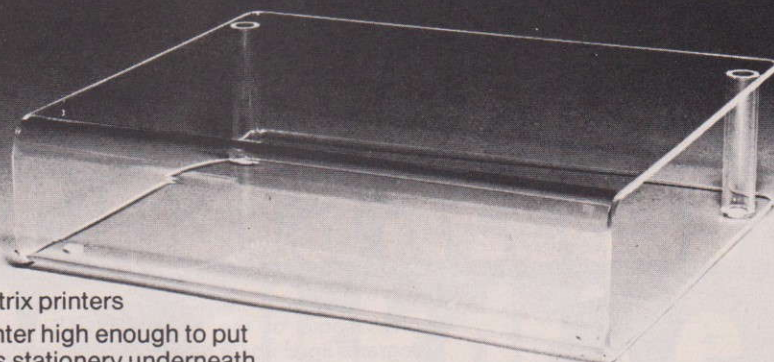


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# Competition

## competition

This month's competition involves some of the great new programs lined up for the BBC by Mirrorsoft, plus a few established favourites.

### HOW TO WIN

All you have to do is answer two simple questions. Mirrorsoft's first "Home Discovery" program for the BBC is Star Seeker, produced in conjunction with the London Planetarium and Dr Paul Phillips FRAS in particular.

Included amongst the program's features is the ability to plot the course of Halley's Comet as it approaches the earth. We wish to know, firstly, what does FRAS stand for? and secondly, what is the name of the European space agency project to intercept Halley's Comet called? Just jot down your answers and send

them to A&B at our Golden Square address, marking the envelope "Mirrorsoft" competition.

A dozen lucky winners will receive copies of Mirrorsoft programs. We are giving away copies of Hi-Bouncer, Star Seeker itself, Quick Thinking, Caesar the Cat, Look Sharp, First Steps with the Mister Men and Count with Oliver.

### LOOK OUT

Look out for other titles in the "Home Discovery" series, coming out in the autumn including programs to test your personality, your IQ and the diet you're on! Plus the official BBC Mastermind.

The winners of the competition will be the first dozen correct answers out of the hat.

The winners will be notified once the competition has closed and the results will be published in a future issue of A&B Computing. The competition is open to all UK and Northern Ireland readers of A&B except employees of Argus Specialist Publications Ltd., their printers and distributors, employees of the Mirror Group or anyone connected with the competition.

All entries must be postmarked before 31st September 1984. No correspondence will be entered into with reference to the results and it is a condition of entry that the editor's decision is accepted as final.

### WINNERS

Winners of our Postern competition in the May/June issue, with some impressively high word totals from the combination "I am a Postern person", were: B. Rayner, 19 Grebe Close, St. Ives, Cambridgeshire; Ralph C. Taylor, Bwlch Glas, Penrhyndeudraeth, Gwynedd LL48 6RU; Andrew Cooper, 16 Bottesford Lane, Scunthorpe, South Humberside; Hilary Jones, 1 Belle Vue Road, Gateacre, Liverpool L25 2QD; Jonathan Parrish, "Sunville", 8 Lynn Road, Ingoldisthorpe, Kings Lynn, Norfolk; T.J. Noyes, 36 York W Avenue, Droitwich Spa, Worcestershire; Mrs. R.M. Cameron, 62 Errington Road, Hebden Bridge, West Yorkshire; P.R. Obson, The Coach House, Barnaby Mead, Gillingham, Dorset; Mr. M.B. Perrins, 18 Wolsey Road, Lichfield, Staffordshire; Andrew Rowlands, 431 Normanby Road, M. Normanby, Middlesbrough, Cleveland; Mrs. J. A. Huchins, "Acorns", 147 Haven Road, Haverfordwest, Pembrokeshire; Rebecca Devon, Heleigh House, Middlehill, Box, Corsham, Wiltshire; Keith Renouard, Arc-en-Ciel, Boulivot, Grouville, Jersey, Channel Islands; S. Gibson, 154 Knights Croft, New Ash Green, Dartford, Kent; Peter Ellison, Highfield Farm, The Row, Hunmanby, Nr. Filey, Yorkshire. Many thanks for the efforts of all the entrants.



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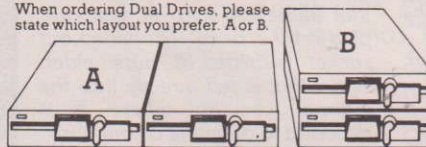
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# Questions Answers

Bruce Smith

**Q:** A reader with an unreadable name and no address asks "I have heard the term Sprite used often when people have been talking about home micros. Could you tell me exactly what this is and if the BBC Micro has it/them?"

**A:** Well I think the best way to describe a Sprite would be it is sort of a user definable character that acts rather like a ghost. The character itself can normally be multisized and any colour or combinations of colours. Depending on the priority of the Sprite it can be moved over background objects or behind them or other Sprites.

Sprites can certainly be programmed on the Beeb making extensive use of the GCOL command. However this can be time consuming and for anybody really interested I would strongly recommend one of the Sprite generator programs around. I know of four such packages, these are available as follows,

Sprite-Gen, DACC, 23 Waverley Road, Hindley, Wigan WN2 3BN. Price £17.95

Sprite Master, Soft Machine, 3 Station Crescent, Westcombe Park, Blackheath SE3. Price £9.95

Sprites Version 2, Simonsoft, 25 Tatham Road, Abingdon, Oxon OX14 1QB. Price £12.95

Sprite Utilities, Beebugsoft, PO Box 109, High Wycombe, Bucks HP11 2TD. Price £10/£12 disc

My own preference would be for the Beebugsoft version, though each has much to offer. Alternatively Computer Concepts Graphics ROM has a good implementation of Sprites.

**Q:** Mr. Benchley From Esher is a new reader and was amazed to find out that what he thought was the first issue was in fact the third! "How do I get the relevant back copies to complete my collection?" he asks.

**A:** Unfortunately all back issues of A&B Computing have now sold out. Looking to the future there is at least the consolation that A&B will be with you twice as often as was previously the case.

## A&B is here but to serve. Any enquiries, suggestions or "funnies" are warmly welcomed at our Golden Square address.

**Q:** Even after England's famous 2-0 win in Rio a letter arrives from Mr and Mrs Banks of Brazil. The Banks' bought their Beeb during a visit to England recently. However due to television differences they are unable to get the UHF TV output to produce a picture on the VHF TVs in Brazil. Mr Banks asks "I wonder if you could offer some comment on the type of monitor we should purchase".

**A:** Certainly a monitor should work okay with your beeb. Offering advice on the type you should get is difficult because I really do not know what is available in Brazil. However a few general comments might help. Basically there are two types of monitor that utilise the two monitor outputs on the Beeb. The video out socket provides a pure video signal that is fed directly into the internal circuitry where it is decoded to drive the colour guns. The other output is the RGB (Red, Green, Blue) output, this feeds the colour guns directly

without altering or mixing the signal in any way, so from a picture point of view RGB produces the best result.

The other differences between monitors are generally that they may be high resolution or medium resolution. The former would really only be required if you intend programming a lot of graphics or using your Beeb in 80 column mode. Hopefully these two points will help you make a good selection.

**Q:** Mr Smith (no relation) of Stockport writes "I have a BBC B. Could you tell me how I can use a database program to create data files, store them, load and edit a file and transfer it to a holding file, load a second file to edit and transfer to the same holding file and then save the lot to tape. Also what is the easiest way of increasing the memory of my Beeb."

**A:** The best way of implementing all the above would be to purchase a silicon disc. This term

refers to a page RAM extension which allows all the various filing system commands to be used in addition to providing much more memory. A good investment, though not cheap at £139.95, would be the 128K Sideways RAM Board from Solidisk Technology. This system is also available in 16K and 32K versions though you would probably need the 128K version. The bigger version also comes with full software and full details can be obtained from Solidisk at 17 Swayne Avenue, Southend-On-Sea, Essex SS2 5JJ.

**Q:** A. Patel of Aston Under Lyne has some parent trouble, he writes, "Having bought a BBC B I have had many hours of pleasure playing games on it. My only dismay was that I was unable to play games etc at night because the various zaps, bangs and pings would wake my parents. Could you please tell me if it is at all possible for me to somehow turn down the volume at which the internal speaker operates?"

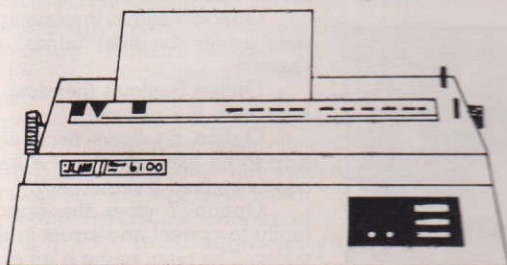
**A:** Yes it is really quite a simple procedure. Firstly with your Beeb switched off and unplugged from the mains remove the top half of the casing by removing the four screws (two at the back and two underneath). Next you need to remove the keyboard which should be held in place by three nuts and bolts, two to the left and one on the right. With these bolts fully removed pull the keyboard towards you as far as it will go. Follow the two wires from the speaker to where they plug onto the board. Just above and to the left of this you should see a small rectangular box (coloured blue on my Beeb) sitting to the left of two disc shaped capacitors and immediately below the R24 resistor. In the far side of this box is a small white coloured 'wheel' with a slot in it. Inset a small screwdriver into this and rotate it half a turn towards the speaker. Re-assemble your Beeb and switch on. Typing VDU 7 should now provide a very muted bleep. Turning the preset further left will decrease the volume more while moving it the other way will increase the volume.



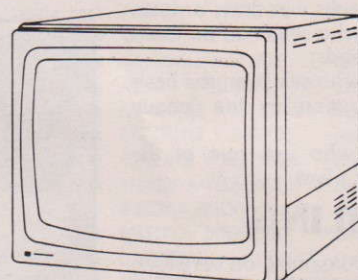
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# Pools Prediction

S Hetherington

**Any BBC owners who fancy a scientific approach to winning the pools should be able to put this program for the punter to profitable use.**



Every week thousands of hopeful punters fill in their football pools hoping by their efforts to gain some of the money contributed by less fortunate punters. Their methods fall into one of seven types:

- 1) Those who enter the same line of numbers each week.
- 2) Those who select a random series of numbers each week.
- 4) Those who select on the basis of team results win draw or lose.
- 5) Those who select on the basis of team trends.
- 6) Those who select on the basis of the position in the league tables.
- 7) Those who use one of the newspaper plans.

## GAMBLING

The first two gamble on very long odds and, while they either won't win at all or may only get one win in a lifetime, any win is likely to be a large one. The remainder, by reducing the odds by using past results in one way or another are far more likely to win but are less likely to gain one of those super dividends. This is particularly true of the last group, simply because of the number of identical coupons sent in. Unless one has a belief in some mystical number system, any computer program must use one or all of the methods 2 to 6.

A reader recently wrote in and asked for such a program, and so this one is offered. It does not purport to be anything new nor does it guarantee that using it will ensure a win, but it does take into account all the factors in methods 2 to 6 and so should reduce the odds. On the other hand since it will obviously tend to select the favourites as it were, then any wins are bound to be small. The writer has this season won one second, two third, two fourth, one fifth, and two sixth dividends. They were small and have only just covered the outlay. On the other hand, an identical entry using method 1 has not won a penny.

## MENU OPTIONS

To use the program, it is first necessary to enter the teams and results to date into memory using

option 1. These can be copied from the newspaper. As each team is entered the operator is asked to forecast whether the team is likely to win, lose or draw. This initiates the trend calculations. One method is to assume that the top third of the teams in each table would win, the next third draw and the others lose.

Note: The variables high% and low% are provided to allow the number of the top and bottom teams to be altered for program testing. To avoid wasted work during the testing of the

program, alter the value of high% in line 140 to about 10. This means that you only need to enter ten teams initially to test your program. Alter it back to 130 before you attempt to fill in all the 5 league tables.

Option 2 allows you to update the tables each week by filling in the team results. It is only necessary to enter sufficient of the team name to identify it. PRO-Cteamseek sorts out the full team name. Teams with similar starting letters such as Clyde and Clydesdale present a problem. I have overcome this by putting an

identifying code before the shorter name i.e. "X Clyde", but there are many other ways.

Option 3 is the forecasting part of the program. By entering the home and away teams, again using abbreviated names, the operator is presented with a series of forecasts based on the different methods of forecasting and makes his own decision based on these forecasts.

Option 4 allows the saving of data under the title "tables" on cassette.

Option 5 allows the recall of data from the cassette.

Option 6 allows each division to be examined and a hard copy obtained if required.

Option 7 gives the opportunity to correct any errors in the tables. The team name is entered and then the full correct details are entered.

Option 8 is included so that the operator is asked if he has saved the data before it allows him to leave the program.

## PRINTER

The program is configured for an Epson printer. The print option is a convenience for those who have a printer but the program can be used without and still be quite effective. When using the forecast option, the printer produces a list of the matches with the forecast result and states whether this result is certain or only possible. A useful modification to this part of the program would be to differentiate between those which seem absolutely certain and those which are a little less sure. The writer uses an eight from twelve permutation and sometimes the forecast will give more than twelve "certain" draws and it is necessary to make a choice.

The program itself needs little explanation except perhaps for the calculation of the trends. This uses a statistical method which smooths the graphical analysis and was supplied to the author by a more mathematically minded friend. Line 80 sends line feeds to the printer and may be omitted if the printer is configured to line feed on carriage return. Line 90 disables the escape key and transfers this function to the

safer "Control-@". Line 100 protects against accidental pressing of the "Break" key.

There is no doubt that for the purist there are many improvements that can be made.

Mode 7 has been used throughout and, while the program can be equally effective on a black and white screen the use of colour does make for a clearer and more satisfying display.

## VARIABLES

NAME	DESCRIPTION
awaygoal%()	Away goals for & against as a 4 fig. number
awaymatch%	Temporary storage of match result
awayres%()	Away results as a 6 fig. number
choice%	Menu selection number
coll%	collated result as a 6 fig. number
date\$	Date of last data entry
draw%	No. of matches drawn (not integrated)
ed%	Lowest line to be deleted in PROCwipe
en%	indicates data loaded if en% = 1
foraway%()	Away team trend
forehome%()	Home team trend
forx%	Trend before new entry
gola%	4 fig. number for goals before allocating to homegoal% or awaygoal%
high%	Normally = 130 but may be altered for program testing
homematch%	Temporary storage of home results
homeres%()	Home results as a 6 fig. number
leagueb%	number of team bottom of selected league
leaguet%	number of team top of selected league
lost%	No. of matches lost (Not integrated)
low%	lowest team number = 1, unless altered to aid program testing
name\$()	Array of full team names
pointer%()	Team points
position%()	A number based on team points and goal average
printop%	Equals 1 if hard copy option selected
px	...
qx	...
Q1	Home team points gained
Q2	Away team points gained
st%	Highest line to be deleted in PROCwipe
sx	...
tem%	Temporary team number
test%	Set to one when team name = ""
tl	...
truaway%()	Temporary away results during trend calculation
truhome%()	Temporary home results during trend calculation
trux%	temporary away trend
tx	...
won%	Matches won (Not integrated)
Y%	response from PROCYESORNO. 1 = Yes. 0 = No

\*\*\* These figures used for trend analysis.

## PROCEDURES

NAME	LINE	DESCRIPTION
check	1020	requests confirmation of entered details
choice	750	requests number selection
collate	850	condenses results into single number, e.g. 10302 (1 win, 3 draws, 2 lost)
date	4070	allows date to be entered or altered
decol	880	decodes results (opposite to PROCcollate)
degol	940	decodes goals (opposite to PROCgolate)

BIRMINGHAM v NOTTS.FIRST	possible Draw	PLYMOUTH v EXETER	possible Home
COVENTRY v MAN.UNITED	certain Draw	PRESTON v PORT VALE	certain Home
EVERTON v SUNDERLAND	certain Draw	SHEFF. UTD v ROTHERHAM	certain Home
IPSWICH v WOLVES	certain Home	WIGAN v BOLTON	certain Draw
LEICESTER v QPR	certain Away	ALDERSHOT v READING	certain Draw
NOTTS.CO'TY v LUTON	possible Away	BRISTOL CITY v STOCKPORT	certain Home
STOKE v NORWICH	possible Away	BURY v ROCHDALE	certain Home
TOTTENHAM v ARSENAL	possible Home	DONCASTER v NORTHAMPTON	possible Home
WATFORD v ASTON VILLA	possible Draw	HALIFAX v YORK	certain Away
WEST BROM. v LIVERPOOL	certain Away	HARTLEPOOL v DARLINGTON	certain Draw
WEST HAM v SOUTHAMPTON	certain Home	HEREFORD v CREWE	possible Home
BARNLEY v CAMBRIDGE	certain Home	MANSFIELD v CHESTERF.LD	possible Draw
CARDIFF v SWANSEA	certain Home	PETERBORO v COLCHESTER	possible Draw
CRYSTAL PAL v BRIGHTON	possible Home	TORQUAY v SWINDON	certain Draw
FULHAM v DERBY	possible Home	TRANMERE v BLACKPOOL	possible Draw
GRIMSBY v SHEFF.WED	certain Draw	WREXHAM v X CHESTER	possible Draw
LEEDS v HUDD'FIELD	possible Draw	MOTHERWELL v HEARTS	certain Away
MAN.CITY v OLDHAM	certain Home	ALLOA v HAMILTON	certain Draw
MIDDLESB'GH v CARLISLE	certain Draw	AYR UNITED v CLYDEBANK	possible Home
NEWCASTLE v BLACKBURN	certain Home	AYR UNITED v X CLYDE	possible Draw
SHREWSBURY v CHELSEA	certain Draw	CLYDEBANK v RAITH ROV	possible Home
BOURNEMOUTH v NEWPORT	possible Draw	FALKIRK v KILMARNOCK	possible Home
BURNLEY v BRADFORD	certain Home	MORTON v BRECHIN	certain Draw
GILLINGHAM v SOUTHEND	certain Home	PARTICK v DUMBARTON	certain Draw
HULL v SCUNTHORPE	certain Home	COWDENBEATH v STENHOUSE	possible Draw
LINCOLN v WALSALL	possible Home	DUNFERMLIN v STIRLING A	possible Draw
MILLWALL v ORIENT	possible Home	EAST FIFE v QUEENS PK	possible Home
OXFORD v BRISTOL ROV	possible Home	EAST STIRL' v ALBION ROV	certain Draw

### Typical Forecast

display	2080	display full division tables
DIV	2270	offers menu of divisions for selection
divis	400	sort division from team number & sets top & bottom
end	2900	check before exit from program
filetab	1490	saves data on tape
forecst	2370	presents forecasts and offers printed selection
golate	910	condenses goals for & against into single number
insort	3900	sorts league using position found in PROCposition
menu	280	offers primary selection
notab	2050	prints warning if no tables in memory
position	3670	generates a number based on points & goal average
print	3330	prints forecasts as hard copy
printop	3230	offers choice of hard copy of forecast
recall	1750	recall data form tape
result	790	allow entry of individual team results
score	1210	allows entry of match results
show	1070	displays entered details for checking
space	2010	tests for space bar pressed
sort	3450	sorts league tables using number from PROCposition
summary	2850	print trend scale
tabin	3510	show that tables are loaded
tables	490	allow entry of division tables
teamdiv	4010	selects division from team number
teamseek	2970	finds team from shortened entry
TITLE	3120	prints title at top of display
twin	3460	detects entry of same team for and against
wipe	970	screen clear selected lines
YESORNO	3180	converts "Y" & "y" to 1 and "N" & "n" to 0

CONTINUED OVER

DIVISION 1	W	D	L	F	A	W	D	L	F	A	PT
LIVERPOOL	60	10	1	15	03	40	30	1	11	06	33
MAN.UNITED	60	00	3	18	07	30	30	1	10	10	30
WEST HAM	50	20	1	18	08	40	10	3	8	05	30
TOTTENHAM	30	20	2	10	10	50	20	2	18	13	28
COVENTRY	30	20	2	8	07	50	20	2	16	13	27
NOTTS.F' RST	60	20	1	20	10	20	10	4	8	12	26
LUTON	40	20	2	19	13	40	00	4	8	12	26
ASTON VILLA	70	10	1	15	11	10	20	4	9	14	26
SOUTHAMPTON	60	10	1	12	05	20	20	4	6	08	26
QPR	50	10	2	11	05	30	10	4	14	10	25
NORWICH	50	10	3	16	12	20	40	2	9	09	25
IPSWICH	40	20	2	16	08	20	20	4	11	12	22
WEST BROM.	40	10	2	9	06	30	10	5	11	17	22
SUNDERLAND	30	30	3	11	10	30	10	3	6	10	22
ARSENAL	40	00	5	14	12	30	00	4	12	10	21
EVERTON	30	20	3	4	05	30	10	4	6	12	20
BIRMINGHAM	40	00	3	7	05	10	30	5	7	14	18
NOTTS.CO'TY	50	20	3	9	12	20	00	7	9	15	14
WATFORD	10	30	4	14	17	20	10	5	11	13	12
LEICESTER	30	20	3	10	14	2	07	10	20	12	12
SOLVES	20	20	3	9	12	4	05	7	17	12	12
WOLVES	4	05	6	20	10	00	6	5	20	7	7

DIVISION 2	W	D	L	F	A	W	D	L	F	A	PT
SHEFF.WED	70	20	0	19	07	40	30	1	11	06	38
CHELSEA	50	20	1	18	06	40	50	1	17	12	34
MAN.CITY	60	20	0	20	06	50	00	4	11	13	34
NEWCASTLE	70	00	1	22	08	30	20	4	13	17	32
HUDD'FIELD	60	20	1	13	05	20	40	2	12	10	29
GRIMSBY	50	30	0	16	05	20	30	4	8	15	27
BLACKBURN	30	60	0	17	10	40	00	4	7	15	27
CHARLTON	70	30	0	16	06	4	04	7	17	27	27
CARLISLE	40	40	1	6	01	20	30	3	9	10	24
BARNLEY	40	20	2	15	11	30	00	6	13	14	23
MIDDLESB'GH	40	20	2	15	10	20	20	5	6	09	22
SHREWSBURY	40	30	1	14	08	10	40	4	7	15	22
CRYSTAL PAL	40	10	3	7	07	20	30	4	12	14	22
BRIGHTON	40	20	3	19	11	20	10	5	12	22	20
PORTSMOUTH	40	00	4	19	10	20	20	5	9	12	20
LEEDS	40	20	2	12	09	10	30	5	9	17	20
CARDIFF	50	10	2	15	08	10	00	8	4	14	19
OLDHAM	40	20	3	10	12	10	20	5	9	17	18
DERBY	30	30	3	12	15	20	10	5	4	16	18
FULHAM	30	10	4	13	13	4	05	5	14	14	14
CAMBRIDGE	20	30	4	11	15	1	07	4	20	10	10
SWANSEA	20	20	6	6	12	1	06	6	16	8	8

Option 6 Print Out

## PROGRAM LISTING

```

10REM*****
20REM*
30REM* POOLS PREDICTOR
40REM*
50REM* S.Hetherington 1983
60REM*****
70MODE7:en%=0:date$="000000"
80*FX6,0
90*FX220,0
100*KEY100.:M
110DIMname$(130),homeres%(130),homegoal%(130)
120 DIMawayres%(130),awaygoal%(130),pointot%(130),pos
tion(130)
130DIMforhome%(130),foraway%(130),truhome%(130),truaw
ay%(130)
140px=0.2:qx=1-px:tx=0.08:sx=1-tx:t1=((2/px)-1)/2)+1
:low%=1:high%=130
150PROCmenu
160PROCchoice
170 IFchoice%>48 AND choice%<57 THEN190
180GOTO160
190 ON choice%-48 GOTO 200,210,220,230,240,250,260,27
0
200PROCtables:GOTO150
210PROCscore:GOTO150
220PROCforcast:GOTO150
230PROCfiletab:GOTO150
240PROCrecall:GOTO150

```

```

250PROCdisplay:GOTO150
260PROCcorrect:GOTO150
270PROCend
280DEFPROCmenu
290CLS:PROCTITLE("POOLS FORECASTER")
300 PRINT:PRINTTAB(0,4)"1) Enter league tables"
310 PRINT:PRINTTAB(0,6)"2) Enter match results"
320 PRINT:PRINTTAB(0,8)"3) Forecast Results"
330 PRINT:PRINTTAB(0,10)"4) File league tables on tap
e"
340 PRINT:PRINTTAB(0,12)"5) Recall league tables from
tape"
350 PRINT:PRINTTAB(0,14)"6) Display league tables"
360PRINT:PRINTTAB(0,16)"7) Correct entry"
370 PRINT:PRINTTAB(0,18)"8) EXIT FROM PROGRAMME"
380IF en%=1 THEN PRINTTAB(0,20)"League tables loaded.
"
390ENDPROC
400DEFPROCdivis
410IFtem%<23 THEN div$="DIVISION 1":leaguet%=1:league
b%=22:ENDPROC
420IFtem%<45 THEN div$="DIVISION 2":leaguet%=23:leagu
eb%=44:ENDPROC
430IFtem%<69 THEN div$="DIVISION 3":leaguet%=45:leagu
eb%=68:ENDPROC
440IFtem%<93 THEN div$="DIVISION 4":leaguet%=69:leagu
eb%=92:ENDPROC
450IFtem%<103 THEN div$="SCOTS PREM":leaguet%=93:leag
ueb%=102:ENDPROC
460IFtem%<117 THEN div$="SCOTS DIV 1":leaguet%=103:le
agueb%=116:ENDPROC
470IFtem%<131 THEN div$="SCOTS DIV 2":leaguet%=117:le
agueb%=130:ENDPROC
480ENDPROC
490DEFPROCtables
500IFen%=1THEN ENDPROC
510 tem%=low%
520REPEAT:CLS:PROCdivis
530E$=div$+" Teams "+STR$(leaguet%)+ " to "+STR$(leagu
eb%)
540PRINTtem%
550PROCTITLE(E$)
560PRINTTAB(0,6)"Team "tem%
570INPUTTAB(0,9)"(Max 11 letters)"name$(tem%):IF LEN(
name$(tem%))<1 OR LEN(name$(tem%))>11 THEN550
580PRINTTAB(0,11)CHR$(134)"Home results ":PROCresult:
homeres%(tem%)=coll%:homegoal%(tem%)=gola%
590PROCwipe(9,17)
600PRINTTAB(0,11)CHR$(133)"Away results ":PROCresult:
awayres%(tem%)=coll%:awaygoal%(tem%)=gola%
610INPUTTAB(0,17)"Total points?",pointot%(tem%)
620PROCshow
630IFY%=1THEN660
640IFY%=0THEN PROCwipe(9,17):GOTO530
650GOTO620
660tem%=tem%+1
670 UNTIL tem%=high%:en=1
680CLS:PRINTTAB(0,3)"Forecasts for exponential smooth
ing"
690PRINTTAB(0,5)"Enter home & away forecasts"
700 PRINTTAB(0,8)"0= Sure to lose: 1= Draw: 2= Sure t
o win"
710PRINTTAB(3,10)"TEAM "CHR$(134)"HOME
"CHR$(133)"AWAY"
720 FOR I =low% TO high%:PROCwipe(11,12):PRINTTAB(0,
12);I:"name$(I):INPUTTAB(18,12),forhome%(I):INPUTTAB(
32,12),foraway%(I)
730NEXTI:en%=1:PROCsort
740ENDPROC
750DEFPROCchoice
760PRINTTAB(3,22)CHR$(136)CHR$(130)"Select by number"
770choice%=GET
780ENDPROC

```

```

790DEFPROCresult
800 INPUT "Matches won",won%:INPUT "Matches drawn",draw
%:INPUT "Matches lost",lost%
810PROCcollate
820 INPUT "Goals for",for%:INPUT "Goals against",agst%
830PROCgolate
840ENDPROC
850DEFPROCcollate
860coll%=lost%+draw%*100+won%*10000
870ENDPROC
880DEFPROCdecol
890won%=INT(coll%/10000):draw%=INT(coll%/100)-won%*10
0:lost%=coll%-draw%*100-won%*10000
900ENDPROC
910DEFPROCgolate
920gola%=for%*100+agst%
930ENDPROC
940DEFPROCdegol
950for%=INT(gola%/100):agst%=gola%-for%*100
960ENDPROC
970DEFPROCwipe(st%,ed%)
980FOR WI =st% TO ed%
990PRINTTAB(0,WI)SPC(39)
1000NEXT
1010ENDPROC
1020DEFPROCcheck
1030PRINTTAB(0,22)CHR$(136)CHR$(130)"Are the details c
orrect (Y or N)"
1040PROCYESORNO
1050PROCwipe(21,22)
1060ENDPROC
1070DEFPROCshow
1080PROCTITLE("CHECK")
1090 PRINTTAB(0,6)"Team "tem%
1100 PRINTTAB(0,10)name$(tem%)
1110PRINTTAB(20,10)CHR$(134)"HOME";TAB(30,10)CHR$(133)
"AWAY"
1120PRINTTAB(0,12)"Won ";TAB(0,13)"Drawn";TAB(0,14)"Lo
st ";TAB(0,15)"Goals for";TAB(0,16)"Goals against";TAB(
0,17)"Points"
1130coll%=homeres%(tem%):PROCdecol
1140 gola%=homegoal%(tem%):PROCdegol
1150 PRINT;TAB(22,12)won%;TAB(22,13)draw%;TAB(22,14)lo
st%;TAB(22,15)for%;TAB(22,16)agst%;TAB(26,17)pointot%(t
em%)
1160coll%=awayres%(tem%):PROCdecol
1170gola%=awaygoal%(tem%):PROCdegol
1180PRINT;TAB(32,12)won%;TAB(32,13)draw%;TAB(32,14)los
t%;TAB(32,15)for%;TAB(32,16)agst%
1190PROCcheck
1200ENDPROC
1210DEFPROCscore
1220PROCdate
1230CLS:PROCTITLE("Match Results")
1240IFen%<>1THENPROCnotab:ENDPROC
1250PROCteamseek
1260 IF test%=1 THEN PROCsort: ENDPROC
1270PRINT"Enter the scores"
1280 PRINT " ";name$(homest%);:INPUT,homegoal%:PRINT " ";
name$(awayt%);:INPUT,awaygoal%:PRINT
1290 PROCcheck:IF Y%=1 THEN 1320
1300IF Y%= 0 THEN PROCwipe(4,16): PRINT "Edit all matc
h details":GOTO1250
1310GOTO1290
1320homegoal%(homest%)=homegoal%(homest%)+homegoal%*100+
awaygoal%:awaygoal%(awayt%)=awaygoal%(awayt%)+awaygoal%
*100+homegoal%
1330IF homegoal%>awaygoal% THEN homematch%=10000:awaym
atch%=1:Q1=2:Q2=0:GOTO1360
1340IFawaygoal%>homegoal% THEN homematch%=1:awaymatch%
=10000:Q1=0:Q2=2:GOTO1360
1350homematch%=100:awaymatch%=100:Q1=1:Q2=1
1360 homeres%(homest%)=homeres%(homest%)+homematch%:away
res%(awayt%)=awayres%(awayt%)+awaymatch%:pointot%(homest

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%)=pointot%(homest%)+Q1:pointot%(awayt%)=pointot%(awayt%
)+Q2
1370forx%=forhome%(homest%):forhome%(homest%)=forx%*qx+Q
1*px
1380trux%=truhome%(homest%):truhome%(homest%)=tx%*(forhom
e%(homest%)-forx%)+(sx*trux%)
1390forhome%(homest%)=forhome%(homest%)+(t1*truhome%(hom
et%))
1400IF forhome%(homest%)>2 THEN forhome%(homest%)=2
1410IF forhome%(homest%)<0 THEN forhome%(homest%)=0
1420forx%=foraway%(awayt%):foraway%(awayt%)=forx%*qx+Q
2*px
1430trux%=truaway%(awayt%):truaway%(awayt%)=tx%*(forawa
y%(awayt%)-forx%)+(sx*trux%)
1440foraway%(awayt%)=foraway%(awayt%)+(t1*truaway%(awa
yt%))
1450IF foraway%(awayt%)>2 THEN foraway%(awayt%)=2
1460IF foraway%(awayt%)<0 THEN foraway%(awayt%)=0
1470PRINT"This result entered in league tables"
1480 TIME=0:REPEAT UNTIL TIME =200:GOTO1230
1490DEFPROCfiletab
1500PROCTITLE("Save Data")
1510IFen%<>1THENPROCnotab:ENDPROC
1520PRINTTAB(0,5)"Please load data tape"
1530 PRINTTAB(0,7)"Press SPACE BAR to rewind to star
t":PROCspace:*MOTOR1
1540PROCwipe(5,7):PRINTTAB(0,5)"Press space bar when r
ewound":PROCspace:*MOTOR0
1550PROCwipe(5,6):PRINTTAB(0,5)"Switch recorder to 'Re
cord':PRINT"Then press space bar":PROCspace
1560 PRINT""SAVING DATA. Please wait "
1570 X=OPENOUT("tables")
1580PRINT#X,date$
1590 FOR I =low% TO high%
1600PRINT#X,name$(I)
1610PRINT#X,homeres%(I)
1620PRINT#X,homegoal%(I)
1630PRINT#X,awayres%(I)
1640PRINT#X,awaygoal%(I)
1650 PRINT#X,pointot%(I)
1660PRINT#X,forhome%(I)
1670PRINT#X,foraway%(I)
1680PRINT#X,truhome%(I)
1690PRINT#X,truaway%(I)
1700PROCwipe(4,20)
1710PRINTTAB(0,9)"Teams filed "I:NEXT I
1720CLOSE#X:PROCwipe(4,20):PRINTTAB(0,9)"COMPLETE"
1730PRINTTAB(0,22)"Press space bar to continue"
1740PROCspace:ENDPROC
1750DEFPROCrecall
1760PROCTITLE("Collect Data")
1770IF en%=1 THEN PROCtabin:ENDPROC
1780en%=1
1790PRINTTAB(0,5)"Please load data tape"
1800PRINTTAB(0,7)"Press SPACE BAR to rewind to start":
PROCspace:*MOTOR1
1810PROCwipe(5,7):PRINTTAB(0,5)"Press space bar when r
ewound":PROCspace:*MOTOR0
1820PROCwipe(5,6):PRINTTAB(0,5)"Switch recorder to 'Pl
ay':PRINT"Then press space bar":PROCspace
1830PROCwipe(4,22):PRINTTAB(0,9)"COLLECTING DATA."TAB(
0,12)" Please wait a few minutes"
1840X=OPENIN("tables")
1850INPUT#X,date$
1860 FOR I =low% TO high%
1870INPUT#X,name$(I)
1880INPUT#X,homeres%(I)
1890INPUT#X,homegoal%(I)
1900INPUT#X,awayres%(I)
1910INPUT#X,awaygoal%(I)
1920 INPUT#X,pointot%(I)

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CONTINUED OVER

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1930 INPUT#X,forhome%(I)
1940 INPUT#X,foraway%(I)
1950 INPUT#X,truhome%(I)
1960 INPUT#X,truaway%(I)
1970 PRINTTAB(3,3)"Teams recalled ";I:NEXT I
1980 CLOSE#X
1990 PROCwipe(4,22):PRINTTAB(0,10)"All recalled":PRINT
TAB(3,22)"Press Space bar to continue":PROCspace
2000 ENDPROC
2010 DEFPROCspace
2020 IF INKEY$(0)>" " THEN 2020
2030 REPEAT UNTIL GET$=""
2040 ENDPROC
2050 DEFPROCnotab
2060 CLS:PRINTTAB(3,10)"NO TABLES IN MEMORY"TAB(3,12)"O
nly options available: 1 & 5"TAB(0,22)"PRESS SPACE BAR":
PROCspace
2070 ENDPROC
2080 DEFPROCdisplay
2090 IF fen%<>1 THEN PROCnotab:ENDPROC
2100 PROCdiv:PROCchoice:IF choice%>48 AND choice%<56 THEN
2120
2110 GOTO 2100
2120 PROCteamdiv:PROCdivis
2130 PROCprintop:CLS
2140 IF printop%=1 THEN VDU2
2150 PRINTCHR$(133)div$:TAB(13);"W D L F A W D L F A
PT"
2160 FOR tem%=leaguet% TO leagueb%
2170 PRINTname$(tem%);
2180 y$=STR$(homeres%(tem%)):PRINTTAB(18-LEN(y$));y$;
2190 y$=STR$(homegoal%(tem%)):PRINTTAB(23-LEN(y$));y$;
2200 y$=STR$(awayres%(tem%)):PRINTTAB(30-LEN(y$));y$;
2210 y$=STR$(awaygoal%(tem%)):PRINTTAB(35-LEN(y$));y$;
2220 PRINTTAB(37);pointot%(tem%)
2230 leaguet%=0:NEXTtem%
2240 VDU3
2250 PRINTTAB(0,23)CHR$(134)"PRESS SPACE BAR TO CONTINU
E":PROCspace
2260 ENDPROC
2270 DEFPROCdiv
2280 PROCTITLE("DIVISION SELECT")
2290 PRINT:PRINTTAB(0,6)"1) DIVISION 1"
2300 PRINT:PRINTTAB(0,8)"2) DIVISION 2"
2310 PRINT:PRINTTAB(0,10)"3) DIVISION 3"
2320 PRINT:PRINTTAB(0,12)"4) DIVISION 4"
2330 PRINT:PRINTTAB(0,14)"5) SCOTS PREM"
2340 PRINT:PRINTTAB(0,16)"6) SCOT DIV 1"
2350 PRINT:PRINTTAB(0,18)"7) SCOT DIV 2"
2360 ENDPROC
2370 DEFPROCforcast
2380 CLS:PROCTITLE("Results forecast")
2390 IF fen%<>1 THEN PROCnotab:ENDPROC
2400 PROCprintop
2410 REPEAT
2420 PROCteamseek
2430 IF test%=1 THEN ENDPROC
2440 CLS:PROCTITLE(name$(homest%)+" v "+name$(awayt%))
2450 PROCsummary
2460 coll%=homeres%(homest%):PROCdecol
2470 homewin%=won%:homelos%=lost%:homedraw%=draw%:homes
um%=won%+lost%+draw%:IF homesum%=0 THEN homesum%=1
2480 coll%=awayres%(awayt%):PROCdecol
2490 awaywin%=won%:awaylos%=lost%:awaydraw%=draw%:aways
um%=won%+lost%+draw%:IF awaysum%=0 THEN awaysum%=1
2500 probhome=((homewin%/homesum%)+(awaylos%/awaysum%))
/2
2510 PRINTTAB(16,10)CHR$(134)"(Home win ";INT(probhome
*100+.5)/100
2520 probdraw=((homedraw%/homesum%)+(awaydraw%/awaysum
%))/2
2530 PRINTTAB(16,12)CHR$(130)"(Draw ";INT(probdraw
*100+.5)/100
2540 probaway=((homelos%/homesum%)+(awaywin%/awaysum%))
/2
2550 PRINTTAB(0,11)CHR$(131)"Probabilities "CHR$(133)"
(Away win ";INT(probaway*100+.5)/100
2560 PRINT:goal%=homegoal%(homest%):PROCdegol:forone%=fo
r%:fortwo%=agst%:gola%=awaygoal%(awayt%):PROCdegol:fort
re%=for%:fourfour%=agst%
2570 PRINTCHR$(131)STRING$(39,"*")
2580 shome=((forone%/homesum%)+(fourfour%/awaysum%))/2:s
away=((fortwo%/homesum%)+(fortre%/awaysum%))/2
2590 PRINTTAB(0,14)CHR$(131)"Score chance"TAB(30-LEN(na
me$(homest%))CHR$(134)name$(homest%);" ";INT(shome*10+.5
)/10
2600 PRINTTAB(30-LEN(name$(awayt%)),15)CHR$(133)name$(a
wayt%);" ";INT(saway*10+.5)/10
2610 PRINTTAB(0,16)CHR$(131)STRING$(39,"*")
2620 PRINTTAB(0,17)CHR$(131)"Relative league position"
2630 IF homet%<awayt% THEN 2650
2640 PRINTTAB(5,18)CHR$(133)name$(awayt%);" ";homest%-aw
ayt%" Above "CHR$(134)name$(homest%):GOTO 2660
2650 PRINTTAB(5,18)CHR$(133)name$(homest%);" ";awayt%-ho
met%" Above "CHR$(133)name$(awayt%)
2660 PRINTTAB(0,19)CHR$(131)STRING$(39,"*")
2670 totototh%=INT((forhome%(homest%))*20+.5)-1
2680 IF totototh%>36 THEN totototh%=36
2690 IF totototh%<2 THEN totototh%=2
2700 tototota%=INT((2-foraway%(awayt%))*20+.5)-1
2710 IF tototota%>36 THEN tototota%=36
2720 IF tototota%<2 THEN tototota%=2
2730 PRINTTAB(totototh%,8)CHR$(134)"H"
2740 PRINTTAB(tototota%,8)CHR$(133)"A"
2750 average%=INT(((2-foraway%(awayt%))+forhome%(homest%
))/2)*20+.5)-1
2760 IF average%>36 THEN average%=36
2770 IF average%<2 THEN average%=2
2780 PRINTTAB(average%,8)""
2790 IF printop%=1 THEN PROCprint
2800 PROCwipe(21,23)
2810 PRINTTAB(0,22)CHR$(135)"Press space bar to continu
e"
2820 PROCspace:PROCwipe(4,16)
2830 UNTIL test%=1
2840 ENDPROC
2850 DEFPROCsummary
2860 PRINTTAB(0,6)CHR$(133)"AWAY "CHR$(130)"
DRAWN "CHR$(134)"HOME"
2870 PRINTTAB(0,7).....
....
2880 PRINTCHR$(131)STRING$(39,"*")
2890 ENDPROC
2900 DEFPROCend
2910 CLS:PRINTTAB(0,10)"ARE YOU SURE YOU WISH TO LEAVE
PROGRAMME (Have you saved the data)"
2920 PROCYESORNO
2930 IF YZ<>1 THEN 150
2940 CLS:PRINTTAB(0,10)"THANK YOU. GOOD BYE"
2950 *FX220,27
2960 END
2970 DEFPROCteamseek
2980 PRINTTAB(0,22)"To finish type' *':test%-0
2990 homest%=0:PRINTTAB(0,4)CHR$(134)"Home Team";:INPUTh
ome$:HL=LEN(home$)
3000 PROCwipe(5,6)
3010 IF home$="" THEN test%=1:ENDPROC
3020 awayt%=0:PRINTTAB(0,5)CHR$(133)"Away Team";:INPUTa
way$:AL=LEN(away$)
3030 IF home$=away$ THEN PROCtwinn:GOTO 2990
3040 homest%=0:awayt%=0
3050 FOR tem%=low% TO high%
3060 IF home$=LEFT$(name$(tem%),HL) THEN homest%=tem%
3070 IF away$=LEFT$(name$(tem%),AL) THEN awayt%=tem%

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3080 IF homet% > 0 AND awayt% > 0 THEN 3110
3090 NEXT tem%:PRINT "Team name error..re-enter"
3100 TIME=0:REPEAT UNTIL TIME =200:GOTO2980
3110 tem%=high%:NEXT:ENDPROC
3120 DEFPROC TITLE(E#)
3130 IF E# > "" THEN TITLE# = E#
3140 CLS:PRINTCHR$(129)STRING$(39,"*")
3150 PRINTTAB(20-LEN(TITLE#)/2,1)CHR$(130);TITLE#
3160 PRINTCHR$(132)STRING$(39,"*")
3170 ENDPROC
3180 DEFPROC YESORNO
3190 A=GET AND 223
3200 IF A=89 THEN Y%=1:ENDPROC
3210 IF A=78 THEN Y%=0:ENDPROC
3220 GOTO3190
3230 DEFPROC printop
3240 PROCwipe(5,22)
3250 PRINTTAB(0,10)"Do you want a print out (Y or N)"
3260 PROCYESORNO
3270 PROCwipe(10,10)
3280 IF Y%=1 THEN printop%=1:ENDPROC
3290 printop%=0:ENDPROC
3300 DEFPROC print
3310 PRINTTAB(0,21)"Enter 1 for home,2 for Away,3 for D
raw"
3320 PROCchoice
3330 IF choice%=49 THEN result$="Home":GOTO3370
3340 IF choice%=50 THEN result$="Away":GOTO3370
3350 IF choice%=51 THEN result$="Draw":GOTO3370
3360 GOTO3320
3370 PROCwipe(21,23)
3380 PRINTTAB(0,22)"Sure thing (Y or N)"
3390 PROCYESORNO
3400 IF Y%=1 THEN sure$="certain "
3410 IF Y%=0 THEN sure$="possible"
3420 VDU2
3430 PRINTname$(homet%);" v ";name$(awayt%)TAB(25)sure$
;" ";result$
3440 VDU3
3450 ENDPROC
3460 DEFPROC twin
3470 PRINTTAB(0,10)"Dont be daft !!!!!"
3480 TIME=0:REPEAT UNTIL TIME =500
3490 PROCwipe(4,16)
3500 ENDPROC
3510 DEFPROC tabin
3520 CLS:PRINTTAB(3,10)"Tables already loaded.":PRINT
" Options 1 and 5 not available"
3530 ENDPROC
3540 DEFPROC sort
3550 PROC TITLE("POSITION SORTING")
3560 PRINTTAB(0,6)"Please wait a few minutes"
3570 FOR tem%=21 TO 129 STEP 18
3580 PROCdivis
3590 PRINTTAB(0,9)"Sorting ",div$
3600 FOR team%=leaguet% TO leagueb%
3610 PROCposition
3620 NEXT
3630 FOR team%=leaguet% TO leagueb%
3640 PROCinsort
3650 NEXT:NEXT
3660 ENDPROC
3670 DEFPROC position
3680 coll%=homeres%(team%):PROCdecol
3690 tomatch%=lost%+draw%+won%
3700 coll%=awayres%(team%):PROCdecol
3710 tomatch%=tomatch%+lost%+draw%+won%
3720 IF tomatch% < 1 THEN tomatch%=1
3730 togoal%=INT(homegoal%(team%)/100)+INT(awaygoal%(
team%)/100)
3740 golav=togolav%/tomatch%
3750 position(team%)=pointot%(team%)*100+golav
3760 PROCwipe(13,13)
3770 PRINTTAB(0,13)name$(team%),position(team%)
3780 position(team%)=50000-position(team%)
3790 ENDPROC
3800 DEFPROC insort
3810 FOR J =leaguet%+1 TO leagueb%
3820 I=J-1
3830 position=position(J):name$=name$(J):pointot%=point
ot%(J)
3840 homeres%=homeres%(J):homegoal%=homegoal%(J):forhom
e%=forhome%(J)
3850 awayres%=awayres%(J):awaygoal%=awaygoal%(J):forawa
y%=foraway%(J)
3860 truhome%=truhome%(J):truaway%=truaway%(J)
3870 IF position > position(I) THEN 3940
3880 position(I+1)=position(I):name$(I+1)=name$(I):poin
tot%(I+1)=pointot%(I)
3890 homeres%(I+1)=homeres%(I):homegoal%(I+1)=homegoal%(
I):forhome%(I+1)=forhome%(I)
3900 awayres%(I+1)=awayres%(I):awaygoal%(I+1)=awaygoal%(
I):foraway%(I+1)=foraway%(I)
3910 truhome%(I+1)=truhome%(I):truaway%(I+1)=truaway%(I
)
3920 I=I-1
3930 IF I > leaguet% THEN 3870
3940 position(I+1)=position: name$(I+1)=name$: pointot%(I
+1)=pointot%
3950 homeres%(I+1)=homeres%:homegoal%(I+1)=homegoal%:fo
rhome%(I+1)=forhome%
3960 awayres%(I+1)=awayres%:awaygoal%(I+1)=awaygoal%:fo
raway%(I+1)=foraway%
3970 truhome%(I+1)=truhome%:truaway%(I+1)=truaway%
3980 PROCwipe(13,13):PRINTTAB(0,13)name$(team%),positio
n(team%)
3990 NEXTJ
4000 ENDPROC
4010 DEFPROC teamdiv
4020 choice%=choice%-49
4030 IF choice% < 2 THEN tem%=choice%*22+1:ENDPROC
4040 IF choice% < 6 THEN tem%=choice%*24:ENDPROC
4050 tem%=117
4060 ENDPROC
4070 DEFPROC date
4080 CLS:PRINTTAB(0,19)
4090 PRINTTAB(0,10)"LAST ENTRY "date$
4100 PRINTTAB(0,22)"Press SPACE to continue"
4110 PROCspace
4120 CLS
4130 PRINTTAB(0,20)"PLEASE ENTER TODAY'S DATE"
4140 INPUT date$
4150 ENDPROC
4160 DEFPROC correct
4170 IF en% < 1 THEN PROCnotab:ENDPROC
4180 CLS:PROC TITLE("Correction")
4190 INPUTTAB(0,5)"TEAM",home$:HL=LEN(home$)
4200 PROCwipe(5,20):sel%=0
4210 FOR tem%= low% TO high%
4220 IF home$=LEFT$(name$(tem%),HL) THEN sel%=tem%
4230 IF sel% > 0 THEN 4260
4240 NEXT tem%:PRINT "Team name error..re-enter"
4250 TIME=0:REPEAT UNTIL TIME =200:GOTO4180
4260 tem%=high%:NEXT
4270 y$=name$(sel%):PRINTTAB(0,6):y$;
4280 y$=STR$(homeres%(sel%)):PRINTTAB(18-LEN(y$)):y$;
4290 y$=STR$(homegoal%(sel%)):PRINTTAB(23-LEN(y$)):y$;
4300 y$=STR$(awayres%(sel%)):PRINTTAB(30-LEN(y$)):y$;
4310 y$=STR$(awaygoal%(sel%)):PRINTTAB(35-LEN(y$)):y$;
4320 PRINTTAB(37):pointot%(sel%)
4330 PRINTTAB(0,7)"Enter new details":PRINT
4340 INPUT "TEAM NAME",name$(sel%)
4350 INPUT "Home results",homeres%(sel%)
4360 INPUT "Home goals",homegoal%(sel%)
4370 INPUT "Away results",awayres%(sel%)
4380 INPUT "Away goals",awaygoal%(sel%)
4390 INPUT "Points",pointot%(sel%)
4400 ENDPROC

```

# Programmers' Paradise

The BBC is a programmer's paradise in itself because of its excellent BASIC, built in assembler, easy routes to Operating System routines, availability of various programming languages apart from BBC BASIC, and so on. The Electron offers all of the same excellent opportunities to the programmer.

However there are always aspects of programming that can be made even easier, the professional approach. The range of 'utilities', from the simplest character definer to complex graphics routines, continues to grow.

Here we offer a look at a few favourites. Animator is an interesting example of the new brand of "Sprite Generator" for the BBC. Even A&B gets in on the act this issue with "Spritzen Up". Sprites, a Commodore 64 user would tell us, are hardware generated and no routine in software can match them. We should call software sprites 'moving graphics'. Whatever you want to call them, they can be fun to use. The Spectrum and 64 have games designers so why not the BBC and Electron?

There's more machine code from Salamander's Turbo Compiler. It can certainly boost the speeds of any game you might be writing. Anyhow let's take a peek into Programmer's Paradise.

## A programmer's eye view of software to aid writing software.



<b>Title</b>	<b>McVid</b>
<b>Publisher</b>	<b>Pica Software</b>
<b>Machine</b>	<b>Model B/ Electron</b>
<b>Price</b>	<b>£14.95/£15.95</b>

McVid stands for machine code video utilities. The package consists of a tape or disc with five separate machine code files for each of the graphics modes (0,1,2,4,5). Each file, which performs similar functions, loads in just beneath screen memory taking about 1.5K away from normal user memory. The code provides a number of machine code graphic subroutines which may be called from user programs written in either BASIC or machine code.

The package also includes a demo program to show off some of the routines. Unfortunately the demo side of my tape would not load (on two different recorders) and nor would the replacement tape. The company apologetically sent me a disk, and hopefully will have sorted out the tape problem by the time this review appears. When I finally got the demo program running it proved quite spectacular. Running in Mode 2 it moved a sprite representing the earth seen from the moon while simultaneously landing a rotating and enlarging

spacecraft. The demo ends with very rapid lateral scrolling of the whole display. Unfortunately my subsequent experiences with the package did not live up to the expectations aroused.

There is one good thing about the documentation — a full and very well commented assembler listing of one of the routines (for Mode 5). We are told that the code is similar for the other modes, but unfortunately there are no unassembled source programs provided on the tape/disc so anyone wishing to extract routines without

\*LOADING the whole file will have some work to do. The listing apart, the documentation — so important with this type of package — is really rather poor. There is also an odd approach in that it claims to be aimed mainly at the machine code programmer. I find this strange because (a) all the routines can be accessed from BASIC (e.g. the demo program is entirely written in BASIC) and (b) it is surely BASIC programmers who would benefit most from the ability to call in fast machine code routines for their graphics. Unfortunately the design of the software and the documentation will make this package pretty useless to anyone who does not have at least a working knowledge of the principles of assembly language programming.

The routines provided enable one to draw two dimensional line figures by setting up a table of data, which can then be drawn at any position on the screen and in varying sizes and rotations. Screen co-ordinates, scaling and rotation parameters are poked into specified locations in memory before calling the appropriate address. This is probably the most powerful and useful part of the package. There are also routines for drawing and animating sprites (large multicoloured objects) and for lateral scrolling of the screen. The latter is not a trivial matter even though one can program the appropriate Sheila register from BASIC via VDU 23. The problem on sideways scrolling is that the screen positions are shifted up by the hardware scroll and need to be moved down in software — hence a machine code routine is necessary to achieve a fast and smooth effect.

Since it is simplest to program, the lateral scrolling was the first thing I tried. I immediately discovered an apparent bug since my BASIC routine scrolled to the left correctly, but on right scrolling produced garbage on the screen. At first I assumed that my Mode 5 program was written wrongly, but when I converted it to Mode 2 (as used on the demo program) it ran perfectly. I can't say whether there are any other bugs since it takes a long time to

check every routine in every Mode (you would think the author would have done so though wouldn't you?).

My next effort was to follow the claim that filled circles could be drawn with the package. I thought this might be very useful since I have had problems with pie chart programs running too slowly in BASIC. Unfortunately the method described (minimally, with no listing) involves drawing a line repeated at different orientations from a specified centre. This, of course, produces a moiré pattern, not a true filled circle like the Plot 85 method in BASIC. The original routine I wrote in BASIC drew a largish circle in 3.3 seconds. Since the documentation insists that the routines are better used from machine code I also wrote a version storing the parameters and doing the looping in an assembler subroutine. The circle now drew in 2.7 seconds — hardly worth the trouble really. I also discovered in the process that when you jump to one of the subroutines the 6502's register values are not restored on return. Hence if you do call them from machine code you are forced into efficient methods (e.g. storing a loop counter in memory rather than in the X or Y registers).

Let me illustrate some of the problems with the documentation. The example listings all lower HIMEM to avoid clashing with the machine code, but do so in inconsistent ways with no ground rules given in the text. One of the demo listings is presented with no description of what it does, and a totally unnecessary assembler subroutine (the BASIC has to be slowed down to compensate!) which unforgivably contains no comments. One is told where to store X and Y co-ordinates for the graphics but not how they relate to the usual graphic points (experiment suggests that they are actually based on the number of pixels available in each mode). The description of co-ordinates stored for drawing shapes is even worse — "next X as signed 8 bit number" is all you get. You have to work out that it is relative plotting, plus or minus the number of

pixels, and if you've never heard of two's complement it's just too bad.

In conclusion, I have great difficulty seeing who is going to use this package. If you want fast graphics for your own applications/entertainment and are not worried about publication or portability you would be much better off spending the extra to buy a graphics extension ROM which will be much easier to use and takes no user memory. The documentation is so poor that anyone expert enough to understand it probably won't need the routines. For example, if you want to write commercial machine code games you could hardly afford 1.5K of general purpose code of which you might only use a part. It would have been much more useful for the author to have published his routines as a well documented book of separate and relocatable assembler listings for each of the functions he provides.

#### Ratings Table:

SOUNDS	N/A
GRAPHICS	40%
DOCUMENTATION	50%
VALUE FOR MONEY	50%
OVERALL	50%



<b>Title</b>	<b>Sprites</b>
<b>Publisher</b>	<b>Beebugsoft</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£10.00/£12.00</b>

Sprites, or Sprite Utilities as it is more accurately called on the disc version cover, is a suite of programs allowing the Beeb user to define multicoloured characters, to clone them or join them together and to send them flying about your Mode2 screen, propelled by a purpose written machine code routine. All you have to do is specify the locations at which you wish the Sprite to be drawn and a CALL to S% does the rest.

Each Sprite can be defined in two planes to allow for simple animation and machine code routines are available to detect collisions and to allow for an automatic wrap-around screen. There is also a super sprite facility which allows for four variations of spriteliness. Seven sprites are available at any one time and definition takes place on the well-loved eight by eight grid with single key-press access to the palette.

The outstanding feature of the pack is the documentation and the ability to list the example programs (which all have colour highlighting) to play around with the routines and thus learn how

they work. The machine code routine is situated at &2800 and HIMEM suitably moved about. Variables are passed to and from the routine in the system variables A% to Z%. Various memory locations can be looked at or changed with the indirection operators, both to test for various conditions and to charge parameters.

Detailed instructions are given on how to incorporate your definitions into a BASIC program and on how to use the machine code routine. You will probably have to read up on using machine code if you are not already familiar with the way it is handled on the BBC but the manual is clearly written with lots of examples and should form the basis of supplies you with most of what you need to know. The Demos form the basis of a tutorial in sprite handling which is entertaining and should see you writing your own games before long. Don't forget to send them along to A&B.

#### Ratings Table:

SOUNDS	50%
GRAPHICS	90%
DOCUMENTATION	95%
VALUE FOR MONEY	75%
OVERALL	90%

<b>Title</b>	<b>Animator</b>
<b>Publisher</b>	<b>Screenplay</b>
<b>Machine</b>	<b>Model B</b>
<b>Price</b>	<b>£14.95</b>

The writers of Animator are so confident in their Sprite routines that they run a competition for users to write their own games using them. Anyone who has witnessed the graphics introduction to the Grampian TV series will have got a taste of the creations Neil Kolban and John Cassar, the authors, go in for.

The whole package is designed for ease of use, from the 25 page booklet to the animated demonstration program provided alongside the Creator and Compiler programs that do the real work. Despite this, the beginner will have to be willing to learn a bit about pro-

**CONTINUED OVER**

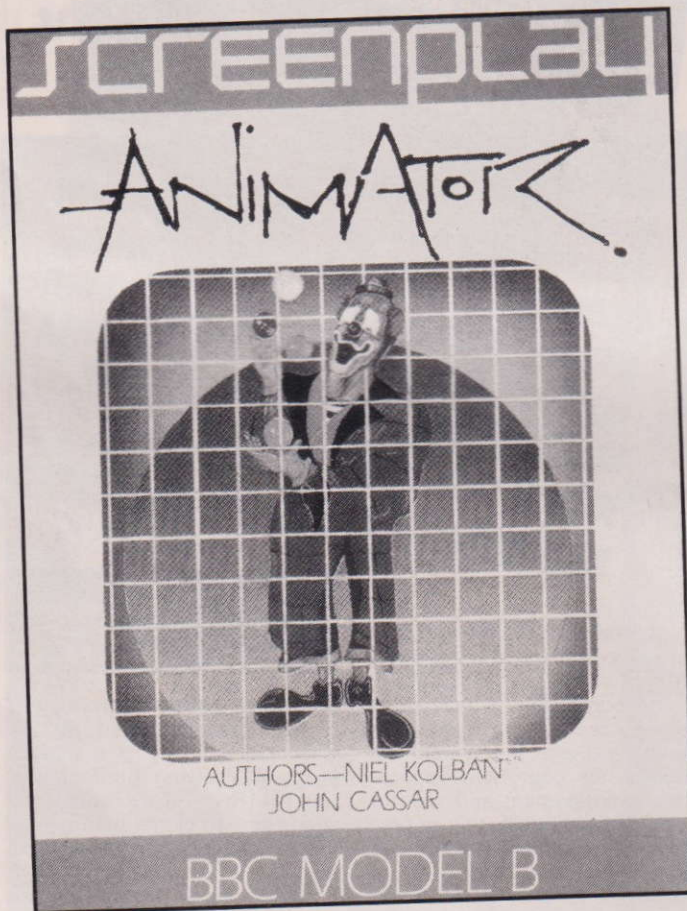
gramming before being able to fully utilise the power of Animator. Example programs are listed but the idea of a utility such as this is to provide the basis for original games ideas. You could spend hours creating your own sensational sprites only to be unable to incorporate them into a program. The documentation does cover most possibilities however and a little study results very quickly in a familiarity with how Animator works and how to get the best out of it.

The Creator program is a mega character definer in full colour, 30 by 30 pixels. You move the cursor in customary fashion around the grid, filling in with the colour of your choice.

As you can imagine this can turn out to be a bit of a chore if you have not done some design work beforehand. Be prepared. It's a shame that on such a large grid it is not possible to repeat fill along a line of pixels since it is often required to fill large areas with the same colour.

It is possible to move your defined character around on the grid in order to produce multi-position characters and a read-out of the co-ordinates aids accurate positioning. When you are satisfied with the results of your design, the program asks you to mark the boundary of your character. As the documentation points out, it is often a good idea to level at least some blank pixels around the sprite. The sprite data can then be saved to tape. The individual user will have to keep a library of sprites, as backup to long hours of work and for feeding into the Compiler program.

Animator comes with the Compiler half on the second side of the tape, the first ending with a demonstration program, just to familiarise the user with the format for CALLing the MC (machine code) for planting sprites on the screen. The address of MC from BASIC is &2E1C. The second parameter in the CALL statement after MC is A%, the sprite number. This can be a number in the range 0 to 191. Numbers 0 to 63 represent



the originals so to speak, add 64 to get the first variant (rotated vertically) and add 128 to get the second variant (rotated horizontally).

The next two parameters represent the X,Y co-ordinates of the sprite (restricted to the dimensions of the Mode 2 screen of course) and the fourth defaults to 0 but can be specified 0 or 1. Normally the sprite will be printed 'absolutely' (GCOL 0) but if 1 is specified then the sprite will be EORed with whatever is already on the screen (GCOL3).

There is also a collision routine CK (&2DDA) which is called in the same way but with P% instead of C% as the last parameter. P% is set to 255 if a collision occurs, 0 if not. The documentation carries well-

REMed examples and hints on use from BASIC and Assembler.

The actual compilation of sprite data is menu driven. You can load in the data, view sprites, edit, renumber or delete and of course you can save the sprite machine code, the code you will eventually call from your own program. The second side of the tape also contains a simple dam-busters type program by way of demonstration. It's also listed in the manual.

Animator is a good all round sprites package and an easy to use suite of programs. The finished product can be very impressive. The first demo, among other things, creates a picture which makes passers by think you have got an aquarium in your television. Of course this

sort of utility reduces a programmer's flexibility of approach to any particular game but there is no doubting the convenience of a ready made character moving routine as good as Animator.

Title	Turbo Compiler
Publisher	Salamander
Machine	Model B/ Electron
Price	£9.95

Turbo is a 2K compiler for both BBC Micro and Electron. It takes a BASIC program and turns it into 'stand alone' machine code. This means that the program will run on any Electron or BBC without needing the presence of Turbo.

This is essentially the difference between a compiler and an interpreter such as the BBC BASIC in the BBC and Electron. A BBC BASIC program could not run without the presence of the BBC BASIC interpreter in the machine. Machine code also offers faster processing because it talks the same binary language as the computer.

Of course both BBC and Electron have an excellent built-in 6502 assembler which can produce stand alone code, so why do we need a compiler? The main reason is that Turbo supports a sub-set of BASIC commands and is thus a fairly straightforward step for BASIC programmers to make. The structures with which they are familiar hold good to an extent with Turbo.

Turbo has 52 command variations, principally for assigning variables, FOR...NEXT, PRINT, GOTO, GOSUB and IF...THEN. More BBC specific commands like CLS, CLG, MODE and SOUND are supported. There is also CALL and VDU. With VDU it is possible to emulate all of the graphics commands like MOVE and PLOT.

The tape you buy from Salamander Software contains both cassette and disc system versions and there are demonstration programs as well as step by step instructions for loading and activating Turbo.

When the compiler is loaded, hitting Break brings up the

message that Turbo is present in your machine. PAGE is now set by the user. Since the code has to be accommodated, minimum setting is hex 1500 (hex 2100 for disc users). This can be changed as the programmer wishes but the new location has to be signalled to the compiler through changing the contents of two zero page locations. Similarly with storage space for the compiled machine code, normally hex 2200 (hex 2800 for disc).

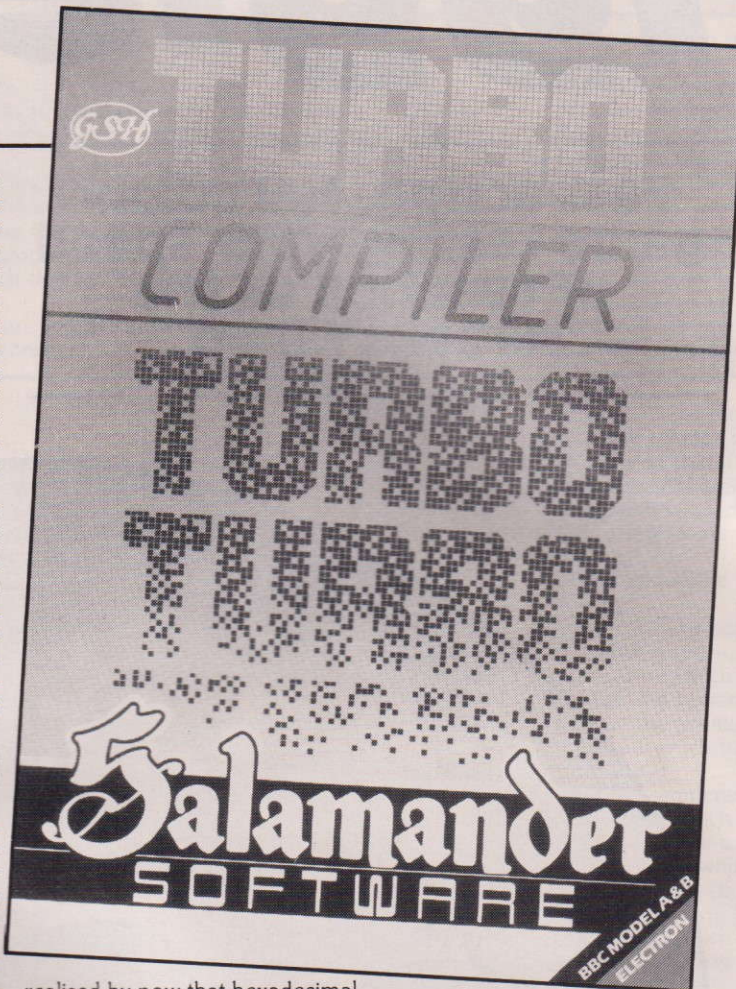
It is a shame that Salamander can not have point of sale showings of the demonstration program which accompanies Turbo. Sales would rocket. There is a considerable difference from normal speed especially with a moiré type pattern and a block of meanies which shoot across the screen. Trying to run the demonstration program (written in Turbo BASIC) without first compiling it, revealed the difference in speed and also the interesting fact that it did not entirely work as a straight BBC BASIC program, hanging up some two thirds through the demo.

To compile your BASIC program a \*TURBO is all that is required. A subsequent CALL to the location of the compiled code sets the program in motion.

Because it is 'stand alone' code and it makes use of Acorn Operating System routines, Turbo will work with the 6502 second processor, a positive point for all those now embarking on such an upgrade. It is just a question of loading the code into a location of your choice in the second processor memory.

When \*TURBO is entered as a command to compile the source program, "garbage" characters appear on the screen (Turbo presumably uses screen memory as work space) and if all is well with the program "OK" is displayed at the top left-hand corner of the screen.

What if something is not quite right with the source program? It can easily happen because of the strict and unfamiliar syntax of Turbo. In that case "ERROR in" will appear followed by a line number in hexadecimal. You have probably



realised by now that hexadecimal numbering is a necessity in most Turbo syntax. Only line number, GOSUB, GOTO and THEN, plus MODE need decimal numbers supplied.

The necessarily excellent documentation implements 65 BBC BASIC keywords using Turbo sub-set commands. Some implementations are not easy and here there is a parallel with assembler. It is often a good idea to use BASIC to do the difficult bits and CALL short routines which supply speedy versions of PRINT, PLOT and so on. Don't expect to be able to use REPEAT...UNTIL structures or PROCs and functions.

The most useful structure in Turbo is FOR...NEXT but even this has its limitations: no nested loops so you have to get into the tortuous use of IF...THEN. Step size is always +1 without exception and only eight bit numbers can be handled (0-255). The following three line sound effect demonstrates what you can not do.

```
10 FOR V% = &FFFFTO&FFF1
20 SOUND&0001, V%,
&003A, &0001
30 NEXT V%
```

The hexadecimal notation for -15 and -1 is too large for Turbo to handle. The step is in a negative direction and produces "ERROR in OA". Four hexadecimal numbers are needed in SOUND statements. The eight bit V% cannot be used in SOUND because 16 bit precision is required. A parameter block is needed with a call to OSWORD. Variables available for use are A% to Z% for eight bit numbers and A% to Y% for 16 bit.

Other restrictions include line numbers in the range of 0-255, one BASIC statement per line, no spaces in the program (also broken above) and double precision variables are made up from two normal variables. All strings are stored as with the \$ in-direction operator.

After considerable use the

Turbo 'dialect' does become less of a chore. As well as reading the documentation and trying the examples, it is a good idea to study the demo program. After all it deals in graphics, which is, I suspect, what Turbo will be used for most. If you have already delved into the BBC manual on indirection, calls to the operating system or assembler, then Turbo's operation will not seem so mysterious.

BASIC programmers will have to be willing to learn a bit more about their computer and go through some trial and error. Turbo is not the friendliest of programs so saving your source program before compilation should be priority. Funny things can happen if you use 16 bit addresses where you shouldn't.

Turbo is a very interesting program and can produce impressive results. It is best used to create machine code routines to enhance BASIC programs although routines can be strung together to create complex programs. The package goes as far as it can to document Turbo and give the programmer advice on how to implement some of the BASIC statements he/she might be familiar with.

The compiler itself is compactly written which means that you could get to use all 255 BASIC statements in some modes! though probably not in the ones that count. The compilation of the longest possible program is almost instantaneous and machine code can be \*SAVED for use complete or as an all-purpose routine.

I'm not sure that Turbo is an "ideal intermediate stage" for those wishing to move from BASIC to assembler. It certainly involves a closer insight into the fundamental working of the computer and should attract those who wish to utilise machine code in their programming but as an alternative to assembler rather than as a stage towards it. Assembly language, when learned, is much more flexible than Turbo. Those who wish to rely on their knowledge of BASIC and require quick results will find Turbo a willing tool and good value for money.

# Wiggler

In "Wiggler" your task is to control a ravenous worm around a strawberry patch to satisfy its huge appetite. The trouble is, the farmer has taken the trouble to place anti-worm cans in various places, and these are rather nasty for the hungry wiggler.

Type in the first program — listing 1 — and SAVE it on cassette or disc. Now type in the second program — listing 2 — but before you RUN it, SAVE it after the first program under the name "WIGGLER". This is necessary because the second program is written to work at PAGE &1900 so if you run it at PAGE &E00, i.e. if your system is cassette based, then the program will overwrite itself as it tries to assemble the machine code routine on top of itself. Very nasty indeed. So once you have typed it in and SAVED it, it is probably best to LOAD it at &1900 then debug it as necessary. However, if you have a disc based system, you can debug it without any worry. Once you have typed in both programs, you can CHAIN it and the first program will automatically load in the second program at the correct address. The game starts as soon as the second program loads. From the middle of the screen, a small worm will start to move so you have to control him to the strawberries while avoiding all the anti-worm cans.

You control the wiggler with Z,X, \* and ? to move right, left, up and down respectively. By pressing "Q" at any point during the game, you can switch the sounds off. If you want it back on, simply press "S". When you have mis-guided three wigglers and your score is in the top eight, you will be asked to enter your name in the Hall of Fame.

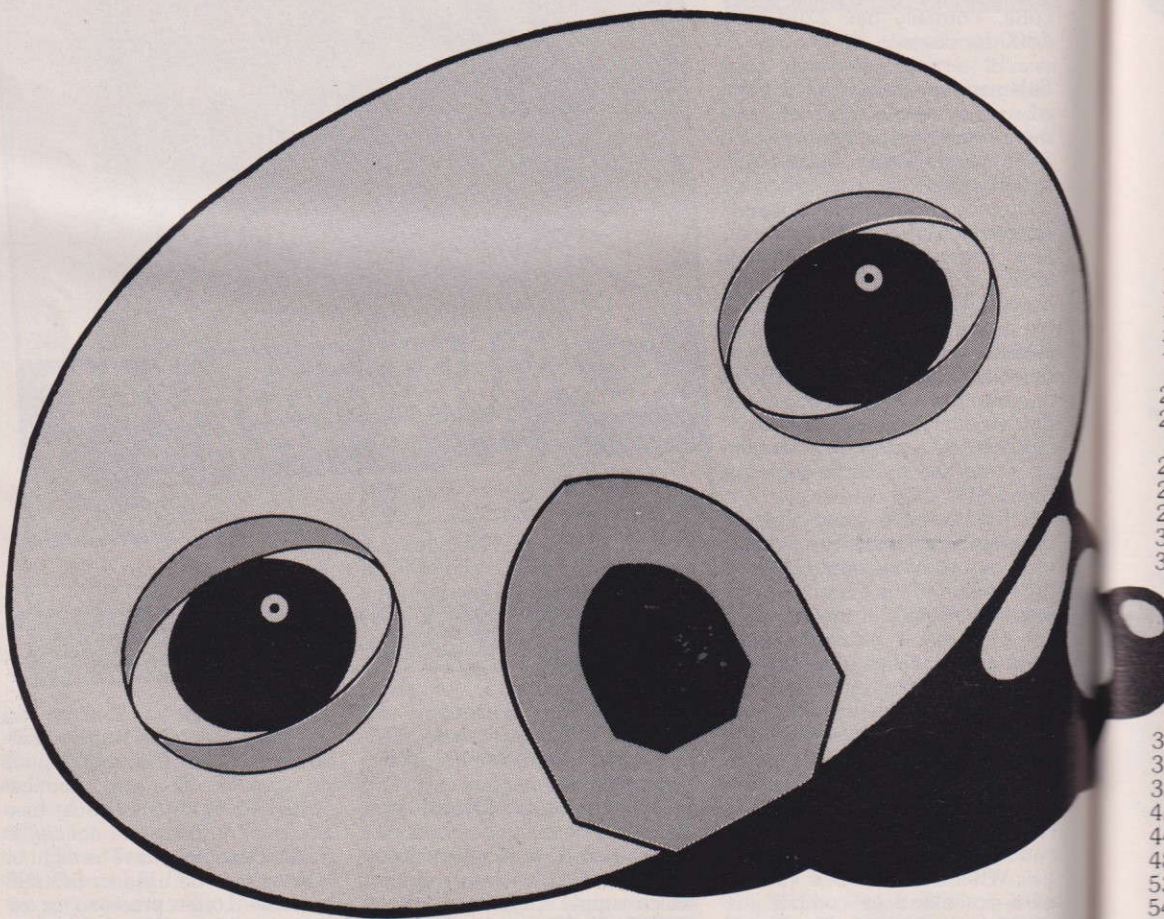
## HOW IT WORKS

The two programs are very structured (or as structured as the language BASIC allows) so should prove to be very easy to understand. I have even tried to write the machine code using modular programming techniques used in high level languages so it should not prove too difficult to understand even for those not

**Fast action, full colour  
game testing your speed  
of reaction as the  
screens fill up.**

so proficient at machine code programming. In any case, the run-down below should aid in the understanding of the programs.

The second program shows just how easy it is to mix machine code and BASIC, making use of the extremely powerful indirection operators available in Beeb BASIC (i.e. ?, ! and \$).



## MAIN VARIABLES

li-number of lives.  
screen-number of screen cleared.  
sp-speed of wiggler.  
die-flag to indicate whether wiggler is dead or not.  
sc(8)-DIM which holds the top eight scores.  
obst-food-variable used in FOR-NEXT loops.  
head-location which holds the ascii code of the head to be printed.  
dir-direction of wiggler.  
score-address of the location which holds the score. Accessed by ! operator.

Some of the OSBYTE calls (equivalent to \*FX commands) and other calls are only available in OS1.2 but that should not be too much of a problem as there are, by now, very very few people with the bug filled 0.1 operating system.

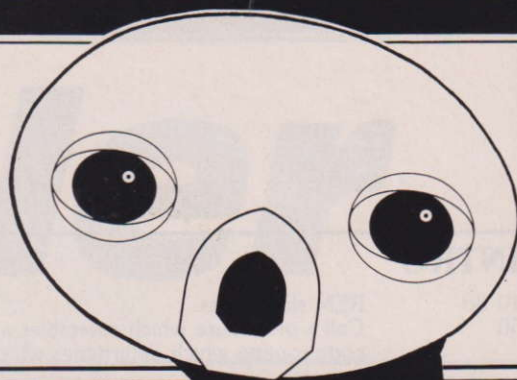
## INTRO

10-30	REM statements.	410	If disc system in use, call PROCEDURE disc else call PROCEDURE tape.
50	Call a procedure which assembles a short machine code routine which determines which filing system is in use.	420	End of this procedure.
60	Select MODE7 and print the instructions.	430-460	Wait for the space bar to be pressed.
70	Define characters and envelopes.	470-500	Print the a message and define a text window.
80	Set PAGE to the correct value and CHAIN in the second, main program.	510-530	A function which returns a differing value according to the filing system in use.
100-240	Procedure which defines the characters and envelopes.	540-610	Procedure to assemble a machine code routine to be used in the above function. This routine makes use of the call to OSARGS (&FFDA) with the accumulator and Y set to zero. The usual method of seeing whether PAGE is set to &1900 was not used as there are now DFS that take up no RAM and leave PAGE at &E00.
260	Start of procedure to print the instructions.		
270-400	Print the instructions.		

## THE GAME

10	Select MODE2 and call the procedure which assembles the machine code.	880-890	Reserve space for the co-ordinates for each segment. Notice that P% is set to &E00. It is for this reason that if the program is run at &E00, it will overwrite itself.
20	Beginning of main-loop.	910	Beginning of machine code.
30	Initialise various variables.	920	Call a subroutine which switches the sound on or off.
40	Select MODE2 and get rid of flashing cursor.	930	Call a subroutine which updates the position of wiggler.
50-90	Game.	940-970	Check the character in front of wiggler's head.
100	End of game.	980-990	If it's not a space, take appropriate action.
110	Call hall of fame procedure.	1000-1030	Subroutine which lengthens the wiggler.
120	Another game.	1060-1190	Update the position of the wiggler's head.
140	The game itself.	1200-1260	Update the position of each segment according to the head which has just been updated.
150	Beginning of games loop.	1270	Colour 6.
160	Call a procedure which scans the keys.	1280-1380	Print the segments and the head.
170	CALL machine code routine.	1390-1420	Subroutine which returns the ascii code of the character at the cursor position. It makes an OSBYTE call with the accumulator set to 135.
180	Print score.	1430-1460	Subroutine which is called when a wiggler eats a strawberry.
190	Wait for a suitable amount which depends on the screens cleared.	1470-1590	Subroutine which checks whether "Q" or "S" has been pressed and switches sound on/off accordingly.
200	End of loop.	1620-1640	Set up the top eight scores and scorers. The subroutine "S_or_Q" makes an OSBYTE call with Y set to &FF. This is equivalent to an negative inkey.
210	If dead, call a procedure to which decreases the number of lives etc. else go onto next screen.	1650	End of this procedure.
220	End of game.		
230-250	Procedure which causes a delay.		
260-310	Scan keys and change direction appropriately.		
320	Beginning of procedure which sets up the screen.		
330	Clear screen.		
340	Print number of lives.	1660-1720	Plays music.
350	Print score.	1730	Beginning of hall of fame procedure
360-420	Print the wall.	1740	Call a subroutine which checks whether the top eight scores/scorers have to be updated.
430	Print the current screen.	1750-1850	Print the top eight.
440-470	Print the anti-worm cans.	1860	End of this subroutine.
480-520	Print the strawberries.	1870	Beginning of subroutine which updates the top eight.
530	End of this procedure.	1880	Checks whether the current score is bigger than the lower score in the hall of fame.
540-580	Initialise the co-ordinates for the individual segments.	1890-1920	Update top eight scores.
590-610	Procedure which initialises direction, length of wiggler, and the flag to indicate whether you are dead or not.	1930-2000	Input name routine. An OSWORD call is made with accumulator set to zero. This is the method used by Acornsoft etc. in their hall of fame and is a convenient way for string input.
620-660	Procedure which is called when you have misguided a wiggler.	2010	End of this procedure.
670-760	Procedure which is called when you have cleared a screen.		
770-830	Procedure which is called when you have misguided three worms. Plays a tune.		
840	Beginning of procedure which assembles the machine code routine. These routines are the time consuming routines.		
850-860	Define some variables and initialise them.		
870	Operating system calls.		

CONTINUED OVER



## PROGRAM LISTING 1

```

10REM ...WIGGLER...
20REM By Shingo Sugiura
30REM Copyright (C) 1984 April
40
50PROCassemble
60MODE7:PROCinst
70PROCdefine
80PAGE=&1900:CHAIN"WIGGLER"
90
100DEFPROCdefine
110VDU23,223,&2B,&6C,&EE,&EE,&BA,&FE,&7C,&3B
120VDU23,224,&3C,&5A,&E7,&DB,&DB,&E7,&5A,&3C
130VDU23,225,&FF,&FF,&81,&81,&81,&81,&FF,&FF
140VDU23,226,&24,&66,&E7,&FF,&DB,&DB,&126,&3C
150VDU23,227,&3C,&7E,&DB,&DB,&FF,&E7,&66,&24
160VDU23,228,&3C,&126,&223,&252,&252,&126,&3C
170VDU23,229,&3C,&7E,&FB,&3F,&3F,&FB,&7E,&3C
180VDU23,230,&3C,&24,&3C,&6E,&2C,&2C,&24,&7E
190VDU23,231,&0B,&3C,&7E,&7E,&76,&2C,&3C,&1B
200VDU23,255,&2B,&6C,&EE,&EE,&BA,&FE,&7C,&3B
210ENVELOPE1,128,21,0,-12,4,5,7,7,-17,0,-11,120,73
220ENVELOPE2,3,0,0,0,0,0,126,-1,0,-5,126,0
230ENVELOPE3,1,0,0,0,1,1,1,126,-4,-1,-4,126,0
240ENDPROC
250
260DEFPROCinst
270PRINTCHR$129CHR$141CHR$157CHR$131TAB(15)"WIGGLER"
280PRINTCHR$129CHR$141CHR$157CHR$131TAB(15)"WIGGLER"
290PRINT'TAB(9)CHR$130"By Shingo Sugiura"
300PRINT" You have to control a creature"
310PRINT"called the WIGGLER. He is a distant"
320PRINT"relative of the slow worm but much"
330PRINT"faster and its diet consists of wild"
340PRINT"strawberries. You have to guide it"
350PRINT"so that it will grow to be an adult"
360PRINT"worm. Beware of the anti-worm cans."
370PRINT'CHR$133TAB(12)"CONTROLS:-"
380PRINT" Z .. Left * .. Up"
390PRINT" X .. Right ? .. Down"
400PRINT" Q .. No sound S .. Sound on"
410IF FNfile=4 PROCdisc ELSE PROCTape
420ENDPROC
430DEFPROCdisc
440PRINT'CHR$134CHR$136"Press the SPACE BAR to conti
nue.";
450REPEAT UNTIL GET=32
460ENDPROC
470DEFPROCTape
480PRINTTAB(0,23)CHR$134CHR$136"Please leave cassette
running.";
490VDU28,5,21,35,19
500ENDPROC
510DEFNfile
520CALLcode
530=?&70
540DEFPROCassemble
550DIM code 15
560P%=code
570OPT 0
580LDA#0:LDY#0:LDX#&70
590JSR &FFDA:STA &70
600RTS:J
610ENDPROC

```

## PROGRAM LISTING

```

10MODE2:PROCassemble
20REPEAT
30I=2:score=0:screen=1:sp=9
40MODE2:VDU23,10,32,0,0,0;
50REPEAT
60PROCinit:PROCscreen
70PROCco_ord
80PROCgame
90UNTIL death
100PROCfin
110MODE7:PROCTable
120UNTIL FALSE
130
140DEFPROCgame
150REPEAT
160PROCkeys
170CALL &E00
180COLOUR7:PRINTTAB(5,1):score
190PROCwait(sp*20)
200UNTIL ?die=1 OR ?len>=40
210IF ?die=1 THEN PROCdeath ELSE PROCnew_screen
220ENDPROC
230DEFPROCwait(T)
240FOR delay%=0 TO T:NEXT delay%
250ENDPROC
260DEFPROCkeys
270IF INKEY(-67) AND ?dir<>2 ?dir=1
280IF INKEY(-98) AND ?dir<>1 ?dir=2
290IF INKEY(-73) AND ?dir<>4 ?dir=3
300IF INKEY(-105) AND ?dir<>3 ?dir=4
310ENDPROC
320DEFPROCscreen
330CLS
340COLOUR6:PRINTTAB(0,31)STRING$(11,CHR$223)
350COLOUR7:PRINTTAB(0,1)"SCORE":score:TAB(10)"HIGH";
sc(0)
360VDU17,133,17,2
370PRINTTAB(0,2):STRING$(20,CHR$225);
380PRINTTAB(0,28):STRING$(20,CHR$225);
390FOR A=2 TO 27
400VDU31,0,A,225,31,19,A,225
410NEXT A
420COLOUR128
430PRINTTAB(10,30)"SCREEN":screen;
440COLOUR3
450FOR obst=0 TO screen*2+10
460PRINTTAB(RND(16)+2,RND(25)+2):CHR$230
470NEXT obst
480VDU17,1
490FOR food=0 TO 50
500PRINTTAB(RND(16)+2,RND(25)+2):CHR$231
510NEXT food
520VDU17,6
530ENDPROC
540DEFPROCco_ord
550FOR A=0 TO 40
560A?xco=9:A?yco=15
570NEXT
580ENDPROC
590DEFPROCinit
600?dir=1:?len=2:?die=0:death=FALSE
610ENDPROC
620DEFPROCdeath
630I=1-1:IF I<0 THEN death=TRUE
640FOR sound=170 TO 155 STEP-2:SOUND&01,3,sound,2:NEX
T sound
650PROCwait(3000)
660ENDPROC
670DEFPROCnew_screen
680RESTORE 740
690screen=screen+1:sp=sp-1:IF sp<=0 sp=0
700FOR music=1 TO 14
710READ A,B:SOUND1,2,A,B

```

```

720NEXT music
730PROCwait(5000)
740DATA69,3,73,3,77,3,81,4,69,2,73,4
750DATA61,2,69,4,53,2,61,4,33,2,53,6,101,5,53,2
760ENDPROC
770DEFPROCfin
771RESTOREB20
780FOR music=1 TO 7
790READ A,B:SOUND1,2,A,B
800NEXT music
810PROCwait(5000)
820DATA81,7,69,3,53,5,81,5,89,5,49,5,53,5
830ENDPROC
840DEFPROCassemble
850head=&70:dir=&71:die=&72:len=&73:chr=&74:score=&75
860!&80=&11!&82=1!&84=1!&86=4
870oswrch=&FFEE:osbyte=&FFF4:osword=&FFF1
880DIM xco 40,yco 40,sc(8)
890FOR PASS=0 TO 2 STEP 2:P%=&E00
900*T.
910OPT PASS
920JSR S_or_Q
930JSR move
940LDA#31:JSR oswrch
950LDA xco:JSR oswrch
960LDA yco:JSR oswrch
970JSR find:LDA chr:CMP#32:BEQ cont
980CMP#135:BEQ grow
990LDA #1:STA die
1000.grow
1010JSR eat
1020INC len:CLC:LDA score:ADC#10:STA score
1030LDA score+1:ADC#0:STA score+1:LDA score+2:ADC#0:STA
  score+2
1040.cont
1050JSR cal:RTS
1060.move
1070LDA#31:JSR oswrch
1080LDY len:LDA xco,Y:JSR oswrch
1090LDA yco,Y:JSR oswrch:LDA#32:JSR oswrch
1100LDA dir:CMP#1:BNE nr
1110INC xco:LDA#228:STA head:RTS
1120.nr
1130LDA dir:CMP#2:BNE n1
1140DEC xco:LDA #229:STA head:RTS
1150.n1
1160LDA dir:CMP#3:BNE nu
1170DEC yco:LDA#226:STA head:RTS
1180.nu
1190INC yco:LDA#227:STA head:RTS
1200.cal
1210LDY#40
1220.loop1
1230LDA xco-1,Y:STA xco,Y
1240LDA yco-1,Y
1250STA yco,Y
1260DEY:BNE loop1
1270LDA#17:JSR oswrch:LDA#6:JSR oswrch
1280LDY #2
1290.loop2
1300LDA #31:JSR oswrch
1310LDA xco,Y:JSR oswrch
1320LDA yco,Y:JSR oswrch
1330LDA#224:JSR oswrch
1340DEY:BNE loop2
1350LDA #31:JSR oswrch
1360LDA xco,Y:JSR oswrch:LDA yco,Y:JSR oswrch
1370LDA head:JSR oswrch
1380RTS
1390.find
1400LDA #135:JSR osbyte
1410STX chr
1420RTS
1430.eat
1440LDA#7

```

```

1450LDX#&80:LDY#&00:JSR osword
1460RTS
1470.S_or_Q
1480LDX#&EF:JSRinkey:BEQnot_quiet
1490LDA#210:LDY#&00:LDX#&01:JMPosbyte
1500.not_quiet
1510LDX#&AE:JSRinkey:BEQnot_noisy
1520LDA#210:LDY#&00:LDX#&00:JMPosbyte
1530.not_noisy
1540RTS
1550.inkey
1560LDY#&FF:LDA#&81
1570JSR osbyte
1580TXA
1590RTS
1600JNEXT
1610names=&F20
1620FOR A=0 TO 7
1630$(names+A*15)="SHINGOSOFT":sc(A)=4000-A*500
1640NEXT
1650ENDPROC
1660DEFPROCburst_of_music
1670RESTORE1630
1680FOR music=1 TO 8
1690READ pitch,dur:SOUND 1,2,pitch,dur
1700NEXT music
1710DATA95,8,83,3,75,6,83,6,63,6,55,5,63,2,47,9
1720ENDPROC
1730DEFPROCtable
1740PROCammend:CLS

```

```

1750PRINTCHR$129CHR$157CHR$130CHR$141TAB(10)"WIGGLER H
  ALL OF FAME"
1760PRINTCHR$129CHR$157CHR$130CHR$141TAB(10)"WIGGLER H
  ALL OF FAME"
1770PRINTTAB(10)CHR$134CHR$141"Today's Greatest"
1780PRINTTAB(10)CHR$134CHR$141"Today's Greatest"
1790FOR I=0 TO 7
1800VDUI+49,46:PRINTTAB(6);sc(I);TAB(12)"... ";$(names+
  I*15)
1810NEXTI
1820PRINTTAB(2,23)CHR$134CHR$136"Press the SPACE BAR t
  o replay.";
1830REPEAT
1840CALLS_or_Q
1850UNTIL INKEY-99
1860ENDPROC
1870DEFPROCammend
1880IF !score<=sc(7) ENDPROC
1890FOR I=7 TO 0 STEP-1
1900IF !score>sc(I) sc(I+1)=sc(I):$(names+(I+1)*15)=$(
  names+I*15):fix=I
1910NEXT
1920sc(fix)=!score
1930PRINTTAB(6,2)CHR$134CHR$141"Congratulations!!"
1940PRINTTAB(6,3)CHR$134CHR$141"Congratulations!!"
1950PRINTTAB(6,8)CHR$129"Your score of ";!score
1960PRINTTAB(0,10)CHR$129"qualifies for the Hall of Fa
  me."
1970PRINTTAB(4,13)CHR$131"Please enter your name."
1980VDUI31,5,15,134,157,129,31,26,15,156,31,9,15:~FX15
1990!&1000=names+fix*15:~?&1002=14:~?&1003=32:~?&1004=127
2000X%=0:Y%=&10:AX=0:CALL&FFF1
2010ENDPROC

```

# Bookshelf

## Bookshelf

**Interfacing Projects for the BBC Micro** by Bruce Smith. Published by Addison-Wesley. Price: £6.95.

If you have often wondered what those plugs were for and would like to get down and make use of some of them then this could be the book for you. The analogue to digital and user ports will have plenty to occupy them if you go ahead with the many projects detailed in this excellent BBC accessory.

Some of the projects will require some previous knowledge of the subject (the EPROM programmer and X-Y plotter are very ambitious for instance). Bruce Smith does a good job demystifying the subject but there is a fair bit to get through. Diagrams, circuits and veroboard layouts are all included and there is copious software (even OSBYTE and non OSBYTE alternatives) to get the projects working. As well as programs to drive the hardware, there are examples of how to use the end result (e.g. a geography quiz incorporating the lightpen).

To make life easier for all, Watford Electronics are supplying complete kits of parts and for individual projects. If you are new to the game at least the author takes the first five chapters to explain the hardware connections and software support which the projects require. There is also some help for Model A owners (how to fit an A/D port and a user port).

The projects themselves start with a power distribution board, an all-purpose creation for the following devices. Next up is a highly useful input/output monitor board, giving visual indication of the logic state of the 6522 VIA lines — great for learners!

The joystick controller and light pen will appeal to all those game players and users of educational programs who would prefer to do it themselves. The door bell and rain detector and light operated switch are for the highly practical among us and could well spark off some more sophisticated ideas. There is also

## From rain detection to piano playing, there's a book about it for your BBC or Electron.

a Thermistor interface, sound detector and digital to analogue converter. The latter might well come in handy if you are following the BBC Computers in Control series. The light controller project may appeal to computerate disc jockeys!

An excellent book from Bruce Smith. Some straightforward circuits for the beginner mixed in with some sophisticated devices. Ideal for the BBC based hobbyist or the school computer department. Only connect!

**DIY Robotics and Sensors with the BBC Computer** by John Billingsley. Published by Sunshine. Price: £6.95.

A book which supplies information on robot anatomy, software for "off the shelf" robots, a guide to do-it-yourself design and much more.

The first section of the book concerns itself with providing a power source for the suggested projects, joystick and lightpen, plus upgrading any model A to a specification allowing the other applications to be tackled. This includes supplying the user port (6522 programming is tackled here) and analogue input.

The remainder of the book introduces a range of devices important to the field of robotics, stepper motors, Darlington drivers which supply the "clout" to drive steppers (steppers are driven directly from logic signals without conversion to analogue state). Later on we encounter analogue output and position servos, the alternative method. There are chapters on interfacing your robot, robot vision and a look into the future.

The text is backed up by a number of listings which are,

rather annoyingly, often listed in typeset form and then again, almost immediately, in printout form of impeccable quality. A waste. There are also a great number of drawings, crudely reproduced but on most occasions making the point about combinations of components and wiring. Much of this however will make little sense to the complete beginner and I wouldn't recommend the book to someone with no previous knowledge of electronics computing. There are two ways of taking this book, as a useful set of programs and advice for those already "practising" robotics or a fascinating introduction and spur to learn more for soldering-iron fanatics. The ideal book for any school electronics/computing department which does more than just type with its micros.

**Instant Arcade Games for the Electron** by Jean Frost. Published by PAN. Price: £3.95.

The Electron has an excellent BASIC which supports the idea of procedures, or PROC'S as they are often referred to. Though PROC'S are not the be-all and end-all of BASIC programming, they are certainly very important and this book from the Personal Computer News Computer Library uses them to good effect.

The aim of the book is to allow games to be built up from simple Lego-type PROC'S which are provided within the text.

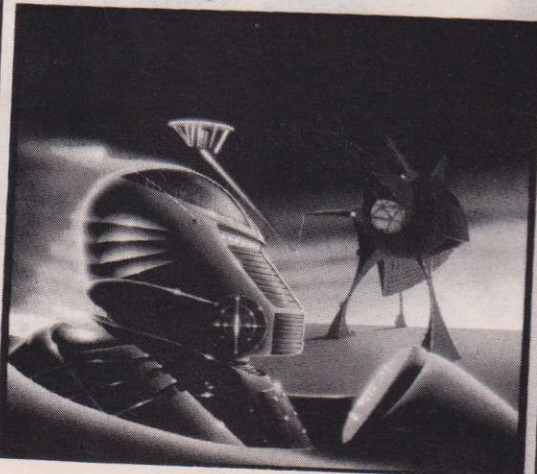
Jean Frost has split this book into predominantly two areas, one dealing with the zap-'em type arcade game and the second devoted to adventure-type games. Both of these types of games are dealt with in similar fashion as regards their construction.

The zap-'em games are considered to be made up of some thirteen types of feature including fuel, ammunition and scoring as well as standard features such as movement, firing and collision detection. Opportunities are certainly taken to introduce features of BBC BASIC and these are used well within the PROC'S defined. The adventure section covers

### DIY robotics and sensors with the BBC computer

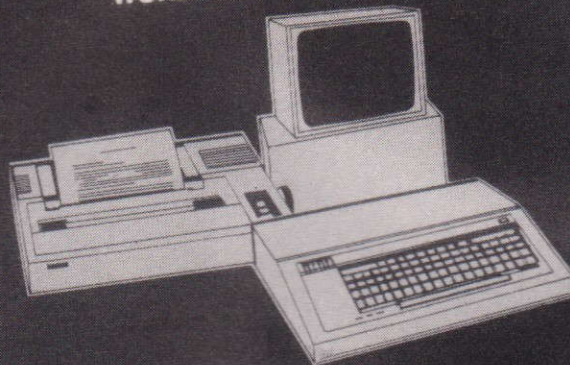
practical projects for control applications

john billingsley



# WORD PROCESSING ON THE BBC MICRO

WORDWISE AND EPSON



Michael B Wood

An NCC 'How to...' Book

PROC'S on inventories, mazes, descriptions of rooms, legal, input checks and response to input.

Each of the PROC'S is covered by its listing and where necessary explanations of techniques used within the PROC. This is done in a clear and concise style with a welcome occasional hint of humour.

The areas covered are in the main necessary for anybody wanting to write one of these types of game. Though there is nothing inspirational about the programming, it's very solid and adaptable.

This is a good book for getting a game together quickly, but if you want to write a best-seller I think that you'll have a lot of enhancing to do.

**Practical Programs for the Electron** by Owen and Audrey Bishop. Published by Granada. Price: £5.95.

It was only after some thought that I realised that I was enjoying reading this book. It took a little while longer to realise that the reason was because the programs really were going to be of use! Even as I read my two typing fingers were itching.

This very well-written book consists of some fourteen diverse listings. One or two are of dubious or limited value, but the majority have immediate applications.

Each listing has a chapter to itself and is made up of a short intro to the program, an extensive explanation of the methods of use and hints for keying in followed by the program design and listing. Each chapter ends with comments on variations that might be attempted.

My personal favourites in this lot were an excellent phone-call coster (though I did change the display colours to suit my own ageing television), and a very good budget program, which I am using for my own personal accounts. Other listings worthy of mention are a space planner, to help design room layouts for furniture using quite complex line-drawing techniques, a pie-chart generator and a character generator.

This is an excellent book, well worth reading and using. I feel that the book is superb value for money.

**Word Processing on the BBC Micro** by Michael B. Wood. Published by NCC Publications. Price: £5.25.

This is a very comprehensive guide to using the best-loved wordprocessor for the BBC — Wordwise — together with the well known Epson FX80. The author rightly points out the powerful print and layout facilities offered by the Epson/Wordwise combination and there are detailed chapters on both. By way of extended example, Michael Wood has also prepared the entire 93 pages of the book with Wordwise and printed it out on an FX80, the result of which is a very nicely produced product indeed.

Wordwise allows standard or well-used codes to be entered into function keys for instant access to various preset styles and formatting. There are plentiful examples and lists of control codes for later reference.

Descriptions of Wordwise and the FX80 make up the first two chapters, clarifying the Wordwise manual and offering a BBC-centric look at the FX80, VDU, FX commands and control codes, and the DIL switches at the printer end. Further in-depth looks at Wordwise in operation and printing facilities, lead on to a very useful chapter on standard documents, the most useful of

wordprocessing applications, standard styles, paragraphs or texts and standard jobs. The typical standard job is a letter and chapter 9 deals entirely with it.

A useful index completes the ideal introduction to wordprocessing with this combination of program/printer.

**Graphic Art for the Electron** by Boris Allan. Published by Sunshine. Price: £5.95.

Boris Allan is a well-known and very prolific contributor to computer publications and books. As such the books that he writes deserve full reading. I must be honest and say that I did not enjoy this book very much and certainly found that there were leanings to pretension.

The book covers two present areas of computer trendiness, the first being turtle graphics and the second graphic art. There are many diagrams (why does he insist on calling them icons?) and these are certainly very well presented, but I always had the feeling that the book was an intellectual exercise for the author's own gratification.

Turtle graphics are covered in some detail taking the first three chapters at a brisk pace. Chapters four to seven then carry on to cover the use of the VDU command, user-defined graphics, exotic beasts such as the Central Limit Theorem and random sampling, doodling systems and finally ideas for going forward from this book.

For me the most useful part of this book was the "suggested

reading", because I certainly would not recommend this work as useful reading in turtle graphics and computer art.

**Games and other Programs for the Acorn Electron.** Published by Penguin. Price: £3.95.

One of the very worthy publications which are totally devoted to the Electron is the club magazine of Elbug, the independent Electron User Group, brother of the excellent Beebug. It was only a matter of time before many of the well thought out programs from the magazine were published as a compilation....and this is it.

The book, as is the case with these types, is divided into four types of listing. The first set of programs comes under the title of action games, including superb reaction games such as Robot Attack and Hedgehog but also giving Much-Man, the standard Pac-Man look-alike. The second section is devoted to thought games. This was a very disappointing set of listings having such uninspiring efforts as Higher/Lower (see Bruce Forsyth's Play Your Cards Right) and Return of the Diamond (a nine room adventure!). The third section covers visual displays and though interesting the first time seen, they can only really serve as a demonstration of the Electron's magnificent graphics capabilities. The final section is certainly the most useful, comprising of a set of utilities. OK, some are standard, such as the Bad Program Rescue and the Bad Program Lister, but there are also some helpful bits and pieces on double height text and 3-D lettering.

For someone who doesn't subscribe to either Elbug or Beebug, both of which have published these listings, this book is quite a fair buy at £3.95.

**The BBC Microcomputer Disk Companion** by Tony Latham. Published by Prentice Hall International. Price: £7.95.

This is an excellent, clearly laid out and informative guide to us-

CONTINUED OVER

# BOO!

## artificial intelligence on the BBC and Electron

make your micro think

keith & steven brain

ing disc drives with the BBC. As well as providing hardware and software explanations, the author also goes into ways of exploiting disc storage with a random access database and word processor type program.

The book is designed to be useful and succeeds. When you have read through and begin to experiment with your disc drive system it is very easy to use the book as a work reference, pulling it off the shelf to look up an error message, the correct syntax of DFS command or the explanation of a MOS command that did not stick first time around.

The beginner will have no problem understanding the first couple of chapters which spell out the advantages and disadvantages of disc storage, unravel the jargon, explain the various combinations of drive, discs and densities which can be fairly confusing to the uninitiated.

On the programming side, this is the most comprehensive book available on the subject. All aspects of file handling are dealt with and we are even asked to brave a revealing section on assembly language file handling. Indirection Operators and the relevant O.S. commands are dealt with in great detail — all any programmer might require. A number of examples include a Disc Menu program.

Other useful programs include a formatter and verifier, listed for the interest even of those who may already have a commercial program to do the job. There is a comprehensive and informative glossary, particularly necessary in the world of disc drives since they provide an excuse for a whole new world of jargon.

There are sound ideas on maintaining discs, avoiding pollution and therefore error. There are some good diagrams and exploded views and step by step instructions for connecting up. Also for newcomers to discs are frequent comparisons with the cassette handling of the BBC to point up the differences. There are a few mistakes in the text but nothing to confuse, and a picture

of a what looks to me like a double drive captioned as a single drive. This does not spoil what is a good solid instruction and reference manual for disc users.

**Artificial Intelligence on the BBC and Electron** by Keith and Steven Brain. Published by Sunshine. Price: £6.95.

Modified from the Commodore 46/Dragon version of this book, the BBC/Electron version makes extensive use of flow charts, example routines and full scale program. There is background history to artificial intelligence and expert systems, currently buzz words in the advanced research into "fifth" generation computers.

The book introduces us to decision making and considerable emphasis is laid on getting something intelligible back out of the computer. Natural language communication demands huge resources of memory as well as complex software but the principles can safely be gone into with even the Beeb/Electron.

The authors take us through the development of an expert system, first of all laying down the rules within the program and then letting the program learn rules for itself. Shape recognition is an extension of the matching

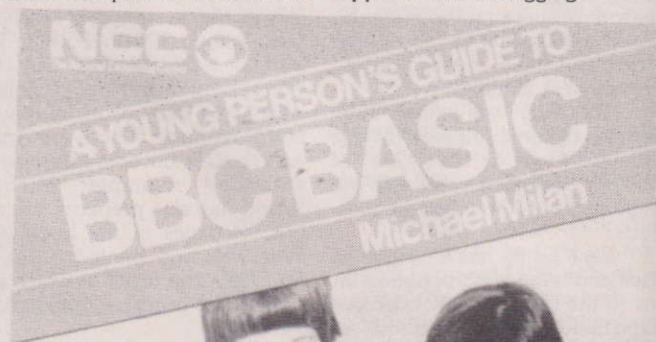
action the first principles discussed throughout the book.

**A Young Person's Guide to BBC BASIC** by Michael Milan. Published by NCC Publications. Price: £4.95.

This is a very readable and friendly introduction to BASIC programming by a member of the NCC (National Computing Centre) training team with programs by his son! Every step is spelled out and there are lots of hints about what might be going wrong and what to do about it.

Drawings and cartoons liven up the presentation and some wordsquares at the end of chapters help revise the new keywords learned.

There are lots of shortish examples to type in and get used to debugging and these become full-scale programs as the book progresses — and a lot of fun some of them are. Emphasis is laid upon procedures and program design as well as specific BBC facilities and there's a very useful appendix on debugging.



# Bookshelf

## ASSEMBLY LANGUAGE PROGRAMMING for the ACORN ELECTRON



Ian Birnbaum

A couple of chapters full of program examples tackle sound and graphics. There is nothing particularly original in content as far as learning programming with the BBC (or now Electron) is concerned. However the style and presentation are perfectly apt for the newcomer to these two popular computers.

**A Hardware Guide for the BBC Microcomputer** by A.D. Derrick, D.S. Harding, S.D. Middleton and M.P. Smith. Published by Wise Owl Publications. Price: £11.95 + £1.50 p&p.

This book does not come into the usual programming made easy or advanced BBC graphics or sound. It is rather a trip into the hardware dungeons of the silicon packed PCB which is the BBC Micro.

It will prove of most interest to the hobbyist who does not mind getting out the screwdriver and even the soldering iron to his micro. The authors go into considerable detail when describing the functions and interrelation of the various key chips and this is backed up by the second section of the book which is entirely devoted to the data sheets of the 6205, 6422, VIA, 8271 floppy disc controller, MC6845 CRTC and so on.

There is good advice for all those embarking on the potentially risky business of handling MOS devices and in soldering around highly sensitive components and the standard warning about invalidating your guarantee. The intention of the authors was to reproduce the full circuit diagram of the machine but unfortunately Acorn would not give their permission — strange since the BBC is supposed to be the machine for computer literacy and the same permission was granted to the Advanced User Guide.

As well as explaining how things work, the authors provide details for a number of upgrades for the BBC: all those from model A to B, floppy disc and an alternative speech upgrade which brings about the possibility of using one of the Texas military PHROMs — ideal for the computer wargamer!

There are some excellent line drawings which make clear the intricate flow paths involved in, for instance, the cassette interface. There is plenty of indication of where changes in hardware can be made by joining or breaking links but this is for the real fanatic.

Unfortunately the only photographs of the circuit board, though admirably labelled, are not at all clear and spoil the good intentions of the authors to inform newcomers of the exact locations of the important components on the board.

Although of limited use to the individual user, unless a hobbyist with practical experience of computer hardware, this book is ideal reference material for anyone dealing with the maintenance or expansion of a BBC Micro. It should certainly find its way into the library of any school or college which uses the BBC and will prove interesting reading for even the non-specialist user who wants to find out just what is happening when he or she tells the computer what to do in software.

**Assembly Language Programming for the Acorn Electron** by Ian Birnbaum. Published by Macmillan. Price: £7.95.

Ian Birnbaum's BBC version of this book has become somewhat of a standard work among BBC users and can claim some credit for many of the BBC fraternity now writing assembler programs for software houses and magazines.

The new BBC edition and this, its Electron cousin, improve even on the original with extra material about the EQU commands available in assembler in BASIC 2. As well as a tutorial on the subject the book offers some highly useful programs, from machine code sorts to printer dump, REM stripper and machine code monitor. These and many others are available in machine readable form as well as listed in the book. Still, if you have worked through the book up to the utility programs then it is unlikely that you will have any trouble debugging the listings.

Ian Birnbaum carefully establishes a number of building

blocks upon which the learner can safely rely when venturing into the complexities of indirect indexed and indexed indirect addressing. The commas and brackets of assembly listings start to mean something as he explains precisely what is going on in the 6502 as well as providing some clear and educational examples. There is no attempt to baffle the reader with impossible to follow listings, only examples which clearly demonstrate what the text has previously explained. In some instances it is deemed necessary to annotate the listing but usually an explanation by line number follows.

You may be wondering how come there is a printer dump for the Electron but don't complain because it's a good one and one day you may be able to use it with an interface added on. This is the great advantage of the Electron, all the facts about the BBC assembler transfer without change. In fact the BASIC 2 facilities are instantly available without perhaps having to upgrade, as with an older BBC.

The assembly code structures which the beginner is introduced to are deliberately based upon the BASIC structures already familiar to the user. Decision making and loops are two such structures which can be mirrored in assembly in order to make the instructions clear before setting out to produce more efficient code. Along the way we find ourselves tackling not only the mnemonics themselves but what effects they produce in the 6502, the accumulator, X and Y registers and other flags. This turns out to be the best way in which to remember what each instruction does. If you don't, then an excellent (in content but strangely not in production, using hand written copy as it does) appendix lists the instruction set with all the relevant information.

Time flies as you get caught up in the workings of even the more simple demonstrations, following the code and when the keyboard is available, learning by doing. There are large chapters on multiplication and division

CONTINUED OVER

# Bookshelf

and subroutines and interrupts. Each section within the chapter is ended with an exercise to test your knowledge and there are full answers (many of them complete programs) at the back of the book. These are obviously useful for the individual reader but make this book an especially good buy for a school or college teaching computer science at this level. Armed with a cassette copy of the programs, a teacher will be able to demonstrate the program in use and refer pupils to the text for detailed explanation and further ideas.

Ian Birnbaum's book is the perfect assembly introduction for the Electron user who already knows a good deal about how the computer works and has a fair amount of BASIC programming experience. All the aspects of assembly are dealt with, the standard 6502 set and the instruction peculiar to the Electron needed to make use of them. It's not everyone's cup of tea but there is much pleasure to be had from learning about the inner workings of what we see on the screen of our electron and in testing the example programs. The book to get if your manual is well fingered around the assembler section.

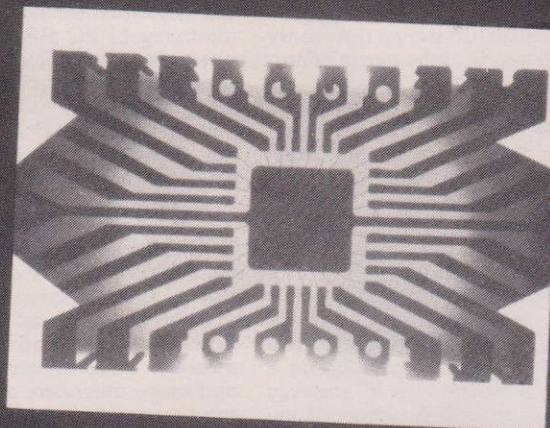
**Making Music on the BBC Computer** by Ian Waugh. Published by Sunshine. Price: £5.95.

Thankfully this book is not just another run through of the ENVELOPE and SOUND commands, although much of the standard information is reproduced in useful tabular form. Ian Waugh's book rather guides the reader into interesting musical areas, especially into the reproduction effects like echo, tremolo and vibrato and chorus. His detailed study of how the SOUND and ENVELOPE commands program the sound chip, clears up any reasons behind various anomalies the experimenter will have encountered and leaves the reader confident to tackle the later chapters on recreating sheet music, writing music/sound compositions, pro-

## making music on the BBC computer

a musician's guide to programming

ian waugh



Wise Owl Publications

grams and automatic composers.

The author is not afraid to correct the User Guide where it's misleading or just plain wrong. His detailed analysis of the frequencies produced by the chip with the recommended pitch parameter forces the conclusion that the whole scale is one pitch value out. It would be better off starting with the lowest B at the value of 0 rather than 1 as it stands in the guide.

A chapter on channel 0 begins with effects and ends with a rhythm generator and a sound-scope program — well worth typing in (although a tape is available). We are also introduced to the ADVAL (negative value) function. This is put to further use as the QWERTY keys are turned into a mono, duo, and 3-note polyphonic keyboard. There is also an idea for a bass sequencer.

The chapter Making Micro Music deals with many of the synchronisation problems of programming a piece of music. Ian Waugh uses his favourite READ DATA methods but introduces the use of arrays to give the required flexibility. Extra DATA is supplied so that you can play bits of Mozart and Tchaikowsky on your Micro.

Getting the computer to do the hard work of composing for you is fraught with difficulty and there are a variety of methods and combinations of methods. Most are dealt with here and the technical edge taken off them by the author's clear explanation and substantial examples.

Harmony and transposition finish off the serious business and the final chapter deals with the fun area of combining animation and sound to produce cartoon like effects.

This book proved an excellent all rounder on music making with the BBC. There is a good instruction to the convention of music, its written language and lots of interesting ideas on how to translate sound into the world of BASIC. Ian Waugh takes the trouble to make each item clear and parallels the computer production with other examples from the world of music. A fresh and revealing approach.

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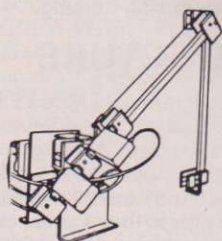
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# ROBOTICS

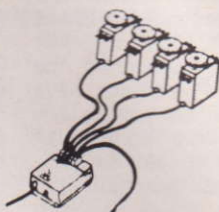
## ROBOT ARM



The Beasty arm mechanism is driven by the Beasty and three servos, the result being a three axis robot arm. The arm uses a hook to manipulate objects although a gripper can be made by using a further servo. This versatile arm has been designed with enthusiasts and schools in mind although where it will end is anyone's guess!

Arm complete  
£110.00

## BEASTY SYSTEM



The popular Beasty interface connects directly to the BBC Microcomputer and enables the computer to accurately control up to four servo motors. These are powerful geared, DC motors, with internal feedback which allow you to twist, turn, push, pull, lift, lower and generally manipulate objects.

Beasty £29.95  
Servos £14.50

## CAMERA

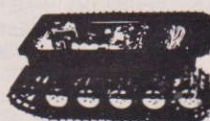


The EV1 is an electronic camera that links to your computer. Using its own optical sensor, the camera quickly captures high quality images for visual display, printing and analysis. The EV1 is supplied with a high quality lens, a detailed handbook together with comprehensive software.

Resolution: 256 x 128  
Frame rate: up to 15psec.

£129.95

## MOBILE BASE



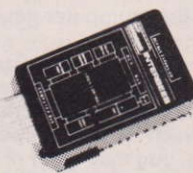
The Beasty mobile base can climb 45 gradients, carry up to 25lbs and has a top speed of 5 mph. Driven by two geared electric motors, running on caterpillar tracks, it can be controlled from your BBC computer by the Beasty and 2 servos or with your own driver electronics.

Spec, 360mm (L)  
304mm (W)  
225mm (H)

(excluding batts).

£60.00

## CONTROL INTERFACE



Widely used in laboratories and schools throughout the country, the DCP Microdevelopments Interbeeb is a very versatile interface with numerous applications. The unit gives you 4 Switch inputs, 4 Relay outputs, 8-bit input port, 8-bit output port and a 8 channel A to D converter plus an expansion bus for add on units (such as a D to A converter).

Interbeeb £69.95

Phone for further details All prices include VAT

# COMMOTION

241 Green Street  
Enfield EN3 7SJ  
Tel: 01-804-1378

# Domgrid

Mike Berry

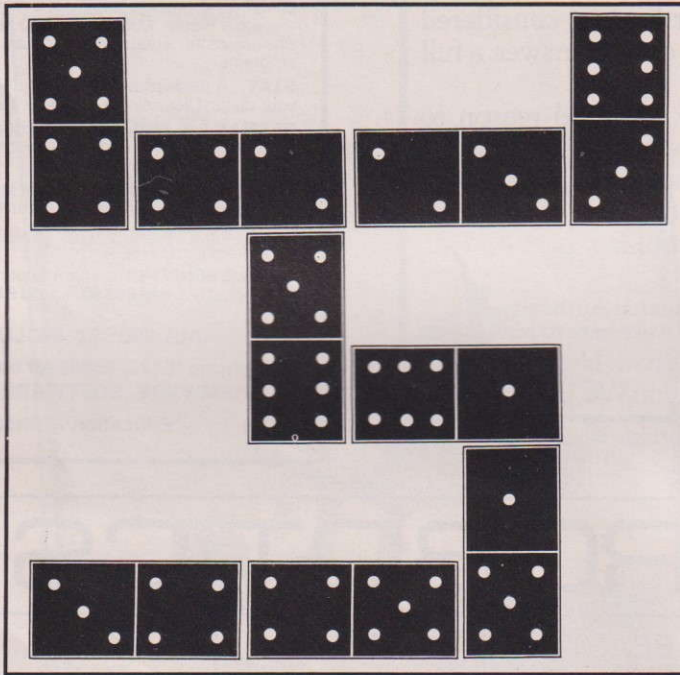
This program uses dominoes. A standard domino set consists of 28 pieces, each of which has a "pip value" at each end. These pip values go from nothing to six, and all combinations are represented, with no duplication. It is a fact that these dominoes can be arranged in a rectangular pattern in a very large number of different ways. If you regard half a domino as one unit, then the rectangular pattern forms an  $8 \times 7$  grid of pip values.

If you write down the pip values and hand them to a friend, that friend could deduce the pattern of dominoes which you started with. However, this is not as easy as it seems, and tests powers of deduction and lateral thinking — just try it, to see what I mean!

DOMGRID generates the  $8 \times 7$  grid of domino pip values. There is one, and only one, pattern of dominoes that will fit this grid. Your job is to find it. You can play the game the easy way or the hard way. In the easy version, the computer will only accept your input if you have identified a domino in the correct position, and in the correct orientation (across or down), according to the computer-generated pattern.

In this version, you will always solve the puzzle, even if only by trial and error. In the hard way, which is much more interesting, you may enter or delete dominoes in any position, provided you don't try to do something silly, such as remove half a domino, or place a domino which overlaps another, or extends beyond the edge of the

## Solve the computer's domino riddle.



board. The advantage of using a computer for this game is that the pattern generation is almost immediate, so that you can proceed quickly to the problem-solving stage. Furthermore, you are forced to really plan your tactics for solving the puzzle, or you will be up all night.

The program uses the facilities of the BBC Micro intelligently. Of particular note are the following:

- The cursor is extinguished in

line 2430 of PROCTITLE, and restored in line 2400 of PROCPATTERN.

- The neat structure of the program. Procedures have been used, not just to contain repetitive sections of code, but to aid development and maintenance. Hopefully, it will also help you to understand the program, and to improve it should you wish.
- The use of integer variables,

which speed up the program considerably.

- The initialisation of variables at the start of the program. This ensures that frequently-addressed variables are near the top of the stack, and again has a substantial effect on processing speed.
- The method for inputting replies to questions. A simple beep, with the cursor put to the appropriate position for correction, is preferable to scrolling messages. If you want to re-enter the value where the cursor is prompting for input, simply hit "Return".
- To give up in Version 2, press '@' in reply to the question "Delete?". I don't like having to Escape from programs, believing that the program should enable you to back out elegantly.
- If your program has to pause for thought, as this one does whilst it invents a pattern, please give the user something to look at. Nothing inspires panic more than a whirring computer producing nothing.

## STRUCTURE

The program uses Mode 2 for the main display. The dominoes are drawn by first drawing a black rectangle over the coloured background, and then placing the white pips in their correct orientation, using User-Defined characters. The program has been developed in a structured manner (see Figure 1), using the following procedures.

**PROCTITLE** Displays the title screen, which is no more than window dressing.

**PROCINIT** Initialises the important variables used in the program, as follows:

**DOMINOES%** — A two-dimensional array, representing the 28 dominoes, each with two pip values. These are read in from DATA statements.

**GRID%** — A two-dimensional array, holding the pip values as they appear in the  $8 \times 7$  grid.

**PATTERN\$** — Defines the value and position of each domino in the grid. The first character in each of the 28 elements is the position across (1-8), the second character is the position down (1-7), and the third character is the direction (A = Across, D = Down).

**FOUND%** — A flag used when searching through

**FINISHED%**

**DEL\$**

**IP%**

**G%**

**A\$**

**D\$**

**DI\$**

The remainder of this procedure sets up the user-defined characters which display the pips on the dominoes.

**PATTERN\$** for a match with the input.

- A flag used in the iterative loop of executing PROCPLAY, to determine when to leave the loop.

- The variable used to hold the reply to the question "Delete?" in Version 2.

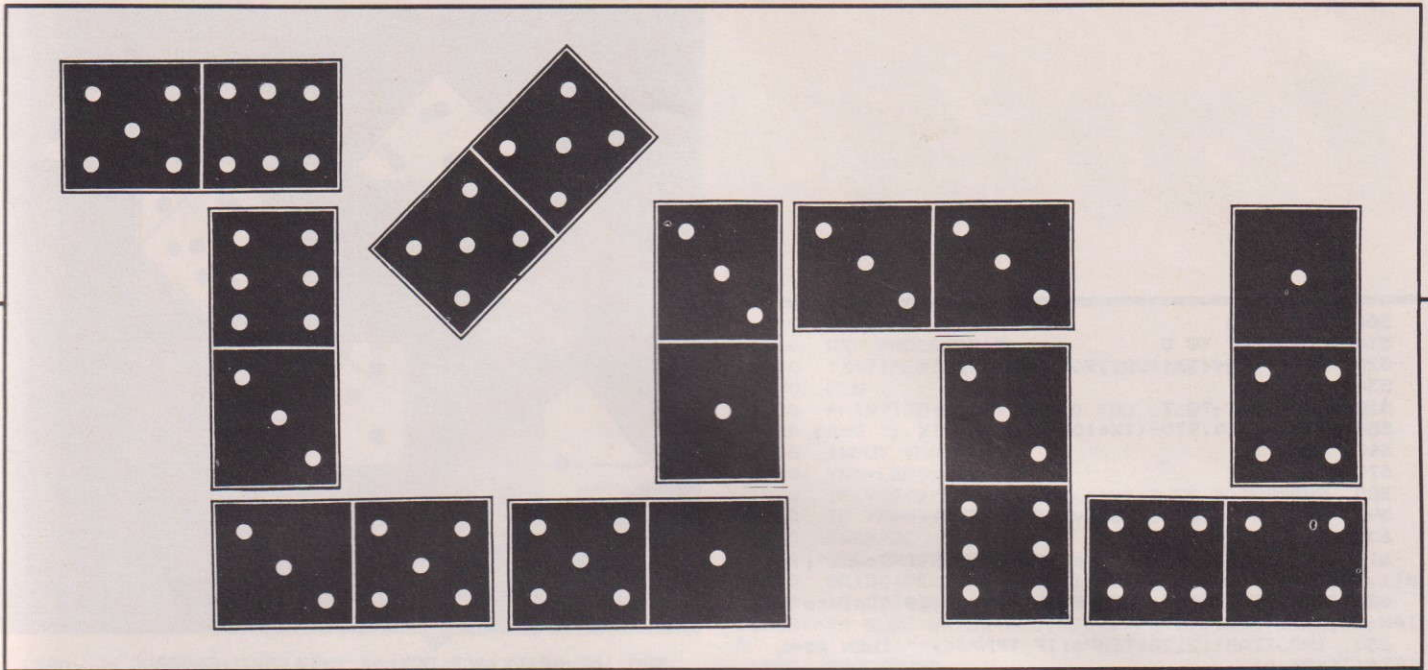
- A loop counter, used to establish the position within PATTERN\$ in Version 2.

- The actual subscript of PATTERN\$. It is incremented each time a new domino is placed during pattern generation.

- The user-entered 'Across' position.

- The user-entered 'Down' position.

- The user-entered domino direction.



**PROCSELECTVERSION** Prints the playing instructions, and enables the user to select the 'Easy' or 'Hard' version (Version 1 or 2). The version number is stored in **VERSION%**.

**PROCPATTERN** Calculates a randomly-based pattern of dominoes. It first sets all domino positions to '9'. Next, it decides on a random direction (across or down), followed by a random selection from the 28 dominoes, taking into account whether the domino will fit in that position, and whether that particular domino has already been used. If the domino can be fitted, and we are in Version 1, its position and direction are stored in **PATTERN\$**, because we will only allow the user to enter dominoes in their correct position. In Version 2, '@@@' is stored in **PATTERN\$**, because any domino position and direction will be accepted from the user, providing it fits. In this version, the dominoes are only recorded in **PATTERN\$** when they are entered by the user. If, at the end of the process of constructing the grid, the last dominoes cannot be fitted in, the whole process is repeated. This seemingly inefficient process is quite justified, since most patterns can be generated in 1 or 2 attempts, and there is never a particularly irritating delay.

**PROCDRAWGRID** Prints the playing board. The background is a neutral colour, divided into columns and rows. The pip values of the dominoes are printed as numbers, from **GRID%**.

**PROCPLAY** This is called each time the user wishes to place a domino. It takes the across and down position, and the direction (corresponding to the coding system used in **PATTERN\$**). In Version 2, it also allows you to delete a domino which you have realised you have placed in an incorrect position. It will not allow you to enter a domino which overlaps a domino previously placed, or one which goes outside the grid.

**PROCV1** Called by **PROCPLAY** when in Version 1, this checks that the entered domino exactly corresponds to the one placed in this position by the computer, and recorded in **PATTERN\$**.

**PROCV2** Called by **PROCPLAY** when in Version 2, this checks that the requested domino has not already been placed, and that it fits on the board, without overlapping. It does not insist that the domino is in the correct place within the computer-generated pattern.

**PROCFOUND** Moves the cursor to the domino position, as correctly entered.

**PROCACROSS** Decides whether to draw or delete an 'Across' domino. If 'Delete' is requested, it calls **PROCDLTE**. Otherwise, it plots the domino.

**PROCDOWN** Performs the identical process to **PROCACROSS** for vertically-oriented dominoes.

**PROCDOT** Forms the domino pip pattern from user-defined characters, set up in **PROCINIT**, and prints them.

**PROCDLTE** This removes a domino which has been previously drawn. Possibly the neatest part of the program, it appears to remove the domino, revealing the original background. It achieves this by re-constructing the background, taking the pip value number from **GRID%**.

## PROGRAM LISTING

```

10  MODE7
20  PROCTITLE
30  PROCINIT
40  PROCSELECTVERSION
50  PROCPATTERN
60  MODE2
70  PROCDRAWGRID
80  REPEAT
90  PROCPLAY
100 UNTIL FINISHED%=1
110 PROCREPEAT
120 MODE7
130 END
140 DEF PROCINIT
150 DIM DOMINOES%(28,2),GRID%(8,7),PATTERN$(28)
160 FOUND%=0:FINISHED%=0:DEL$="N":IP%=0:G%=0:AS$
=" ":D$=" ":DI$=" "
170 FOR I%=1 TO 28
180 FOR J%=1 TO 2
190 READ DOMINOES%(I%,J%)
200 NEXT J%:NEXT I%
210 VDU23,231,0,0,0,24,24,0,0,0
220 VDU23,232,192,192,0,0,0,0,3,3
230 VDU23,233,192,192,0,24,24,0,3,3
240 VDU23,234,195,195,0,0,0,0,195,195
250 VDU23,235,195,195,0,24,24,0,195,195
260 VDU23,236,219,219,0,219,219,0,219,219
270 VDU23,238,3,3,0,0,0,0,192,192
280 VDU23,239,3,3,0,24,24,0,192,192
290 VDU23,242,195,195,0,195,195,0,195,195
300 CLS
310 ENDPROC
320 DEF PROCDRAWGRID
330 VDU5
340 MOVE 100,1020:PRINT "DOMGRID Version ";VERS
ION%
350 VDU18,0,4
360 MOVE 200,900:MOVE1000,900:PL0T85,200,200:PL
OT85,1000,200
370 GC0L 0,2
380 FOR I%=200 TO 1000 STEP 100
390 MOVE I%,900:DRAW I%,200
400 NEXT I%
410 FOR I%=200 TO 900 STEP 100
420 MOVE 200,I%:DRAW 1000,I%
430 NEXT I%
440 GC0L 0,7
450 VDU5
460 FOR I%=1 TO 7:FOR J%=1 TO 8
470 MOVE 125+(J%*100),970-(I%*100)
480 PRINT; GRID%(J%,I%)
490 NEXT J%:NEXT I%

```

CONTINUED OVER

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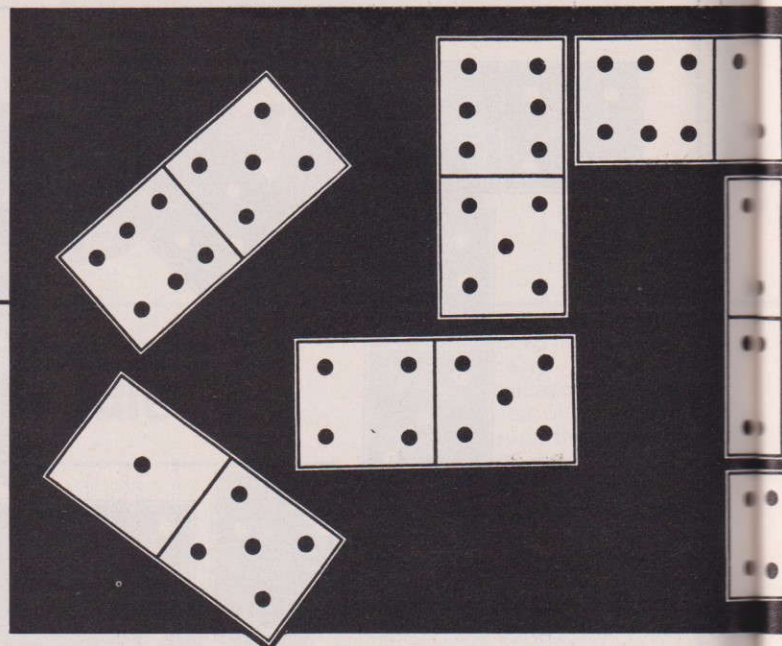
500 GCOL 0,5
510 FOR IX=1 TO 8
520 MOVE 125+(IX*100),960:PRINT ; IX
530 NEXT IX
540 FOR IX=1 TO 7
550 MOVE 1060,970-(IX*100):PRINT ; IX
560 NEXT IX
570 VDU4,20
580 ENDPROC
590 REM++++Loop for Solving Puzzle++++
600 DEF PROCPLAY
610 PRINTTAB(1,28)"Across:";TAB(1,29)"Downs:";TA
B(1,30)"Direction:";
620 IF VERSION%=2 THEN PRINTTAB(14,28)"Delete";
TAB(14,29)"(Y/N)?"
630 INPUTTAB(12,28)TEMP$:IF TEMP$<>"" THEN A$=L
EFT$(TEMP$,1)
640 ACX=VAL(A$):IF ACX<1 OR ACX>8 THEN VDU7:GOT
O 630
650 INPUTTAB(12,29)TEMP$:IF TEMP$<>"" THEN D$=L
EFT$(TEMP$,1)
660 DCX=VAL(D$):IF DCX<1 OR DCX>7 THEN VDU7:GOT
O 650
670 INPUTTAB(12,30)TEMP$:IF TEMP$<>"" THEN DI$=
LEFT$(TEMP$,1)
680 IF DI$<>"D" AND DI$<>"A" THEN VDU7:GOTO 670
690 IF DI$="A" AND ACX=8 THEN VDU7:GOTO 630
700 IF DI$="D" AND DCX=7 THEN VDU7:GOTO 630
710 IF VERSION%=2 THEN INPUTTAB(16,30)TEMP$:IF
TEMP$<>"" THEN DEL$=LEFT$(TEMP$,1)
720 IF VERSION%=2 THEN IF DEL$<>"Y" AND DEL$<>"
N" AND DEL$<>"@" THEN VDU7:GOTO 710
730 IF DEL$="@" THEN FINISHED%=1:ENDPROC
740 FLAG1%=0
750 IF VERSION%=1 THEN PROCV1 ELSE PROCV2
760 FOR IX=1 TO 28
770 IF VERSION%=1 THEN IF PATTERN$(IX)<>"@@@" T
HEN FLAG1%=1
780 IF VERSION%=2 THEN IF PATTERN$(IX)="@@@" TH
EN FLAG1%=1
790 NEXT IX
800 IF FLAG1%=0 THEN FINISHED%=1
810 FLAG1%=0
820 ENDPROC
830 DEF PROCSELECTVERSION
840 PRINTTAB(5,2)"DOMGRID";TAB(5,5)"Select Vers
ion";TAB(5,6)"-----";TAB(5,8)"1 - Easier.
The computer will only";TAB(9,9)"allow you to ent
er a correct";TAB(9,10)"domino position."
850 PRINTTAB(5,12)"2 - Hard. You must try to";
TAB(9,13)"enter all the positions";TAB(9,14)"witho
ut help. If you enter an";TAB(9,15)"invalid positi
on, the computer";TAB(9,16)"will bleep and refuse
to";TAB(9,17)"accept it."
860 PRINTTAB(9,18)"Otherwise, you must battle";
TAB(9,19)"it out until you solve the";TAB(9,20)"gr
id or admit defeat."
870 INPUTTAB(5,22)"ENTER VERSION "VERSION%
880 IF VERSION%<>1 AND VERSION%<>2 THEN GOTO 87
0
890 ENDPROC
900 DEF PROCV1
910 FOR IX=1 TO 28
920 IF A$+D$+DI$=PATTERN$(IX) THEN FOUNDX=1:PAT
TERNS$(IX)="@@@"
930 NEXT IX
940 IF FOUNDX=0 THEN VDU7 ELSE PROCFOUND:FOUNDX
=0
950 ENDPROC
960 DEF PROCV2
970 IF DEL$="Y" THEN GOTO 1140

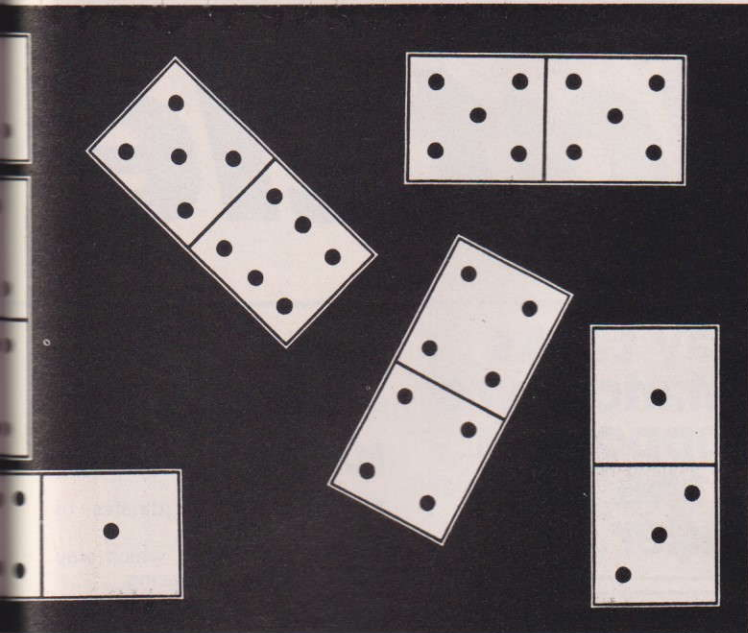
```

```

980 IF GRIDX(ACX,DCX)>6 THEN VDU7:ENDPROC
990 IF DI$="A" THEN IF GRIDX(ACX+1,DCX)>6 THEN
VDU7:ENDPROC
1000 IF DI$="D" THEN IF GRIDX(ACX,DCX+1)>6 THEN
VDU7:ENDPROC
1010 FX=0:FOR IX=1 TO 28
1020 IF DI$="A" THEN IF ((DOMINOES$(IX,1)=GRIDX(
ACX,DCX) AND DOMINOES$(IX,2)=GRIDX(ACX+1,DCX)) OR
(DOMINOES$(IX,2)=GRIDX(ACX,DCX) AND DOMINOES$(IX,1
)=GRIDX(ACX+1,DCX))) THEN FX=1:DOMINOES$(IX,1)=9:D
OMINOES$(IX,2)=9
1030 IF DI$="D" THEN IF ((DOMINOES$(IX,1)=GRIDX(
ACX,DCX) AND DOMINOES$(IX,2)=GRIDX(ACX,DCX+1)) OR
(DOMINOES$(IX,2)=GRIDX(ACX,DCX) AND DOMINOES$(IX,1
)=GRIDX(ACX,DCX+1))) THEN FX=1:DOMINOES$(IX,1)=9:D
OMINOES$(IX,2)=9
1040 NEXT IX
1050 IF FX=0 THEN VDU7:ENDPROC
1060 PROCFOUND
1070 JX=0:REPEAT
1080 JX=JX+1
1090 UNTIL PATTERN$(JX)="@@@"
1100 PATTERN$(JX)=A$+D$+DI$
1110 GRIDX(ACX,DCX)=GRIDX(ACX,DCX)+10
1120 IF DI$="A" THEN GRIDX(ACX+1,DCX)=GRIDX(ACX+
1,DCX)+10 ELSE GRIDX(ACX,DCX+1)=GRIDX(ACX,DCX+1)+1
0
1130 GOTO 1300
1140 FX=0
1150 FOR IX=1 TO 28
1160 IF A$+D$+DI$=PATTERN$(IX) THEN FX=1:IPX=IX
1170 NEXT IX
1180 IF FX=1 AND IPX<28 THEN FOR IJX=IPX TO 27:P
ATTERN$(IJX)=PATTERN$(IJX+1):NEXT IJX
1190 IF FX=0 THEN VDU7:ENDPROC ELSE PROCDLTE
1200 FX=0:FOR IX=1 TO 28
1210 IF DI$="A" THEN IF ((DOMINOES$(IX,1)=GRIDX(
ACX,DCX) AND DOMINOES$(IX,2)=GRIDX(ACX+1,DCX)) OR
(DOMINOES$(IX,2)=GRIDX(ACX,DCX) AND DOMINOES$(IX,1
)=GRIDX(ACX+1,DCX))) THEN FX=1
1220 IF DI$="D" THEN IF ((DOMINOES$(IX,1)=GRIDX(
ACX,DCX) AND DOMINOES$(IX,2)=GRIDX(ACX,DCX+1)) OR
(DOMINOES$(IX,2)=GRIDX(ACX,DCX) AND DOMINOES$(IX,1
)=GRIDX(ACX,DCX+1))) THEN FX=1
1230 NEXT IX
1240 IF FX=1 THEN VDU7:ENDPROC
1250 IX=0:REPEAT
1260 IX=IX+1
1270 UNTIL DOMINOES$(IX,1)=9
1280 DOMINOES$(IX,1)=GRIDX(ACX,DCX)
1290 IF DI$="A" THEN DOMINOES$(IX,2)=GRIDX(ACX+1
,DCX) ELSE DOMINOES$(IX,2)=GRIDX(ACX,DCX+1)
1300 ENDPROC
1310 DEF PROCFOUND
1320 REM+++Found-Move to Domino Posn+++
1330 MOVE 113+(ACX*100),990-(DCX*100)

```





```

1340 IF DI$="A" THEN PROCACROSS ELSE PROCDOWN
1350 ENDPROC
1360 DATA 0,0,0,1,0,2,0,3,0,4,0,5,0,6
1370 DATA 1,1,1,2,1,3,1,4,1,5,1,6
1380 DATA 2,2,2,3,2,4,2,5,2,6
1390 DATA 3,3,3,4,3,5,3,6
1400 DATA 4,4,4,5,4,6
1410 DATA 5,5,5,6
1420 DATA 6,6
1430 DEF PROCACROSS
1440 IF DEL$="Y" THEN VDU5,18,0,4 ELSE VDU5,18,0
,0
1450 PLOT1,178,0
1460 PLOT81,-178,-78
1470 PLOT81,178,0
1480 IF DEL$="Y" THEN VDU18,0,2:PLOT0,-89,78:PLD
T1,0,-78:VDU18,0,7
1490 DOTX=GRIDX(ACX,DCX)
1500 MOVE 125+(ACX*100),970-(DCX*100)
1510 PRINT;DOTX;
1520 PLOT0,-64,0
1530 IF DOTX>0 AND DEL$="N" THEN PROCDOT
1540 DOTX=GRIDX(ACX+1,DCX)
1550 MOVE 225+(ACX*100),970-(DCX*100)
1560 PRINT;DOTX;
1570 PLOT0,-64,0
1580 IF DOTX>0 AND DEL$="N" THEN PROCDOT
1590 VDU4,20
1600 ENDPROC
1610 DEF PROCDOWN
1620 IF DEL$="Y" THEN VDU5,18,0,4 ELSE VDU5,18,0
,0
1630 PLOT1,78,0
1640 PLOT81,-78,-178
1650 PLOT81,78,0
1660 IF DEL$="Y" THEN VDU18,0,2:PLOT0,-78,89:PLD
T1,78,0:VDU18,0,7
1670 DOTX=GRIDX(ACX,DCX)
1680 MOVE 125+(ACX*100),970-(DCX*100)
1690 PRINT;DOTX;
1700 PLOT0,-64,0
1710 IF DOTX>0 AND DEL$="N" THEN PROCDOT
1720 DOTX=GRIDX(ACX,DCX+1)
1730 MOVE 125+(ACX*100),870-(DCX*100)
1740 PRINT;DOTX;
1750 PLOT0,-64,0
1760 IF DOTX>0 AND DEL$="N" THEN PROCDOT
1770 VDU4,20
1780 ENDPROC
1790 DEF PROCDOT
1800 VDU20
1810 IF DI$="A" THEN PRINTCHR$(230+DOTX)
1820 IF DI$="D" AND (DOTX=1 OR DOTX=4 OR DOTX=5)
THEN PRINTCHR$(230+DOTX)
1830 IF DI$="D" AND (DOTX=2 OR DOTX=3 OR DOTX=6)
THEN PRINTCHR$(236+DOTX)
1840 VDU18,0,0

```

```

1850 ENDPROC
1860 DEF PROCREPEAT
1870 TX=TIME+1000:REPEATUNTIL TIME>TX
1880 CLS
1890 PRINTTAB(0,10)"WOULD YOU LIKE";TAB(0,12)"AN
OTHER GAME ";
1900 INPUT YN$
1910 YN$=LEFT$(YN$,1)
1920 IF YN$<>"Y" AND YN$<>"N" THEN GOTO 1900
1930 IF YN$="Y" THEN RUN
1940 ENDPROC
1950 DEF PROCDLTC
1960 GRIDX(ACX,DCX)=GRIDX(ACX,DCX)-10
1970 IF DI$="A" THEN GRIDX(ACX+1,DCX)=GRIDX(ACX+
1,DCX)-10 ELSE GRIDX(ACX,DCX+1)=GRIDX(ACX,DCX+1)-1
0
1980 PROCFOUND
1990 ENDPROC
2000 DEF PROCPATTERN
2010 CLS:PRINT""""Please wait while I invent
a new pattern""
2020 REPEAT
2030 FOR IX=1 TO 8:FOR JX=1 TO 7
2040 GRIDX(IX,JX)=9
2050 NEXT JX:NEXT IX
2060 FOR K=1 TO 7
2070 FOR I=1 TO 8
2080 IF GRIDX(I,K)<9 THEN GOTO 2270
2090 DX=RND(2)
2100 IF I=8 THEN DX=2
2110 IF K=7 THEN DX=1
2120 IF K=7 AND I<8 THEN IF GRIDX(I+1,K)<9 THEN
GOTO 2270
2130 IF I=8 AND K=7 THEN GOTO 2270
2140 IF DX=1 THEN IF GRIDX(I+1,K)<9 THEN GOTO 20
90
2150 IF DX=2 THEN IF GRIDX(I,K+1)<9 THEN GOTO 20
90
2160 AX=RND(28):BX=RND(2)
2170 IF DOMINOES$(AX,BX)=9 THEN GOTO 2160
2180 GX=GX+1
2190 GRIDX(I,K)=DOMINOES$(AX,BX)
2200 IF DX=1 THEN AC$="A" ELSE AC$="D"
2210 IF VERSIONX=1 THEN PATTERN$(GX)=STR$(I)+STR
$(K)+AC$ ELSE PATTERN$(GX)="@@@"
2220 DOMINOES$(AX,BX)=9
2230 IF BX=1 THEN BX=2 ELSE BX=1
2240 IF DX=1 THEN GRIDX(I+1,K)=DOMINOES$(AX,BX)
2250 IF DX=2 THEN GRIDX(I,K+1)=DOMINOES$(AX,BX)
2260 DOMINOES$(AX,BX)=9
2270 NEXT I
2280 NEXT K
2290 FLGX=0
2300 FOR K=1 TO 7
2310 FOR I=1 TO 8
2320 IF GRIDX(I,K)=9 THEN FLGX=1
2330 NEXT I
2340 NEXT K
2350 GX=0:RESTORE
2360 FOR IX=1 TO 28:FOR JX=1 TO 2
2370 READ DOMINOES$(IX,JX)
2380 NEXT JX:NEXT IX
2390 UNTIL FLGX=0
2400 VDU23,29194;0;0;0;
2410 ENDPROC
2420 DEF PROCTITLE
2430 VDU23,8202;0;0;0;
2440 FOR IX=1 TO 2
2450 PRINTTAB(1,6+IX);CHR$(141);"Domgrid"
2460 NEXT IX
2470 PRINTTAB(21,20);"Mike Berry"
2480 T=TIME+500:REPEATUNTIL TIME>T
2490 ENDPROC

```

# Tank Battle

F.J.E. McPherson

This game is about 4K long and will run on a model B, 32K model A or Electron.

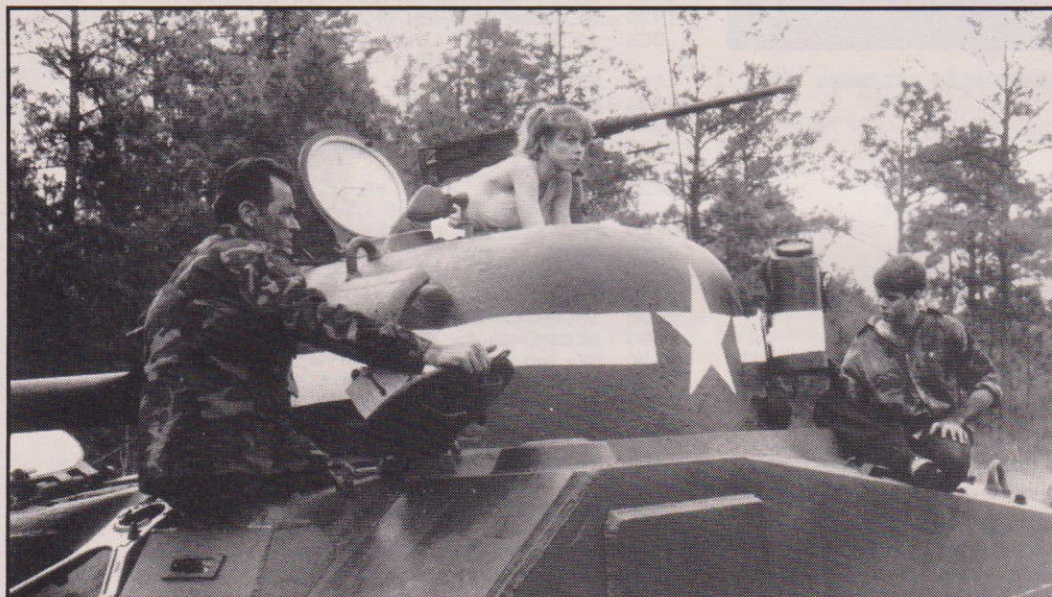
The game involves two players who have to control their tanks around the screen, each trying to notch up over 1000 pts., they do this by getting 10 pts. for each tree they hit and 250 pts. for hitting their opponent. They are obstructed by trees and walls

**Two tearaway tanks trying to outmanoeuvre their deadly opponent. And you are the tank commander.**

which they must go around, and which their bullets will not go through. By pressing ESCAPE the game can be restarted.

## MAIN VARIABLES

X% & Y%: Co-ordinates of player two's tank.  
M% & N%: Shows which way player two's tank is facing.  
C%: Character number of player two's tank.  
D% & F%: Co-ordinates of player one's tank.  
T% & U%: Shows which way player one's tank is facing.  
V%: Character number of player one's tank.  
R% & S%: Co-ordinates of player two's bullet.  
O% & P%: Direction of player two's bullet.  
G% & H%: Co-ordinates of player one's bullet.  
I% & J%: Direction of player one's bullet.  
K%: Player one's score.  
L%: Player two's score.



## HOW IT WORKS

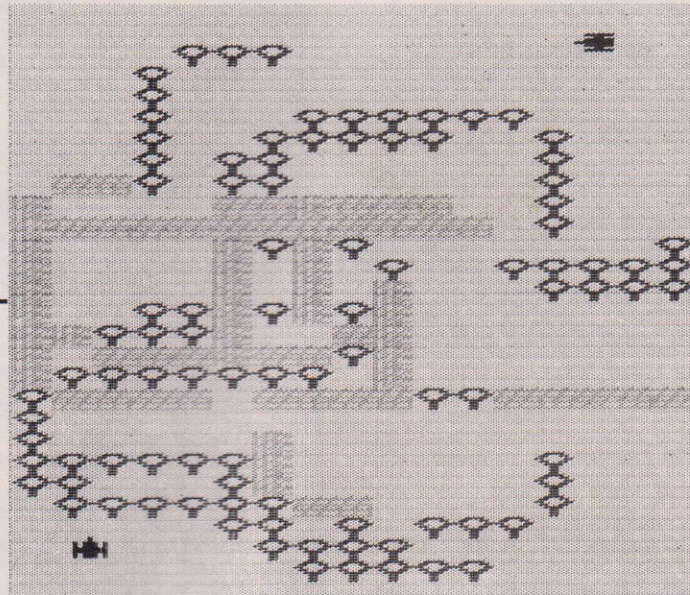
- LINES 10-140** : Calls up all the procedures in the right order.
- PROCcharset** : Defines all the characters needed.
- PROCsetup** : Sets up colours and variables.
- PROCmove** : Main procedure that moves tanks and bullets around the screen and makes relevant sound.
- PROCwon** : Says which player has won and asks the players if they want another game.
- PROClandscape** : Draws the walls and trees randomly on the screen.
- FNx & FNy** : Changes text co-ordinates to graphics co-ordinates.
- PROCintro** : Prints up the introduction and controls needed.
- PROctitle** : Prints, in the middle of the chosen line (L), a chosen string (W\$) in double height.
- PROCd** : Prints "Press any key to continue", and then waits for a key to be pressed before continuing.
- PROCerror** : This traps any errors and prints up the error and where it is located, unless it is the ESCAPE key that has caused the error.

## PROGRAM LISTING

```

10 ON ERROR MODE7:PROCerror
20 MODE7
30 PROCintro
40 MODE2
50 VDU 23;8202;0;0;0;
60 *FX11,0
70 PROCcharset
80 PROClandscape
90 PROCsetup
100 PROCmove
110 MODE7
120 VDU 23;8202;0;0;0;
130 PROCwon
140 END
150 :
160 :
170 DEF PROCcharset
180 FOR Q%=225 TO 240
190 READ Q,W,E,R,T,Y,U,I
200 VDU 23,Q%,Q,W,E,R,T,Y,U,I
210 NEXT
220 :
230 ENDPROC
240 DATA 16,16,186,186,254,254,186,186
250 DATA 9,22,63,125,190,124,40,16
260 DATA252,48,252,255,252,48,252,0
270 DATA16,40,124,190,125,63,22,9

```

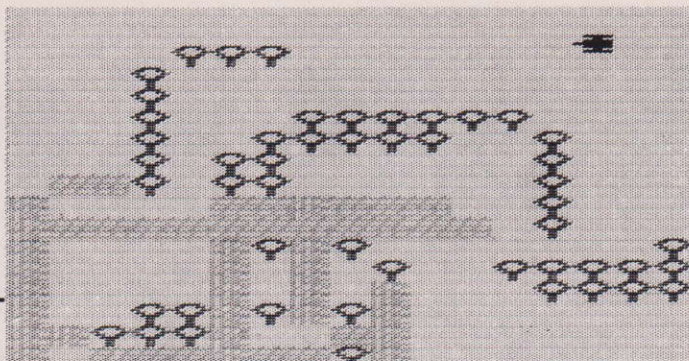


```

280 DATA186,186,254,254,186,186,16,16
290 DATA8,20,62,125,190,124,104,144
300 DATA0,63,12,63,255,63,12,63
310 DATA144,104,124,190,125,62,20,8
320 DATA60,102,195,102,60,24,24,24
330 DATA0,0,195,102,60,24,24,24
340 DATA0,0,0,0,60,24,24,24
350 DATA0,0,0,0,0,0,0,0
360 DATA36,255,73,255,146,255,36,255
370 DATA146,255,36,255,73,255,73,255
380 DATA188,175,235,188,175,235,188,175
390 DATA235,188,175,235,188,175,235,188
400 :
410 :
420 DEF PROCsetup
430 VDU 20
440 ENVELOPE 3,4,10,20,-30,10,10,10,127,0,0,-7,1
26,126
450 FOR QX=10 TO 13
460 VDU 19,QX,4,0,0,0
470 NEXT
480 VDU 19,1,6,0;0,19,0,4,0,0,0
490 VDU 19,6,1,0,0,0
500 X%=160:Y%=160:M%=0:N%=1:C%=225
510 D%=960:F%=912:T%=-1:U%=0:V%=231
520 R%=-20:S%=-20:O%=0:F%=0
530 G%=-20:H%=-20:I%=0:J%=0
540 P1%=0:P2%=0:P3%=0:P4%=0
550 A1%=0:W1%=0
560 K%=0:L%=0
570 ENDPROC
580 :
590 :
600 DEF PROCmove
610 VDU5
620 REPEAT
630 GCOL 0,P1%+128
640 PLOT 71,R%,S%
650 GCOL 0,P2%+128
660 PLOT 71,G%,H%
670 GCOL 0,128
680 IF INKEY(-74) AND R%<0 THEN O%=M%:P%=N%:R%=X
%+32:S%=Y%-16:ENVELOPE1,2,32,-3,150,7,80,30,127,0,
0,-3,126,126:SOUND 1,1,0,1
690 IF INKEY(-82) AND G%<0 THEN I%=T%:J%=U%:G%=D
%+32:H%=F%-16:ENVELOPE2,3,32,-3,150,4,40,20,127,0,
0,-3,126,126:SOUND 2,2,0,1
700 G%=G%+I%*64:H%=H%+J%*32
710 R%=R%+O%*64:S%=S%+P%*32
720 P1%=POINT(R%,S%):P2%=POINT(G%,H%)
730 P3%=POINT(R%-O%*32,S%-P%*16):P4%=POINT(G%-I%
*32,H%-J%*16)
740 IF P1%=6 OR P3%=6 THEN R%=-20:O%=0:P1%=6:P3%
=6
750 IF P2%=6 OR P4%=6 THEN G%=-20:I%=0:P2%=6:P4%
=6
760 GCOL 0,7
770 PLOT 69,R%,S%
780 PLOT 69,G%,H%
790 IF P1%=3 OR P3%=3 THEN L%=L%+250:VDU4:COLOUR
2:PRINT TAB(0,0);L%:VDU 5:R%=-20:O%=0:ENVELOPE 1
,1,42,-84,42,50,50,50,127,0,0,-1,126,126:SOUND 1,1
,200,1
800 IF P2%=1 OR P4%=1 THEN K%=K%+250:VDU4:COLOUR
3:PRINT TAB(15,0);K%:VDU 5:G%=-20:I%=0:ENVELOPE
1,1,42,-84,42,50,50,50,127,0,0,-1,126,126:SOUND 1,
1,0,1
810 IF P2%>10 THEN COLOUR P2%+127:COLOUR 2:VDU4:
PRINT TAB(FNx(G%),FNy(H%));CHR$(237-(P2%-10)):G%=-
20:I%=0:SOUND 0,3,0,1:K%=K%+10:COLOUR 3:PRINT TAB(
15,0);K%:VDU5
820 IF P2%=2 THEN P2%=POINT(G%+16,H%):G%=G%+8:GO
TO 810
830 IF P1%>10 THEN COLOUR P1%+127:COLOUR 2:VDU4:
PRINT TAB(FNx(R%),FNy(S%));CHR$(237-(P1%-10)):R%=-
20:O%=0:SOUND 0,3,0,1:L%=L%+10:PRINT TAB(0,0);L%:
VDU 5
840 IF P1%=2 THEN P1%=POINT(R%+16,S%):R%=R%+8:GO
TO 810
850 COLOUR 128
860 GCOL 0,0
870 COLOUR 0
880 MOVE X%,Y%:VDU CX-A%+A1%
890 MOVE D%,F%:VDU VX-W%+W1%
900 COLOUR 7
910 PLOX=POINT(X%+M%*64+32,Y%+N%*32-16):IF PLOX<
>0 AND (PLOX<7 OR PLOX>10) THEN 940
920 Y%=Y%+(-(INKEY(-1)*N%*16))
930 X%=X%+(-(INKEY(-1)*M%*32))
940 PLOX=POINT(D%+T%*64+32,F%+U%*32-16):IF PLOX<
>0 AND (PLOX<7 OR PLOX>10) THEN 970
950 F%=F%+(-(INKEY(-98)*U%*16))
960 D%=D%+(-(INKEY(-98)*T%*32))
970 GCOL 0,1
980 MOVE X%,Y%:VDU CX
990 GCOL 0,3
1000 MOVE D%,F%:VDU VX
1010 A%=(INKEY(-103)-INKEY(-104))
1020 W%=(INKEY(-65)-INKEY(-2))
1030 CX=CX+A%
1040 VX=VX+W%
1050 A1%=0:W1%=0
1060 IF VX>232 THEN VX=225:W1%=8
1070 IF CX>232 THEN CX=225:A1%=8
1080 IF VX<225 THEN VX=232:W1%=-8
1090 IF CX<225 THEN CX=232:A1%=-8
1100 IF AX<>0 THEN M%=SGN((SIN(RAD(CX-225)*45)*5)
DIV 1):N%=SGN((COS(RAD(CX-225)*45)*5) DIV 1)
1110 IF WX<>0 THEN T%=SGN((SIN(RAD(VX-225)*45)*5)

```

CONTINUED OVER



```

DIV 1):UX=SGN((COS(RAD(V%-225)*45)*5) DIV 1)
1120 UNTIL KX>1000 OR LX>1000
1130 *FX15,0
1140 ENDPROC
1150 :
1160 :
1170 DEF PROCwon
1180 ENVELOPE 2,3,-8,4,8,32,32,16,127,0,0,-1,126,
126
1190 ENVELOPE 1,3,8,-4,-8,32,32,16,127,0,0,-1,126,
126
1200 SOUND 2,1,0,1
1210 SOUND 1,2,0,1
1220 IF LX>1000 THEN X$="2" ELSE X$="1"
1230 PROCtitle(CHR$129+"Player "+X$+" won",11)
1240 PROCd
1250 PROCtitle(CHR$131+"Do you want another game?
",11)
1260 A$=GET$
1270 IF A$="N" OR A$="n" THEN CALL &DBBE
1280 IF A$<>"Y" AND A$<>"y" THEN VDU 7:GOTO 1250
1290 RUN
1300 END
1310 ENDPROC
1320 :
1330 :
1340 DEF PROClandscape
1350 FOR QX=1 TO 14
1360 VDU 19,QX,0,0,0;
1370 NEXT
1380 VDU 4
1390 COLOUR 6
1400 COLOUR 128
1410 FOR QX=0 TO 18 STEP2:PRINT TAB(QX,1);CHR$237
;CHR$238:PRINT TAB(QX,30);CHR$237;CHR$238;:NEXT
1420 FOR QX=1 TO 29:PRINT TAB(0,QX);CHR$240:PRINT
TAB(19,QX);CHR$240:NEXT
1430 COLOUR 2
1440 COLOUR 141
1450 FOR QX=1 TO 20
1460 X%=RND(18):Y%=RND(26)+2
1470 IF X%<9 THEN FOR W%=1 TO RND(6):PRINT TAB(X%
+W%,Y%);CHR$233:NEXT ELSE FOR W%=1 TO RND(6):PRINT
TAB(X%-W%,Y%);CHR$233:NEXT
1480 IF Y%<15 THEN FOR W%=1 TO RND(6):PRINT TAB(X
%,Y%+W%);CHR$233:NEXT ELSE FOR W%=1 TO RND(6):PRIN
T TAB(X%,Y%-W%);CHR$233:NEXT
1490 NEXT
1500 COLOUR 6
1510 COLOUR 128
1520 FOR QX=1 TO 10
1530 X%=RND(18):Y%=RND(26)+2
1540 IF X%<9 THEN FOR W%=1 TO RND(6) STEP2:PRINT
TAB(X%+W%,Y%);CHR$237;CHR$238:NEXT ELSE FOR W%=1 T
O RND(6) STEP2:PRINT TAB(X%-W%,Y%);CHR$237;CHR$238
:NEXT
1550 IF Y%<15 THEN FOR W%=1 TO RND(6):PRINT TAB(X
%,Y%+W%);CHR$239:NEXT ELSE FOR W%=1 TO RND(6):PRIN
T TAB(X%,Y%-W%);CHR$239:NEXT
1560 NEXT
1570 ENDPROC
1580 :
1590 DEF FNx(BX)=BX DIV 64

```

```

1600 :
1610 DEF FNY(Z%)=31-(Z% DIV 32)
1620 :
1630 :
1640 DEF PROCintro
1650 VDU 23;8202;0;0;0;
1660 CLS
1670 PROCtitle(CHR$129+"** Tank Battle **",7)
1680 PRINT TAB(5,12);CHR$132;"written by"
1690 PROCtitle(CHR$131+STRING$(5," ")+"James McPh
erson",13)
1700 PRINT TAB(5,17);CHR$132;"designed by"
1710 PROCtitle(CHR$131+STRING$(5," ")+"Gareth Jon
es",18)
1720 PROCd
1730 PROCtitle(CHR$130+"Tank Battle",0)
1740 PRINT "CHR$134;" In this game there are
2 players.";CHR$134;"Their objective is to get o
ver 1000"CHR$134;"points."
1750 PRINT "CHR$133;" To do this they can gai
n 10 pts for"CHR$133;"every tree they hit and 250
pts for"CHR$133;"shooting their opponent."
1760 PROCtitle(CHR$136+CHR$131+"GOOD LUCK",16)
1770 PROCd
1780 PROCtitle(CHR$131+"Tank Battle",0)
1790 PROCtitle(CHR$134+"CONTROLS",3)
1800 PRINT "CHR$129;" Player 1 Player 2"
1810 PRINT "CHR$130;" <CAPS LOCK> < ro
tate left"
1820 PRINT "CHR$131;" <CTRL> > ro
tate right"
1830 PRINT "CHR$132;" Z <SHIFT> mo
ve forward"
1840 PRINT "CHR$133;" S <RETURN> fi
re"
1850 PRINT "CHR$129;" Please wait a short whi
le after"CHR$129;"pressing a key for the screen t
o be set"CHR$129;"up."
1860 PROCd
1870 ENDPROC
1880 :
1890 :
1900 DEF PROCtitle(W$,L)
1910 FOR QX=L TO L+1
1920 PRINT TAB(17-LEN(W$)/2,QX);CHR$141;W$
1930 NEXT
1940 ENDPROC
1950 :
1960 :
1970 DEF PROCd
1980 *FX15,0
1990 PRINT TAB(5,23);CHR$132;CHR$136;"Press any k
ey to continue"
2000 A=GET
2010 CLS
2020 ENDPROC
2030 :
2040 :
2050 DEF PROCerror
2060 IF ERR=17 THEN ENDPROC
2070 *FX15,0
2080 PRINT TAB(0,10);:REPORT:PRINT ;" at line ";E
RL
2090 *FX11,50
2100 END
2110 ENDPROC

```

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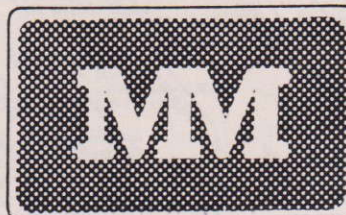
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TRACTOR	62.00	71.30
SHEETFEEDER	185.00	212.75
KEYBOARD	135.00	155.25
EPSON RX80T	195.00	224.25
EPSON RX80F/T	220.00	253.00
EPSON FX80F/T	320.00	368.00
EPSON FX100F/T	465.00	534.75
EPSON RX100F/T	350.00	402.50
FX80 TRACTOR	30.00	34.50
JUKI 6100	325.00	373.75
MANNESMANN TALLY MT80	199.00	228.85
NEC 2050 (IBM PC)	725.00	833.75
OKI MICROLINE 82A	255.00	293.25
OKI MICROLINE 83A	395.00	454.25
OKI MICROLINE 92P	379.00	435.85
SEIKOSHA GP100A	165.00	189.75
SHINWA CP80	175.00	201.25
STAR GEMINI 10X	199.00	228.85
<b>COMPUTERS</b>		
COMMODORE 64	152.17	174.99
COMMODORE 1541 DISK	165.21	189.99
COMMODORE C2N CASSETTE	32.00	36.80
INTFACE 64-PARALLEL	59.50	68.43
APRICOT 2'D+MON	1,425.00	1,638.75
APRICOT 10MB	2,295.00	2,639.25
SANYO MBC555	795.00	914.25
EPSON QX10	1,600	1,840.00
STAR DELTA 10	329.00	378.35

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A&amp;B COMPUTING OCTOBER 1984

Asteroid Miner	Gm	Optima	B	C	OP	£8.95
Astro Navigator	Gm	Micro Power	B	C	GK	£6.95
Astrowars	Gm	Simonsoft	B	C	SI	£6.95
Atlantis	Gm	IJK Software	B	C	IT	£6.95
Atomic Protector	Gm	Optima	B	C	OP	£8.95
Atom Smasher	Gm	Romik	B,E	C	RO	£6.99
Another	Ed	Davy Computing	B	D	DA	£30.00 + VAT
Aviator	Gm	Acornsoft	B	C,D	AL	£14.95, £17.65
Awari	Gm	Foilkade	B	C	NR	£5.95
Backgammon	Ut	Bug Byte	B	C	BB	£8.00
Baillif	Ed	Sulis	B	C	SU	£9.95
Balance Your Diet	Ed	Cambridge Micro	B	C,D	CM	£13.95 + £1.62
Ballard	Ed	Ed.Soft	B	C	ES	£3.00
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Balloons	Gm	C J E Micros	B	C	NV	£6.00
Bandits at 3 O'Clock	Gm	Micro Power	B,E	C	GK	£6.95
Bank	Ed	Primary	B	C,D	PP	£5.95, £7.95
Bank Statement	Ed	Scholar	B	C,D	SC	£6.00, £8.00
Barset and Barpic	Ed	Longman	B	C,D	LM	£14.50 + VAT
Barrage	Ed	Micro Power	B	C	GK	£7.95
Base 10	Ed	Dial	B	C,D	DL	£4.95, £6.50
BASIC Compiler	Ut	Ack	B	C,D	AC	£14.95, £19.95
BASIC Environment	Ut	Harris	B	D	HM	£14.50
Basic Goodies	Ut	Simonsoft	A,B	C	MS	£5.95
Basic Maths	Ed	Aztec S/W	A,B	C	IB	£3.00
Basic Number Help	Ed	Longman	B	C,D	LM	£9.95, £12.95
Basic Statistics	Bs	Micropak	B	C	MP	£7.95
Battlezone Six	Gm	Kansas	B	C	KA	£9.50
Battlezone 2000	Gm	Lothlorien	B	C	LO	£6.95
Battle Tank	Gm	Superior Software	B	C	SE	£7.95
BBC Artfun	Do	R.H. Electronics	B	C	RH	£9.95
BBC Kaleidoscope	Ed	Dial	B	C	DL	£8.50
BBC Logo	Ed	Dial	B	C,D	DL	£6.50, £8.00
BBC Octuplet	Ed	Dial	B	C	DL	£8.50
Beebart	Ut	Quicksilva	B	C	QS	£14.95
Banner	Do	Micro-Aid	A,B	C	IZ	£2.95
Beamscan	Bs	Beamscan	B	C,D	BS	£40.45
Beat the Bug (Molecule)	Gm	Bridge	B	C	BR	£6.90
Beat the Clock	Ed	Arnold-Wheaton	B	C,D	AW	£15 + VAT
Bed Bugs	Gm	Optima	B	C	OP	£8.95
Bee Base	Ut	GCC	B	E	GL	£45.94
Beeb-Chase	Ut	Database Software	B	C	NU	£7.50
Beebmunch	Gm	I.J.K. S/W	B	C	IJ	£5.95
Beebtrek	Gm	Software for All	A,B	C	KN	£7.95
Bells	Ed	Dial	B	C,D	DL	£4.95, £6.50
BEEP-BEEB	Gm	IJK	B	C	IJ	£3.95
Beep-Beeb (Super Simon)	Gm	IJK Software	B	C	IJ	£4.50
Beebcalc	Bs	Gemini	B	C	GM	£19.95
Beebmon	Ut	Micro Power	A,B	C	GK	£7.95
Beebplot	Bs	Gemini	B	C	GM	£19.95
Beeboids	Gm	Odyssey	A,B	C	OG	£2.75
Beebon Mon	Ut	McKeran	A,B	C	MK	£2.00
Beebsynth	Ut	Clares	A,B	C	CL	£7.95
Beeb-Tote	Gm	Micro Power	B	C	GK	£5.95
Beefeater	Ed	Sulis	B	C	SU	£7.95
Bertie Bear	Ed	Dial	B	C,D	DL	£4.95, £6.50
Besieged	Ed	Sulis	B	C	SU	£9.95
Beyond Basic	Ed	BBC/NEC	A,B	C	KB	£7.25
Billiards	Gm	H and H Software	B	C	HH	£8.50
Birds of Prey	Gm	Romik	B,E	C	RO	£6.99
Bismark	Gm	ASP Software	B,E	C	AS	£6.99
Blogger	Gm	Alligata	B,E	C	SY	£7.95
Blockbuster	Gm	Micro Power	B	C	GK	£7.95
Blockfit	Ed	System	B	D	SY	£46.00
Boat Race	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00
Blackjack/Textpro	Gm	Software Invasion	B	C	IS	£6.95
Boeing 767	GM	Flightdeck	B	C	FL	£7.67

## SOFTWARE SUPPLIERS

Supplier  
Code

**AA** Anthony Aspitel Software  
Systems  
56 London Road  
Harleston  
Norfolk  
IP20 9BZ

**AB** ABC Primary  
19 Crumstone Court  
Longmeadow Estate  
Killingworth  
Newcastle Upon Tyne

**AC** ACK Data  
21 Salcombe Drive  
Nottingham NG5 8JF

**AD** Dial Software  
72 Downend Road  
Downend  
Bristol

**AG** Superior Systems Ltd  
178 West Street  
Sheffield WS1 4ET

**MO** Molimerx Ltd  
1 Buckhurst Road  
Town Hall Square  
Bexhill-on-sea  
East Sussex

**AJ** AJ Software  
61 Jeddo Road  
London W1Z 9ED

**AK** A.S.K. Ltd  
London House  
68 Upper Richmond Road  
London SW15 2RP

**AL** Acornsoft Ltd  
4a Market Hill  
Cambridge CB2 3NJ

**AM** Microplus Software  
6 Litton Way  
Leeds

**AN** Addison-Wesley  
53 Bedford Square  
London WC1B 3DZ

**AO** Amcom  
23 Hivings Hill  
Chesham  
Bucks HP5 2PG

**AP** Processor Applications  
22 Mercer Close  
Basingstoke  
Hants

**AS** ASP Software  
Number One Golden Square  
London W1R 3AB

**AV** A J Vision Service Ltd  
61 Jeddo Road  
London W12 9ED

**AW** Arnold-Wheaton Software  
Software Publishing Division  
Parkside Lane  
Leeds LS11 5TD

**BB** Bug-Byte  
Mulberry House  
Canning Place  
Liverpool L1 8JB

**BE** Beebugsoft  
PO Box 109  
High Wycombe  
Bucks HP11 2TD

**BK** BAKsoft  
34 Humberstone Road  
Cambridge

**BM** Blue Moon Software Co.  
Freepost  
Swanley  
Kent BR8 7UY

**BO** Bourne Educational Software  
Headbourne Worthy  
Winchester  
Hants SO23 7SQ

**BR** Bridge Software  
36 Fernwood  
Marple Bridge  
Stockport  
Cheshire SK6 5BE

**BS** Beamscan  
20 Vaughan Avenue  
Hendon  
London NW4 4HU

**BU** Busco  
16 Colwill Walk  
Mainstone  
Plymouth

**CA** Carvells  
3/7 Bank Street  
Rugby

**CR** Carswell Computers  
Carswell Barn  
Faringdon  
Oxon SN7 8JN

**CD** Carsondale Enterprises Ltd  
44 Kingsway  
Stoke-on-Trent  
Staffordshire  
ST4 1JH

**CG** Challenge Games  
64 Ferndale Road  
London E11

**CH** Chalksoft Ltd  
37 Willowslea Road  
Worcester WR3 7QP

**CL** Clwyd Technics Ltd.,  
Microprocessor Centre  
Coach House  
Kelsterton Road  
Flint  
Clwyd CH6 5TH

**CR** Computer Rentals Ltd  
CRL House  
9 Kings Yard  
Carpenters Road  
London E15 2HO

**CS** Cylindrical Software  
177 College Road  
Moseley  
Birmingham B13 9LJ

**CS** Stable Software  
Compton Street  
Compton  
Nr Winchester  
Hants

**CT** Cottage Software  
Heather Cottage  
Selly Hill  
Whitby  
North Yorkshire

**CU** Level 9 Computing  
229 Hughenden Road  
High Wycombe  
Buckinghamshire HP13 5PG

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Title	Type	Manufacturers	Memory	Software Supplier	Price
Bomb Alley	Gm	Software Invasion	B C	IS	£7.95
Bomber Scramble	Gm	Kansas	B C	KA	£9.50
Bounce	Gm	Computercat	A,B C	CC	£4.95
Bouncers	Gm	A&F	B C	GE	£8.00
Bounty Pirates	Gm	Aztec S/W	A,B C	IB	£5.50
Boris in the Underworld	Gm	Superior	B C	SE	£7.95
Boxes/Maze	Ed	Primary	B C,D	PP	£5.95, £7.95
Brain Teasers	Gm	Dynabyte	A,B C	DB	£5.95
Break-in	Ed	Highlight	B C,D	HI	£6.00, £7.00
Break-Up	Gm	Miking S/W	B C	KC	£3.95
Breakout	Gm	I.J.K. S/W	A,B C	IJ	£3.95
Breakout	Gm	Bryants S/W	B C	HW	£3.75
Brick 'em in	Gm	Software For All	B C	KN	£6.95
Bridge to the East	Gm	Ixion	B C	IN	£8.05
Bridgeman	Gm	Bridge	B C	BR	£6.90
Budget	Bs	Micropax	B C	MP	£7.95
Budget-Multiproduct	Bs	Micropax	B C	MP	£12.95
Budget-Multiproduct	Bs	Micropax	B D	MP	£25.00
Bugblaster	Gm	Alligata	B,E C	SY	£7.95
Bug Bomb	Gm	Virgin Games	B C	VG	£7.95
Bumble Bee	Gm	Micro Power	B C	GK	£7.95
Business Game	Ed	Acornsoft	A,B C	AL	£9.95, £9.20
Bun Fun	Gm	Squirrel Software	A,B C	SS	£6.50
Caesar the Cat	Es	Mirror	B C	MR	£6.95
CaLIGNA -	Gm	Golden Challenge	B C,D	GC	£7.95, 10.00
Canyon	Gm	BBC Pubs	B C	KB	£10.00
Capitals	Ed	Edsoft	B C	ES	£5.95
Capitals and Punctuation	Ed	RJE Software	A,B C	RJ	£4.95
Carbohydrate Metabolism	Ed	Garland Comp.	B C	JX	£18.24
Careers Analysis	Ed	Arnold-Wheaton	B D	AW	£155 + VAT
Careers Information	Ed	Arnold-Wheaton	B D	AW	£45 + VAT
Car Journey	Ed	Heinemann	B C	HE	£9.25 + VAT
Caplett 1	Ed	Scholar	B C,D	SC	£7.00, £9.00
Caplett 2	Ed	Scholar	B C,D	SC	£5.50, £7.50
Carousel	Gm	Acornsoft	B C	AL	£9.95
Car Race	Gm	Kingfisher	B C	KF	£6.90
Cashbook Accounts	Bs	Gemini	B C	GM	£59.95
Cashbook	Do	Micro-Aid	B C	IZ	£5.95
Cashbook	Do	Micro-aid	A,B C	IZ	£13.95
Cassette 99	Ed	Ludinski CAL	A,B C	KA	£5.00
Castaway	Gm	Simonsofy	B C,D	SI	£8.95
Castle of Riddles	Gm	Acornsoft	B C	AL	£9.95
Catalog	Bs	Dialog	B C/D	DG	£19.50
Catalogue	Ut	Baksoft	A,B C	BK	£4.00
Cat and Mouse	Ed	Kingfisher	A,B C	KF	£6.90
Cat & Mouse	Gm	Micro Power	A,B C	GK	£4.95
Catchapple	Ed	Kingfisher	A,B C	KF	£6.90
Caveman Adventure	Gm	Program Power	B C	GK	£6.95
Caves of Anoran	Gm	FBC Systems	B C	FB	£7.00
Cells & Serpents	Gm	ASP Software	B,E C	AS	£6.99
Cells & Serpent	Gm	Hexagon S/W	A,B C	JA	£5.00
Centibug	Gm	Superior	B,E C	SE	£7.95
Central Heating	Ed	Heinemann	B C	HE	£9.25 + VAT
Cesil	Ed	Dial	B C,D	DL	£6.50, £8.00
CESSCIL	Ed	Eduquest	A,B C	NW	£19.95
Cesil Interpreter	Ed	Computersmith	B C	LC	£15.00
Challenger	Gm	Joe the Liar	B C	JL	£7.45
Character Shapemaker	Ut	Square	B C	SQ	£7.00
Chargen	Ut	Busco	A,B C	BU	£3.95
Chargen and Demo	Ut	Rainbow Research	B C	RR	£8.50
Character Builder	Ut	Davenport	A,B C	NX	£4.95
Character Definer	Ut	A.J.	B C,D	AJ	£9.95
Character Enlarger	Ut	Cylindrical Software	A,B C	CS	£3.95
Character Orientating	Ut	Cylindrical Software	A,B C	CS	£3.95
Character Generator	Ut	MP S/W	B C	JZ	£3.00
Character Generator	Ut	Software for All	B C	KN	£4.95
Characters	Ut	Computer Concepts	A,B C	GJ	£6.67
Characters & Envelope	Ut	Electronics	B C	IF	£5.50
Definer	Ut	Applied	B C	SY	£9.00
Chard	Ut	System	A,B C	OG	£4.50
Chargen	Ed	Odyssey	B C	AL	£13.80
Chemical Analysis	Ed	Acornsoft	B C	CM	£15.00 + VAT
Chemical Collisions	Ed	Cambridge Micro	B D	AL	£13.80
Chemical Simulations	Ed	Acornsoft	B C	AL	£13.80
Chemical Structures	Ed	Micro Power	B,E C	GK	£6.95
Chemistry	Gm	Micro Power	A,B C	GK	£5.95
Chess	Gm	Micro Power	B,E C	GK	£7.95
Chess	Gm	Acornsoft	B,E C	AL	£9.95
Chess	Gm	Bug Byte	B C	EA	£11.50
Children From Space	Ed	A.S.K.	B C	AK	£9.95
Childs Play Pack	Ed	Dial	B C,D	DL	£6.50, £8.00
CHI-Squared	Bs	Micropax	B C	MP	£7.95
CHI-Squared, contingency tables	Bs	Micropax	B C	MP	£7.95
Chords	Ed	Aztec	A,B C	AZ	£6.50
Christmas Carols	Do	Ega Beva	B C	EB	£9.95
Circle Tutor	Ed	Pee Bee	B C,D	PB	£9.95, £12.45
Circus	Gm	Digital Fantasia	B C	NT	£8.95
City Defense	Gm	Bug-Byte	B C	BB	£7.50
Classification (In)vertebrates	Ed	Scholar	B C,D	SC	£6.00, £8.00
Claws	Ed	Bryants S/W	A,B C	HW	£3.75
Clone Ranger	Ut	J.C. Software	B D	JS	£11.60
Cloze	Ed	GED Software	B C	GD	£4.50
Cloze Procedure	Ed	Bryants S/W	A,B C	HW	£4.85
Code Breaker	Gm	Program Power	A,B C	GK	£4.95
Code-Breaker	Ed	RJE Software	A,B C	RJ	£4.95
Collectors Catalogue	Do	Acornsoft	B C	AL	£9.95
Code Race	Ut	Computer Concepts	B C	GJ	£6.67
Coin Analysis	Bs	Micro-Aid	B C	IZ	£4.95
Colditz Adventure	Gm	Superior Software	B C	SE	£7.95
Colossal Adventure	Gm	Level 9 Computing	B C	CU	£9.90
Colour Snap	Ed	Ega Beva	B C	EB	£11.95
Comatch	Ed	Clares	A,B C	CL	£4.95
Commercial Accounts	Bs	Gemini	B C	GM	£19.95
Commstar	Ut	PACE	B R	PA	£34.00
Community	Gm	Ixion	B C	IN	£6.90
Compass	Ed	GED Software	B C	GD	£4.50
Compendium	Gm	Computercat	B C	CC	£5.95
Complete Machine Code Tutor	Ed	New Generation	B C	NG	£14.95
Comput Applications Project	Ed	Addison-Wesley	B D	AN	£70.00
Connect 4	Gm	Database Software	B C	NU	£5.90
Conquering Everest	Gm	ASP Software	B,E C	AS	£6.99
Constellation	Ed	Micro Power	B C	GK	£6.95
Constellation	Do	Superior	E C	SE	£7.95
Contours/Places	Ed	Primary	B C,D	PP	£5.95, £7.95
Co-ordinates	Ed	Primary	B C,D	PP	£5.95, £7.95
Contract Bridge	Gm	Alligata	B C	SY	£9.95
Contribution Analysis	BS	Micropax	B C	MP	£7.95
Cookbook Wizardry	Do	Database Software	B C	NU	£7.50
Copy Disc	Ut	A.J.	B C	AJ	£5.95
Corn Cropper	Gm	Cases	A,B,E C	CE	£6.95
Corporate Climber	Gm	Dynabyte	B,E C	DB	£7.95
Cosmic Asteroids	Gm	Alligata	B C	AG	£4.95
Cosmic Combat	Gm	Micro Power	B C	GK	£6.95
Cosmic Fighters	Gm	Kansas	B C	KA	£9.50
Cosmic Kidnap	Gm	Superior	B C	SE	£7.95
Coucapur	Ed	Ed. Soft	B C	ES	£4.95
Countdown to Doom	Gm	Acornsoft	B C,R	AL	£9.95
Counter Attack	Gm	OIC	B C	OI	£6.50
Counting	Ed	Clares	A,B C	CL	£4.95
Counting	Ed	Cottage Software	B C	CT	£9.50
County (SW/SM)	Ed	Bryants	A,B C	HW	£4.85
Cowboy Shoot-out	Gm	Micro Power	B C	GK	£5.95
Cranky	Ed	A.S.K.	B C	AK	£9.95



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Crazy Cut  
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Creating a Monster/Word  
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Cylon Attack  
Dairy Farmer

Dallas  
Dambusters  
Danger! UXB  
Dap 1  
Dap 2

Dare Devil Dennis

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Gm	Silversoft	B	C	SV	£6.95
Gm	R.H. Electronics	B	C	RH	£8.95
Gm	Superior Software	B	C	SE	£7.95
Ed	Heinemann	B	C	HE	£9.25
Ut	Acornsoft	B,E	C	AL	£9.95
Gm	SJG Soft	B	C	SJ	£7.50
Do	Acornsoft	B,E	C	AL	£12.65
Gm	Program Power	B,E	C	GK	£9.95
Ed	Bryants	A,B	C	HW	£4.85
Ed	Aztec S/W	A,B	C	IB	£6.50
Ed	Oxhey Tutors	B	C	OT	£6.50
Ed	Ed. Soft	B	C	ES	£5.95
Gm	Acornsoft	B	C	AL	£9.95
Gm	Merlin	B	C	MN	£7.95
Do	Dial	B	C,D	DL	£4.95,
					£6.50
Ed	MP Software	B	C,D	MP	£14.50,
					£17.50
Gm	Micropower	B	C	GK	£7.95
Gm	A&F	B	C	GE	£8.00
Ed	Heinemann	B	C	HE	£9.25
					+ VAT
Gm	Cases	A,B,E	C	CE	£6.95
Gm	Alligata	B	C	SY	£7.95
Gm	Micro Power	B,E	C	GK	£7.95
Ut	Gnomonica	B,E	C	GN	£15
Ut	Gnomonica	B	C	GN	£20
Gm	Visions	B	C	VI	£7.95
Ut	Computercat	B	C	CC	£12.95
Bs	Gemini	B	C	GM	£19.95
Ut	Bryants S/W	B	C	HW	£4.88
Ut	R. H. Electronics	B	C	RH	£12.95
Bs	Acornsoft	B	C	AL	£11.90
Ed	Ed. Soft	B	C	ES	£19.95
Bs	Primasoft	B	C	CT	£9.95
Bs	Computercat	A,B	C	IJ	£11.95
Bs	Software for All	A,B	C	KN	£9.95
Do	Kansas	B	C	KA	£12.50
Ut	Optima	B	C	OP	£9.95
Do	Acornsoft	B	C	AL	£12.65
Ut	Micro-Aid	A,B	C	IZ	£2.95
Gm	Micro Power	B	C	GK	£6.95
Gm	ASP Software	B,E	C	AS	£6.99
Ed	Acornsoft	A,B	C	AL	£11.90
Gm	FBC Systems	B	C	FB	£7.50
Ed	Trekasoft	B	C,D	TR	£5.50
Ut	Beebug	B	C,D	BE	£10.00,
					£19.00
Bs	Acornsoft	A,B,E	C	AL	£9.95
Gm	Thor	B	C	TH	£5.95
Gm	ASP Software	B,E	C	AS	£6.99
Gm	Computersmith	B	C	LC	£5.50
Gm	Anirog Computers	A,B	C	OA	£6.00
Bs	Dialog	B	C,D	DG	£24.00
Ut	Alligata	B	E	SY	£29.95
Bs	Dialog	B	C,D	DG	£10.00
Gm	D. K. Tronics	B	C	DK	£6.95
Gm	Visions	B	C	VI	£7.95
Ut	Superior	E	C	SE	£7.95
Ut	Simonsoft	A,B	C	MS	£6.95
Ut	Micro Power	A,B	C	GK	£5.95
Ut	Program Direct	A,B	C	NP	£3.00
Ut	Davansoft	A,B	C	NX	£5.95
Ut	C J E	A,B	C	NV	£5.00
Ut	Microcomputers				
Disassembler	A.J.	B	C,D	AJ	£5.95,
					£7.95
Ed	Micro-Aid	B	C	IZ	£4.95
Ut	Rainbow S/W	A,B	C	KS	£2.50
Gm	N. Darwood	A,B	C	JB	£6.00

## SOFTWARE SUPPLIERS

CX	Contex Computing 15 Woodlands Close Cople Bedford MK44 3UE	FL	Flight Deck Software 25 Halsey Road Kempston Beds. MK42 8AP
DA	Davy Computing Ltd Moorcroft House 2 Clarence Lane Sheffield S3 7UZ	FM	4MAT Educational Software Linden Lea Rock Park Barnstaple Devon EX32 9AQ
DB	Dynabyte Software 31 Topcliffe Mews Wide Lane Morley Yorks	FY	Wida Software 2 Nicholas Gardens London W5 5HY
DC	D.A.C.C. Ltd 23 Waverly Road Hindley Greater Manchester WN2 3BN	GC	Golden Challenge Software 2-4 Chichester Rents Chancery Lane London WC2A 1EG
DD	DDT Software Southfield House 11 Liverpool Gardens Worthing West Sussex BN11 1RY	GD	70 Stoke Road Bletchley Milton Keynes
DK	DK Tronics Unit 2 Shire Hill Industrial Estate Saffron Walden Essex CB11 3AX	GE	A&F Software 83 Hyde Road Gorton Manchester M18 7JD
DG	Dialog 19 Short's Gardens London WC2H 9AT	GJ	Computer Concepts 16 Wayside Chipperfield Hertfordshire WD4 9JJ
DO	Doctor Soft 258 Coneygree Road Peterborough PE2 8LR	GK	Micro Power Ltd Northwood House North Street Leeds LS7 2AA
DS	Diamondsoft Ltd Cheadle Hulme Cheshire SK8 5YB	GM	Gemini 9 Salterton Road Exmouth Devon EX8 2BR
EB	Ebury Software National Magazine House 72 Broadwick Street London W1V 2BP	GR	Griffin Software 285 Ealing Road Alperton Wembley Middlesex HA0 1HJ
EG	SESS Ltd Central Trading Estate 275-277 Bath Road Bristol BS4 3EH	GS	Gaelsett Software 44 Exeter Close Stevenage Herts SG1 4PW
EH	Heinemann Computers in Education 22 Bedford Square London	GY	Huntsman Walk Rugeley Staffs WS15 2SN
EJ	Logic Systems 85 Hemingford Road Cambridge	HA	Harrison Associates Unit 307 16 Brune St London E1 7NJ
EL	ECL Software 29 Richmond Close Ware Herts SG12 0EN	HC	H.C.C.S. Associates 533 Durham Road Low Fell Gateshead Tyne and Wear NE9 5EY
ET	Etna Software West End House West End Lane Marshchapel Lincs	HE	Heinemann Computers in Education Freepost EM17 The Windmill Press Kingswood Tadworth Surrey KT20 6BR
EU	Educare 139a Sloane Street London SW1X 9AY	HG	J Hargreaves Updown Pewley Way Guildford Surrey
FB	FBC Systems 10 Castlefields Main Centre Derby	HM	Harris McCutcheon Systems 40 Huntingdon Street London N1 1HM
FE	Fernleaf Educational Fernleaf House 31 Old Road West Gravesend Kent DA11 0LH		

CONTINUED OVER

## SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Dmove	Ut	FBC Systems	B C	FB	£12.50
DNA Replication	Ed	Garland Comp.	B C	JX	£17.65
Dodgy Dealer	Gm	OIC	B C	OI	£6.50
Dracula Island	Gm	Kansas	B C	KA	£9.50
Dragon Rider	Gm	Salamander Software	B C	SA	£7.95
Dragon Quest II	Gm	Bug Byte	B C	KP	£11.50
Dragon Quest	Gm	Bug Byte	B C	KP	£11.50
Draughts	Gm	Micro Poer	B C	GK	£6.95
Draughts / Reversi	Gm	Acornsoft	B,E C	AL	£9.95
Draughts	Gm	Superior	B,E C	SE	£6.95
Draw	Ut	Micro Power	B,E C	GK	£9.95
Drawing	Ut	B.B.C.	A,B C	KB	£10.00
Drawing Pictures and Puzzles	Ed	Ega Beva	B C	EB	£9.95
Dr. Who: The First Adventure	Gm	BBC Pubs	B C	KB	£10.00
Dungeon Adventure	Gm	Level 9 Computing	B C	CU	£9.90
Dynamic Nuclear Magnetic Resonance Spectroscopy	Ed	Microwave	B C	MW	£3.95
Eagle Empire	Gm	Salamander	B C	SA	£7.95
Eagle Empire	Gm	Alligata	B C	SY	£7.95
Early Learning	Ed	B.B.C.	A,B C	KB	£10.00
Early Numbers	Ed	Bryants S/W	B C	HW	£4.80
Early Warning	Gm	A&F Software	A,B C	GE	£6.00
Easycalc	Bs	Zero Software	B C	AZ	£12.95
Easy Graphics	Ut	Hexagon Software	B C	HX	£13.50
Easy Times	Ed	Soft Centre	B C	SN	£6.00
Easywrite	Ed	System Software	B C	SY	£10.00
Ecological Simulations	Ed	Garland	B C	JX	£16.50
E.D.G. Graphics Package	Ut	Salamander	B C,D	SA	£19.95
Ed-master	Ed	R. H. Electronics	B C	RH	£12.95
Educare's 50	Ed	Educare	A,B C	EU	£7.95
Education (1)	Ed	Microplus	A,B C	AM	£4.25
Educational (1)	Ed	Golem	A,B,E CD	OB	£8.00
Educational (2)	Ed	Microplus	A,B C	AM	£5.25
Educational (2)	Ed	Golem	A,B,E CD	OB	£8.00
Education (3)	Ed	Microplus	B C	AM	£5.25
Edword	Ed	Clwyd Technics	B R	CL	£38.95
Eiffel Tower	Ed	Chalksoft	B C	CH	£9.25
Eldorado Gold	Gm	Micro Power	B C	GK	£6.95
Electric	Ed	Database Software	A,B C	NU	£5.50
Electricity	Ed	Primary Programs	B C	PP	£5.95
Electron-Aid	Ut	Dynabyte	E C	DB	£6.95
Electronic Colouring Book	Do	Addison-Wesley	B,E C	AN	£9.95
Elem-add and Elem-sub	Ed	Cottage Soft	B C	CT	£7.50
Empire	Gm	Shards	B,E C	SH	£6.95
English skills I / II	Ed	Griffin	B,E C	GR	£11.95
Entrepreneur	Gm	Vulcan	B C	VC	£7.95
Envelope Generator	Ut	System	B C	SY	£7.00
Equation Balance	Ed	RJE Software	B C	RJ	£7.95
Escape From Moonbase Alpha	Gm	Program Power	B,E C	GK	£7.95
Essential French Verbs	Ed	Carsondale	B C	CD	£11.50
European Studies	Ed	Aztec S/W	B C	IB	£6.50
Escape from Pulsar 7	Gm	Digital Fantasia	B C	NT	£8.95
Exmon	Ut	Beebug	B CE	BE	£10.00
Explorer	Ed	Longman	B C,D	LM	£23.00
Extended Colour Fill Graphics	Ed	Gaelsett Software	B C	GS	£9.95
Experiments in Artificial Intelligence	Ed	Ganymede Systems	B C	GY	£12.95
Eye	Ed	Longman	B C	LM	£14.50
Facemaker	Ed	A.S.K.	B C	AK	£9.95
Factfile	Ed	Cambridge Micro	B C,D	CM	£20.08
Factors and Fractions	Ed	Edsoft	B C,D	ES	£5.95
Fair Share	Ed	Griffin	B,E C	GR	£9.95
Family Finance	Do	R.H. Electronics	B C	RH	£12.95
Family Games	Gm	I.J.K. Software	A,B C	IJ	£4.50
Fantasy Adventure	Gm	Dial	B C,D	DL	£6.50
Fairground	Gm	Superior Software	B C	SE	£7.95
Fairyland Adventure	Gm	O.K.	B C	OK	£10.00
Fairytale	Gm	Molimerx	B C	AJ	£10.06
Fall of Rome	Gm	ASP Software	B C	AS	£6.99
Feasibility Experiment	Gm	Digital Fantasia	B C	NT	£10.29
Female Reproductive Cycle	Ed	Garland	B C	JX	£12.00
Felix and the Fruit Monsters	Gm	Micro Power	B,E C	GK	£7.95
Felix In The Factory	Gm	Micro Power	B,E C	GK	£7.95
F For Freddie	Gm	Kansas	B C	KA	£9.50
Fighter Pilot	Gm	Kansas	B C	KA	£9.50
File Handler	Ut	Dial	B C,D	DL	£6.50
File Plus	Do	Data tap	B D	DA	£49.95
Finance Pack	Bs	Dial	B C,D	DL	£4.95
Filer	Bs	Micro Power	A,B,E C	GK	£8.95
Final Accounts Program	Bs	Gemini	B C,D	GM	£59.95
Firefight	Ed	Highlight	B C,D	HI	£6.00
First Count	Ed	Scholar	B C,D	SC	£7.00
First Steps in Algebra	Ed	Small School	B C	SM	£5.00
First Steps with Mister Men	Ed	Mirror	B,E C	MR	£7.50
Firehawks	Gm	Postern	B C	PT	£6.95
Fishy Business	Gm	Salamander	B C	SA	£9.95
Flint's Gold	Gm	Micrograf	B C,D	MF	£6.95
FIZZ BUZZ	Ed	G.E.D. Software	B C	GD	£9.95
Fizz Buzz	Ed	Bourne	A,B C	BO	£4.50
Flags	Ed	IJK Software	B C	IJ	£4.50
Flags	Ed	Micro-Aid	B C	IZ	£5.95
Flanders	Ed	Focusplan	A,B C	FP	£5.95
Fletcher's Castle	Ed	Fernleaf	B C,D	FE	£9.95
Flexibase	Dm,	Alligata	B C	AG	£12.95
Flint's Gold	Bs	Micrograf	B C,D	MF	£9.95
Floater	Ed	Cambridge Micro	B D	CM	£13.95
Flowers of Chrystal	Ed	4MAT	B C,D	FM	£15.00
Flush	Ut	Micro-Aid	A,B C	IZ	£17.65
Football Pools Predictor	Do	Mayday Software	A,B C	IX	£1.00
Footer	Gm	Program Power	B C	GK	£4.99
Forecast	Bs	Acornsoft	B C	AL	£7.95
Forecasting-single exponential	BS	Microfax	B C	MP	£4.95
Forecasting-double exponential	Bs	Microfax	B C	MP	£4.95
Forth	Ut	Aztec	B C	AZ	£7.95
Forth	Ut	H.C.C.S.	B C	HC	£16.85
Forth	Ut	Level 9 Computing	A,B C	CU	£34.72
Forth Toolkit	Ut	Level 9 Computing	B C	CU	£15.00
FORTH	Ut	Acornsoft	B,E C	AL	£12.00
Four-in-a-Row	Gm	Dial	B C,D	DL	£16.85
Frac Attack	Ed	Shards	B C,D	SH	£4.95
Fraction Chase	Ed	GED Software	B C	GD	£6.50
Fractions	Ed	Garland	B C	JX	£9.95
Fractions	Ed	Cottage Soft	B C	CT	£7.95
Franklins Tomb	Gm	Salamander	B C	SA	£9.95
Freefall	Gm	Acornsoft	B,E C	AL	£9.95
French Connections	Ed	Cambridge Micro	B C,D	CM	£9.20
French Vocabulary	Ed	Dial	B C	DL	£15.00
French Irregular Verbs	Ed	Carsondale	B C	CD	£8.50
French Mistress A/B	Ed	Kosmos	B,E C	KM	£18.86
French Vocabulary	Ed	Hargreaves	B C	HG	£9.95
French Text Fill	Ed	Carsondale	B C	CD	£6.50
French Tutor	Ed	Salamander	B,E C	SA	£9.95
Fractions Illustrated-1	Ed	RJE Software	B C	RJ	£5.95
Fractions Illustrated-2	Ed	RJE Software	B C	RJ	£5.95
French Abroad	Ed	Micro-Aid	B C	IZ	£7.95
Frenzy	Gm	Persoft	A,B C	IY	£5.75
Frenzy	Gm	Micro Power	B C	GK	£7.95
Froggy	Gm	Superior	B C	SE	£7.95
Frogjump	Gm	Sapphire	B C	SH	£5.95

Frogger (Machine Code)	Gm	A&F Software	B	C	GE	£8.00
Froglet	Gm	ASP Software	B,E	C	AS	£6.99
Fruit Machine	Gm	Superior Software	B,E	C	SE	£7.95
Fruit Machine	Gm	Bug Byte	B	C	KP	£5.50
Fruit Machine	Gm	Alligata	B,E	C	AG	£5.95
Fruit Machine	Gm	Computersmith	B	C	LC	£5.50
Fruit Machine + Honest Joe	Gm	Beebug	B	C	BE	£7.50
Fruity	Gm	Odyssey	B	C	OG	£3.00
Fun to Learn	Ed	Shards Soft	B	C,D	SH	£6.95, £9.95
Fun Pack	Gm	Sapphire	B	C	SH	£5.95
Fun plot	Ed	Edsoft	B	C	ES	£5.95
Fun Sums	Ed	Kosmos	A,B	C	KM	£4.95
Fun with Numbers	Ed	Golem	B,E	C,D	OB	£8.00, £10.00
Fund With Sorting	Ed	Golem	B,E	C,D	OB	£7.95, £9.95
Fun with Words	Ed	Golem	B,E	C,D	OB	£8.00, £10.00
Fun Games	Gm	B.B.C.	A,B	C	KB	£10.00
Galactic Commander	Gm	Micro Power	B,E	C	GK	£6.95
Galactic Firebird	Gm	Kansas	B	C	KA	£9.50
Galactic Wipeout	Gm	R. H. Electronics	B	C	RH	£8.95
Galaxy Birds	Gm	Superior	B	C	SE	£7.95
Galaxy Wars	Gm	Bug-Byte	B	C	BB	£7.50
Games Compendium B1/2	Gm	Salamander	B	C	SA	£6.95
Games Pack 1/2	Gm	Processor Applications	B	C	AP	£5.95
Games Pack 1	Gm	Computersmith	B	C	LC	£5.50
Games Tape 1	Gm	Pro Software	A,B	C	SP	£7.95
Games Pack 1	Gm	Computersmith	A,B	C	LC	£5.50
Games of Deduction 1-4	Ed	Fernleaf	B	C,D	FE	£35.95
Game of Logic	Ed	N. Darwood	A,B	C	JB	£8.00
Games of Logic	Gm	Golem	A,B	C,D	B	£4.95, £6.95
Games of Strategy	Gm	B.B.C.	A,B	C	KB	£10.00
Games Pack II	Gm	Micromail	B	C	OE	£6.75
G.B. Graph6	Ed	Primasoft	B	C	PR	£6.95
GCE Maths (O) 1/2	Ed	Bryants	A,B	C	HW	£9.50
Genetic Code	Ed	Garland Comp.	B	C	JX	£17.65
Geography Map	Ed	Bryants	B	C	HW	£4.85
Geography						
France/Spain/Germany/Italy/Belgium/USA/India	Ed	Corona	B	C,D	JY	£6.00, £9.00
German Irregular Verbs	Ed	Carsondale	B	C	CD	£13.80
German Master	Ed	Kosmos	B,E	C	KM	£9.95
Get it Right	Ed	Sulis	B	C	SU	£9.95
Get Set	Ed	Griffin	B,E	C	GR	£9.95
Get the Message	Gm	Dial	B	C,D	DL	£4.95, £6.50
Ghost/Diamonds	Gm	A Lane	A,B	C	OC	£3.00
Ghost Maze	Gm	Software for All	B	C	HN	£6.95
Ghouls	Gm	Micro Power	B	C	GK	£7.95
Gideon's Gamble	Gm	Superior Software	B	C	SE	£7.95
Glooper	Gm	Microplus	B	C	AM	£6.95
Glycolysis - TCA Cycle	Ed	Garland	B	C	JX	£15.00
Gnasher	Gm	Superior	B	C	SE	£6.95
Gobbler	Gm	M G B	B	C	MG	£5.45
Golf	Gm	Microplus	B	C	AM	£4.95
Golf	Gm	Computersmith	B	C	LC	£5.50
Golforama	Gm	Dial	B	C,D	DL	£4.95, £6.50
Grand Prix	Gm	Software for All	B	C	HN	£5.95
Grand Prix	Gm	Microplus	A,B	C	AM	£4.25
Granny's Garden	Ed	4MAT	B	C,D	FM	£10.00, £12.00
Graph Capers Senior	Ed	Gem	B	C	GM	£8.50
Graphs	Ed	Bryants	A,B	C	HW	£4.85
Graphics Aid Pack	Ed	Microwave NW	B	C	MW	£8.95
Graphito	Ut	Addison-Wesley	B	C	AN	£21.95 + VAT
Grafix	Ut	Williams	B	D	WI	£10.00
Golf	Gm	Bryants S/W	B	C	HW	£4.88
Golf	Gm	Bug Byte	B	C	BB	£7.00
Golf	Gm	Computersmith	B	C	LC	£5.50
Gomoku	Gm	Micro Power	A,B	C	GK	£3.95
Graphics Package	Ut	Salamander	B	C	NZ	£24.95
Graph and Charts Pack	Bs	Software Acornsoft	B,E	C	AL	£9.95, £9.20
Graphics Pack	Ut	Bug-Byte	B	C	BB	£9.50
Graphs (Arithmetical)	Ed	Bryants	B	C	HW	£4.85

## SOFTWARE SUPPLIERS

<b>HN</b>	<b>Hutchinson</b> 17-21 Conway Road London W1P 6JD	<b>JS</b>	<b>J.B. Software</b> 57 Meadow Crescent Carleton Poulton-le Fylde Lancashire FY6 7QX
<b>HW</b>	<b>Bryants (Educational) Software</b> 1 The Hollies Chalcroft Lane North Bersted Bognor Regis PO21 5SX	<b>JA</b>	<b>Hexagon Software</b> 17 Cambridge Grove Otley
<b>HX</b>	<b>Hexagon Software</b> 17 Straits Road Gornal Dudley West Midlands DY3 2UR	<b>JB</b>	<b>N Darwood Ltd</b> Halfacres Stroud Petersfield Hampshire GU32 3PJ
<b>IB</b>	<b>Aztec Software</b> 25 St Mark Road Deepcar Sheffield S30 5TS	<b>JC</b>	<b>Futura Software</b> 63 Lady Lane Chelmsford Essex CM2 0TQ
<b>IC</b>	<b>Ian Copestake</b> 23 Connaught Crescent Brookwood Woking Surrey GU24 0AN	<b>JS</b>	<b>J.C. Software</b> 124 Woodlands Way Southwater West Sussex RH13 7DR
<b>IF</b>	<b>Electronics Applied</b> 4 Dromore Road Carrickfergus County Antrim BT38 7PJ	<b>JX</b>	<b>Garland Computing</b> 35 Dean Hill Plymouth PL9 9AF
<b>IJ</b>	<b>I J K Software</b> 9 King Street Blackpool Lancs	<b>JY</b>	<b>Corona Software</b> Corona House 21 Tennyson Avenue London E11 2QN
<b>IN</b>	<b>Ixon Software</b> 10 The Crescent Lymsham Weston-Super-Mare Somerset BS24 0BN	<b>JZ</b>	<b>MP Software &amp; Services</b> 165 Spital Road Bromborough Merseyside L62 2AE
<b>IS</b>	<b>Software Invasion</b> 50 Elborough Street Southfields London	<b>KA</b>	<b>Kansas City Systems</b> Unit 3 Sutton Springs Wood Chesterfield S44 5XF
<b>IU</b>	<b>Aardark Software</b> 15 Queensberry Avenue Hartlepool Cleveland TS26 9NW	<b>KB</b>	<b>BBC Publications</b> British Broadcasting Corporation 35 Marylebone High Street London W1M 4AA
<b>IV</b>	<b>James Hager</b> 7 Basset Street Camborne Cornwall TR14 8SW	<b>KF</b>	<b>Kingfisher Computer Services</b> Dunley Lane Keynsham Bristol BS18 2AQ
<b>HS</b>	<b>Simon Hessel Software</b> 15 Lytham Court Cardwell Crescent Bershire	<b>KH</b>	<b>Superior Software</b> 69 Leeds Road Bramhope Leeds
<b>IX</b>	<b>Mayday Software</b> 181 Portland Crescent Stanmore Middlesex HA7 1LR	<b>KM</b>	<b>Kosmos</b> 1 Pilgrims Close Harlington Dunstable Bedfordshire LU5 6LX
<b>IY</b>	<b>Persoft</b> Freeport Baldon Shipley West Yorkshire BD17 5SX	<b>KN</b>	<b>Software for All</b> 72 North Street Romford Essex
<b>IZ</b>	<b>Micro Aid</b> 25 Fore Street Praxe Camborne Cornwall TR14 0JX	<b>KU</b>	<b>Kudusoft</b> 130 Main Street Tweedmouth Berwick-upon-Tweed TD15 2AW
<b>JL</b>	<b>Joe the Lion</b> 213/215 Market Street Hyde Cheshire SK14 1HF	<b>LA</b>	<b>Ludinski Computer-Assisted Learning</b> 24 Avondale Avenue Staines Middlesex

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# SOFTWARE LISTINGS

Title	Type	Manufacturer	Memory	Software Supplier	Price
Great Britain Ltd Greater and Smaller	Gm	Hessel	B C	HS	£5.95
	Ed	Scholar	B C,D	SC	£6.50, £8.50
Grig Blitz	Gm	Computercat	B C	CC	£5.95
Group Statistics	Bs	Micropax	B C	MP	£7.95
Guardian	Gm	Alligata	E C	SY	£7.95
Guided Discovery	Ed	Etna Software	B C	ET	£9.95
Gunsmoke	Gm	Software Invasion	B C	IS	£7.95
Guzzler	Gm	Computersmith	B C	LC	£5.50
Handwriting 1/2	Ed	Chalksoft	B C	CH	£9.95
Hangdroid	Gm	Micromode	B C	MO	£4.00
Hangman	Ed	Micro Aid	B C	IZ	£7.95
Hangman Player	Ed	Square	A,B C	SQ	£7.00
Hangman	Gm	Micro Aid	B C	IZ	£7.95
Hangman	Gm	Aztec S/W	A,B C	IB	£5.50
Hangman	Gm	MP S/W	B C	JZ	£4.00
Happy Letters	Ed	Bourne	B,E C,D	BO	£8.97, £10.98
Happy Numbers	Ed	Bourne	B,E C,D	BO	£8.97, £10.98
Harmony	Ut	Doctor Soft	B C	DS	£6.95
Heist	Gm	Softspot	B C	SF	£6.95
Helicopter Rescue/Tunnel/Roadrace	Gm	A Lane	A,B C	OC	£4.00
Hell Driver	Gm	Micro Power	B,E C	GK	£7.95
Hide and Seek	Ed	A.S.K	B C	AK	£9.95
History Quiz	Do	Acornsoft	B,E C	AK	£12.65
Hitch Hiker	Gm	Computer Concepts	B C	GJ	£7.80
Home Accounts	Bs	Harris	B D	HM	£28.75
Home Accounts	Do	Diamondsoft	B C	DS	£14.95
Home Accounts	Bs	Gemini	B C	GM	£19.95
Home Accounts	Do	Persoft	B C	IY	£12.50
Home Finance	Do	B.B.C.	A,B C	KB	£10.00
Hooked on Numbers	Ed	Acornsoft	B C	AL	£9.95
Hoop-La	Ed	Soft Centre	B C	SN	£6.00
Hopper	Gm	Acornsoft	B,E C,R	AL	£9.95, £9.20
Horror Castle	Gm	A&F	B C	GE	£8.00
Horseshoe	Gm	Dynabyte	B,E C	DB	£6.95
Hot Cakes	Ed	Private Tutor	B C,D	PT	£7.95, £8.95
Housekeeper	Ed	Heinemann	B C	HE	£9.25 + VAT
Howzat	Gm	A&F	B C	GE	£6.90
Human Blood Groups	Ed	Garland	B C	JX	£15
Hunchback	Gm	Superior Software	B C	SE	£7.95
Hydraulics	Ed	Database Software	A,B C	NU	£5.50
Hyperdrive	Gm	IJK	B C	IT	£6.50
Identikit	Ed	Stell	B,E C	ST	£7.95
... I Do'	Do	Acornsoft	B C	AL	£12.65
Identikit/Word Finder	Ed	Heinemann	B C	HE	£9.25 + VAT
Index	Ut	Microwave NW	B C	MW	£6.95
Index Numbers-Basket	Bs	Micropax	B C	MP	£7.95
Index Numbers-Changer	Bs	Micropax	B C	MP	£7.95
Indexit	Ut	Williams	B D	WI	£10.00
Inhabitant	Ed	Longman	B C,D	LM	£9.95, £12.95
Inheritance	Gm	S.W. Hessel S/W	B C	IW	£5.95
Inheritance	Ed	Garland Comp.	B C	JX	£34.70
Inkosi	Gm	Chalksoft	B C	KT	£5.95
Intergalactic Trader	Gm	Micro Power	B,E C	GK	£8.95
International Special Agent	Gm	O.K.	B C	OK	£10.00
Intervention commercial	Bs	System	B C	SY	£345.00
Intervention educational	Ed	System	B C	SY	£115.00
In the Grip of Ice	Gm	O.K.	B C	OK	£10.00
Intro	Ed	Clares	A,B C	CL	£7.95
Introducing Map Skills 1/2	Ed	Cambridge Micro	B C,D	CM	£13.95, £1.62
Introduction to Microcomputing in Teaching	Ed	Hutchinson	B C	HN	£17.25
Invaders	Gm	Software Invasion	B C	IS	£6.95
Invaders	Gm	Superior Software	B C	SE	£7.95
Invaders	Gm	Software for All	A,B C	KN	£6.95
Invaders	Gm	Hexagon S/W	A,B C	JA	£6.00
Invasion	Gm	ASP Software	B,E C	AS	£6.99
Invisible Man	Ed	Chalksoft	B C	KT	£5.95
Invoicing	Bs	Acornsoft	B D	AL	£24.95
Invoices and Statements	Bs	Gemini	B C	GM	£19.95
Janeplus	Ed	Longman	B C	LM	£14.50
Jars	Ed	Acornsoft	B C	AL	£11.90
JCB Digger	Gm	Acornsoft	B C	AL	£9.95, £11.50
Jet Power Pack	Gm	Micro Power	B C	GK	£7.95
Jigsaw Puzzle	Ed	Ega Beva	B C	EB	£9.95
Jigsaw & Sliding Puzzles	Ed	Golem	B,E C,D	OB	£7.95, £9.95
Johnny Reb	Gm	Lothlorien	B C	LO	£6.95
J.R.	Gm	Software for All	B C	KN	£6.95
Jumbles	Ed	Bryants S/W	B C	HW	£4.88
Jumbo	Gm	Molimerx	B C	AJ	£17.25
Jungle Ambush	Gm	Kindsoft	B C	KU	£6.50
Jungle Journey	Ed	Treksoft	B C	TR	£5.50
Junior Maths	Ed	Aztec	A,B C	AZ	£3.00
Junior Maths Pack	Ed	Micro Power	B C	GK	£6.95
Junior Word Splits	Ed	Sulis	B C	SU	£9.95
Just a Mot	Ed	Sulis	B C	SU	£9.95
Kamikaze	Gm	A&F	E C	GE	£7.90
Keeping Myself Alive	Ed	Heinemann	B C	HE	£9.25 + VAT
Katakombs	Gm	Golem	B C,D	OB	£5.95, £7.95
Keyrecog	Ed	Ed. Soft	B C	ES	£4.95
Kidney	Ed	Garland	B C	JX	£12
Kingdom of Hamil	Gm	Acornsoft	B C	AL	£9.95
Killer Gorilla	Gm	Micro Power	B,E C	GK	£7.95
Knowledge Quest	Ed	Pee Bee	B C,D	PB	£10.95, £14.45
Konexion	Gm	M and M Software	A,B C	MM	£5
Kopflager	Ed	Cambridge Micro	B D	CM	£15.00 + VAT
Kremlin	Gm	Doctor Soft	B C	DO	£6.95
Kubla Khan	Gm	Blue Moon	B C	BM	£8.95
Laddis	Ut	Silversoft	B C	SV	£6.95
Labyrinths of La Coshe	Gm	Micro Power	B C	GK	£7.95
Ladder Maze	Gm	Superior	B C	SE	£6.95
Landfall	Gm	Virgin Games	B C	VG	£7.95
Language Tutor	Ed	Rainbow Research	B C	RR	£5.00
La Princesse (French)	Ed	Aztec S/W	B C	IB	£6.50
Language-Lab	Ed	M and M Software	A,B C	MM	£7.50
Landfall & Serpent	Gm	GT Software	B C	JW	£6.50
Laser Command	Gm	Micro Power	B,E C	GK	£7.95
Laser Letters	Ed	Shards	B C,D	SH	£6.95, £9.95
Laser Zone	Gm	Salamander	B C	SA	£7.95
Las Vegas	Gm	R.H. Electronics	B C	RH	£8.95
Launching Logic	Ed	Shiva	B C	SV	£14.95
Learn Addition	Ed	ABC Primary	B C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	B C	AB	£6.50
Leap Frog	Gm	IJK Software	B C	IJ	£7.50
Learning Compendium I	Ed	Ega Beva	B C	EB	£11.95
Learning Compendium II	Ed	Ega Beva	B C	EB	£9.95
Ledger	Bs	Micro Aid	B C	IZ	£7.95
Legion	Gm	Software Projects	B C	SW	£7.95
Letters	Ed	Chalksoft	B C	CH	£6.95
Let's Count	Ed	A.S.K	B C	AK	£9.95
Letterbugs	Ed	Highlight	B C,D	HI	£6.00, £7.00
Librarian/Word Finder	Ed	Heinemann	B C	HE	£9.25 + VAT
Library Classification	Ut	Aztec	A,B C	AZ	£6.50
Library Dewey Classification	Ed	Aztec S/W	B C	IB	£6.50
Life	Gm	Ixon	A,B C	IN	£4.75
Life Plus	Gm	Mayday	A,B C	IX	£4.49
Lift	Ed	Cambridge Micro	B D	CM	£15.00 + VAT
Lift off with Numbers	Ed	Shiva	B C	SV	£14.95
Lightpen Colourgraphic	Ut	R.H. Electronics	B C	RH	£9.95
Linear Programming	Bs	Micropax	B C	MP	£12.95
Linear Regression, Correlation	BS	Micropax	B C	MP	£7.95

Lines and Angles	Ed	4MAT	B	C	FM	£5
Link-4-Plus	Gm	ABC Software	A,B	C	KR	£6.95
Lisp	Ut	Acornsoft	B,E	C,R	AL	£16.85, £16.10
Lisp	Ut	Aztec	B	C	AZ	£16.85
Logo-Forth	Ut	H.C.C.S.	A,B	E	HC	£59.00
Logo 2	Ut	Computer Concepts	B	C	GJ	£10.00
Longitudinal Waves	Ed	Heinemann	B	C	EH	£12.50
Looking at Graphs	Ed	Heinemann	B	C	HE	£9.25 + VAT
Looking at Scales	Ed	Heinemann	B	C	HE	£9.25 + VAT
Look it up	Ed	GED Software	B	C	GD	£4.50
Look Sharp!	Ed	Mirror	B,E	C	MR	£7.95
Logo Challenge	Ed	Addison-Wesley	B	C,D	AN	£29.95, £37.95
Lorry/Farm	Ed	Primary	B	C,D	PP	£5.95, £7.95
Lords of Time	Gm	Level 9	B	C	CU	£9.90
Lost City	Gm	Superior Software	B	C	SE	£7.95
Lost In Space	Gm	Salamander	B	C	SA	£9.95
Lunar Rescue	Gm	Alligata	B	C	AG	£7.95
L Trap	Gm	Gem	B	C	GM	£8.50
Lunar Lander	Gm	A&F Software	B	C	GE	£6.90
Mach 1	Ut	Gnomonica	B	E	GN	£39.95
Magic Adventure	Gm	Kansas	B	C	KA	£8.50
Mailer	Ut	ASD Ltd	B	C	AS	£5.75
Mailing List	Bs	Gemini	B	C	GM	£19.95
Mailing	Bs	Micro-Aid	A,B	C	IZ	£7.95
Mailing System	Bs	Acornsoft	B	D	AL	£24.95
Map Rally	Ed	Bourne	B,E	CD	BO	£8.97, £10.98
Making Ends Meet	Ed	Cambridge Micro	B	C,D	CM	£15.00 + VAT
Manage	Gm	Cases	B	C	CE	£6.95
Mansion Murders	Gm	Challenge Games	B	C	CG	£6.95
Mapping Skills	Ed	Heinemann	B	C	HE	£9.25 + VAT
Mark Book	Ed	Carvells	A,B	C	CA	£5
Mark Book	Ed	BBC	A,B	C	KB	£15
Martian Attack	Gm	Micropower	B	C		£7.95
Mass	Ut	DDT	B	R	DT	£34.95
Masterbard Hamlet	Ed	Sulis	B	C	SU	£12.95
Master Copier	Ut	Aztec S/W	A,B	C	IB	£6.50
Masterfile	Ut	Beebug	B	CD	BE	£10.00, £19.00
Mastermind	Gm	Micro Power	A,B	C	GK	£3.95
Matchup	Ed	Edsoft	B	C	ES	£5.95
Mathgrid	Ed	Soft Centre	B	C,D	SN	£8.00, £10.00
Maths Invaders	Ed	Stell	B,E	C	ST	£7.95
Mathskills 1/II	Ed	Griffin	B,E	C	GR	£11.95
Maths Man	Ed	GED Software	B	C	GD	£4.00
Maths Pack	Ed	Ega Beva	B	C	EB	£11.95
Maths Pack	Ed	Dial	B	C,D	DL	£4.95, £6.50
Maths Topics 1	Ed	Cambridge Micro	B	C,D	CM	£13.95 + VAT
Maths Topics 2	Ed	Cambridge Micro	B	C,D		£15.00 + VAT
Mathspell	Ed	Diamondsoft	B	C	DS	£7.95
Maths Topics 1	Ed	CUP	B	C	UP	£18
Maths Translation	Ed	Corona S/W	B	C	JY	£6.00
Maths Tutors, Graphs	Ed	Salamander	B,E	C	SA	£9.95
Maths Tutors, Vectors	Ed	Salamander	B,E	C	SA	£14.95
Matching	Ed	Clares	A,B	C	CL	£5.95
Maze Invaders	Gm	Micro Power	B	C	GK	£4.95
Maze Man	Gm	C J E	B	C	NV	£6.00
Micro Budget	Do	Microcomputers				
Meditor	Ut	Micro Power	A,B	C	GK	£6.95
Medmon	Ut	MED	B	C	MD	£9.50
Membership Manager	Do	MED	A,B	C	MD	£9.95
Memocalc	Bs	Acornsoft	B	C	AL	£9.95
Mental Arithmetic Tests	Ed	Microaid	B	C	IZ	£9.95
Mental Maths and Place Value	Ed	Small School	B	C	SM	£6.95
Mercy Mission to Mars	Ed	Edsoft	B	C,D	ES	£4.95
Merlins Castle	Gm	D.A.C.C.	B	C	DC	£5.95
Meteors	Ed	Pumpkin	B	C	PU	£5.00
Metrics (5)	Gm	Acornsoft	B,E	C	AL	£9.95
Microbial Pop. Dynamics	Ed	Chalksoft	B	C	KT	£9.95
Microbug	Ed	Microwave NW	B	C	MW	£7.00
	Ed	Arnold-Wheaton	B	C,D	SY	£15.00 + VAT

## SOFTWARE SUPPLIERS

LC	Computersmith 40 Greenfields Avenue Bromborough Wirral Merseyside L62 6DD	NO	Number One Systems 9a Crown Street St. Ives Huntingdon Cambs. PE17 4EB
LM	Longman Group Longman House Burnt Mill Harlow Essex	NP	Program Direct 37B New Cavendish Street London W1M 8JR
LO	Lothlorien 56a Park Lane Poynton Cheshire SK12 1AE	NR	Foilkade Dept PR14 66 Littledean Yate Bristol BS17 4UQ
MA	MP Software and Services 165 Spital Road Bromborough Merseyside L62 2AE	NT	Digital Fantasia 24 Norbreak Road Norbreck Blackpool
MB	Microbyte Software Freeport Newquay TR7 2BR	NU	Database Software 97 Defoe Drive Park Hill Stoke-on-Trent
MD	MED 640 Melton Road Thurmaston Leics	NV	CJE Microcomputers 25 Henry Avenue Rustington West Sussex BN16 2PA
MI	Microgame Simulations 73 The Broadway Grantchester Cambridge CB3 9NQ	NW	Eduquest Thames Avenue Windsor Berkshire SL4 1QP
MG	MGB Software Support 52 Barley Croft Harlow Essex	NX	Davansoft 1 Delapoe Drive Haverfordwest Dyfed SA61 1HX
MK	David McKeran 23 Warwick Drive East Herrington Sunderland Tyne and Wear	OA	Oakleaf Computers Ltd 121 Dudley Road Grantham Lincs
MM	M and M Software 1391 Leek Road Abbey Hulton Stoke-on-Trent Staffs ST2 8BW	OA	Anirog Computers 26 Balcombe Gardens Horley Surrey
MN	Merlin Computer Products 18 Mansel Street Swansea SA1 5SG	OB	Golem Ltd 77 Qualitas Bracknell Berkshire RG12 4QG
MO	Micromode 32 West End Avenue Gatley Cheshire	OC	A Lane (Software) 12/316 Seaside Eastbourne East Sussex BN22 7RH
MP	Micropax 38 Garrick Green Old Catton Norwich NR6 7AN	OE	Micromail PO Box 34 Leighton Buzzard LU7 8SJ
MS	Musicsoft 12 Fallowfield Amphill Beds	OG	Odyssey Software 8 Greenbrook Avenue Hadley Wood Barnet Herts EN4 0LS
MW	Microwave NW 24 Belford Road Stretford Manchester M32 0DL	OH	Edu-CAL 28 Ingersoll Road Shepherds Bush London W12 7BD
NC	National Extension College 18 Brooklands Avenue Cambridge	OK	O.K. Products 65 Rainsborowe Road Colchester Essex CO2 6JU
NG	New Generation Software The Brooklands 15 Sunnybank Lyncombe Vale Bath BA2 4NA	OP	Optima Software Ltd 36 St. Petersburg Stockport SK1 1HL
		OT	Oxhey Tutors 19 Tudor Walk Watford Herts. WD2 4NY

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Parity	Ed	N. Darwood	A,B	C	JB	£10.00
Parts of a Sentence	Ed	Scholar	B	C,D	SC	£5.00, £7.00
Pascal	Ed	Chalksoft	B	C	KT	£5.95
Passit Transformations	Ed	Edsoft	B	C	ES	£5.95
Past to Present	Ed	Heinemann	B	C	HE	£9.25 + VAT
Payroll	Bs	Micro-Aid	B	C	IZ	£17.95
Peeko Computer	Bs	Acornsoft	A,B	C	AL	£9.95, £9.20 + VAT
Peggit	ED	Ed. Soft	B	C	ES	£5.95
Password	Ed	MP Software	B	C,D	MP	£11.00, £14.00
Pengwyn	Gm	Postern	B	C	PT	£6.95
Pansion	Bs	Micro-Aid	B	C	IZ	£4.95
Pentiles	Ed	Silverlind	B	C	SL	£6.95
Percentages	Ed	Scholar	B	C,D	SC	£5.00, £7.00
Percy Penguin	Gm	Superior	B,E	C	SE	£7.95
Perseus and Andromeda	Gm	Digital Fantasia	B	C	NT	£10.29
Personal Accounts	Do	Kansas	B	C	KA	£10.50
Personal Money Management	Do	Acornsoft	B,E	C	AL	£11.90, £11.50
Pettigrews Diary	Gm	Shards	B,E	C	SH	£7.95
Pharaoh's Tomb	Gm	A&F Software	B	C	GE	£8.00
Philosopher's Quest	Gm	Acornsoft	B	C	GA	£9.95
Physics	Ed	Micro Power	A,B,E	C	GK	£6.95
Picture Maths	Ed	A J Visions	B	C	AV	£9.95
Picfile	Ed	Cambridge Micro	B	C,D	CM	£20.08
Picture Spell	Ed	GED Software	B	C	GD	£5.00
Pieman	Gm	Musicsoft	B	C	MS	£3.75
Pinball	Gm	Microbyte	B	C	MB	£5.95
Perspective	Ut	Aztec	B	C	AZ	£6.50
Picasso GS	Ut	Odyssey	B	C	OG	£4.50
Picsave	Ut	Hexagon S/W	A,B	C	JA	£6.00
Pick-a-Word	Ed	Ega Beva	B	C	EB	£11.95
Picture Maker	Ut	Acornsoft	B,E	C	AL	£9.95, £9.20 £12.95
Picture Maths	Ed	A.J.	B	C,D	AJ	£6.50
Picture Puzzles	Gm	Ludinski	B,E	C	KA	£9.25
Pirate	Ed	Chalksoft	B	C	CH	£8.00
Planes	Gm	A&F	B	C	GE	£7.95
Planetarium	Ed	Superior	B	C	SE	£7.95
Planet Invaders	Gm	Merlin	B	C	MN	£7.95
Planetfall	Gm	ASP Software	B,E	C	AS	£11.45
Planetoid	Gm	Acornsoft	B	C	AL	£9.95
Play With Words	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00
Plegaron People Eaters	Gm	R. H. Electronics	B	C	RH	£8.95
Plotter	Ed	Dial	B	C,D	DL	£6.50, £8.00
Plunder	Gm	Cases	B	C	CE	£6.95
Population Growth	Ed	C.U.P.	B	C	CP	£13.95
Poker Dice	Gm	Micro Power	B	C	GK	£5.95
Powerboat Race	Gm	Futura S/W	B	C	JC	£7.95
Polar Traveller	Ed	Trekasoft	B	C,D	TR	£5.50
Polaris	Gm	Bug Byte	B	C	KP	£5.50
Polygon Tutor	Ed	Pee Bee	B	C,D	PB	£7.50, £10.00
Pontoon	Gm	M and M Software	B	C	M	£5
Pool	Gm	Dynabyte	B,E	C	DB	£7.95
Population Growth	Ed	Cambridge Micro	B	C,D	CM	£13.95 + £1.62
Position	Gm	Micro Power	B,E	C	GK	£6.95
Procaid	Ut	Micro Aid	A,B	C	IZ	£3.45
Proclush	Ut	Micro-Aid	A,B	C	IZ	£1.00
Procvac	Ut	Micro-Aid	A,B	C	IZ	£1.95
Proteanse	Gm	D.K. Tronics	B	C	DK	£6.95
Primary Art	Ed	Alligata	B,E	C	SY	£7.95
Primary Time	Ed	Alligata	B,E	C	SY	£7.95
Princess	Gm	Aztec S/W	A,B	C	IB	£6.50
Progo	Ed	Edsoft	B	C,D	ES	£8.95, £10.50
Protractor Tutor	Ed	Pee Bee	B	C,D	PB	£7.80, £10.30
Pub games/Picasso package	Gm	Starsoft	B	C	SR	£9.95
Punc-Man	Ed	Chalksoft	B	C	KT	£7.95
Punction/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Punctuation	Ed	Bryants S/W	B	C	HW	£4.88
Purchasing	Bs	Acornsoft	B	D	AC	£24.95
Putting Numbers In Order	Ed	Scholar	B	C,D	SC	£7.00, £9.00

## SOFTWARE SUPPLIERS

PD	Philip Dodderidge 4 Grange Close Woodford Green Essex IG8 9JS	SC	Starcade 2 Elworthy Avenue Liverpool L26 7AA
PP	Primary Programs Claypits Debden Road Saffron Walden Essex CB11 3JS	SE	Superior Software 69 Leeds Road Bramhope Leeds
PR	Primasoft 2 Spinney Close Glossop Derbyshire	SF	Softspot 29 South Crescent Prittlewell Southend Essex SS2 6TB
PS	Psion Ltd 2 Huntsworth Mews Gloucester Place London NW1 6DD	SH	Shards Software 189 Eton Road Ilford Essex IG1 2UQ
PT	Postern Ltd PO Box 2 Andoversford Cheltenham Glas. GL54 5SW	SH	Shumwari Associates 12 Marlin Court Marlow SL7 2AJ
PV	Private Tutor 29 Holloway Lane Chesham Bais Amersham Bucks	SI	Simonsoft 25 Tatham Road Abingdon Oxon OX14 1QB
QS	Quicksilver Ltd Palmerston Park House 13 Palmerston Road Southampton SO1 1LL	SJ	S.J. Grist 127 Waxwell Lane Pinner Middlesex
QT	Qualitysoft 4 James Close Bridgend Glamorgan CF32 9SJ	SK	Skywave Software 73 Curzon Road Boscombe Bournemouth BH1 4PW
RA	Ratco Software 3/177 College Road Moseley Birmingham B13 9LJ	SL	Silverlind Ltd 156 Newton Rd., Burton-on-Trent Staffordshire DE15 0TR
RH	R. H. Electronics Chesterton Mill French's Road Cambridge CB4 3NP	SM	Small School Software 41 Sinah Lane Hayling Island Hampshire PO11 0HJ
RJ	RJE Software 143 Montague Road Leytonstone London E11 3EW	SN	Soft Centre Renryle Cottage Okehurst Lane Billinghurst West Sussex RH14 9HR
RO	Romik Software 272 Argyle Avenue Slough SL10 4HE	SO	Solar Soft 5 Westmorland Drive Camberley Surrey GU15 1EW
RR	Rainbow Research 288 High Street Ponders End Enfield EN3 4HF	SP	Sapphire Software Box 67 Wakefield Yorkshire
RS	Redshift 12c Manor Road Stoke Newington London N16	SQ	Square Software 12a Uplands Terrace Swansea W Glamorgan
SA	Salamander Software 17 Norfolk Road Brighton East Sussex BN1 4AA	SR	Starsoft 9 Chatsworth Road Worsley Manchester M28 4NU
SC	Scholar Soft Coniscliffe Woolsington Gdns Woolsington Newcastle Upon Tyne NE13 8AP	SS	Squirrel Software 4 Bindloss Avenue Eccles Manchester M30 0DV
SC	Screenplay 134 St. Vincent Street Glasgow	ST	Stell Software 36 Limefield Ave Whalley Lancs BB6 9RJ

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# SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Pyramid	Ed	Highlight	B C,D	HI	£6.00, £7.00
Pyramid Painter	Gm	Thor	B C	TH	£5.95
Questionmaster	Ed	Hutchinson	B C	HN	£28.75
Q Bert	Gm	Superior Software	B C	SE	£7.95
Quick Thinking!	Ed	Mirror	B,E C	MR	£6.95
Railroader	Ed	Stell	B C	ST	£7.95
Rally A/B	Ed	Longman	B C,D	LM	£9.95, £12.95
Record Changer	Do	A.J.	B C,D	AJ	£19.95, £24.95
Record Keeper	Ut	BBC Pubs	B C	KB	£13.80
Recover	Ut	Baksoft	A,B C	BK	£6.00
Readability	Ed	Arnold-Wheaton	B C	AW	£6.00 + VAT
Revenge of Zopr	Gm	Kansas	B C	KA	£9.50
Reversi	Gm	Microbyte	B C	MB	£5.95
Reversi	Gm	Superior Software	B,E C	SE	£6.95
Reversi	Gm	Kansas	B C	KA	£6.25
Reversi	Gm	Silverlind	B C	SL	£6.95
Reversi 1	Gm	Micro Power	A,B C	GK	£5.95
Reversi 2	Gm	Micro Power	B C	GK	£5.95
Ripple Tank	Ed	RJE Software	B C	RJ	£7.95
River Adventure	Ed	Pee Bee	B C,D	PB	£9.50, £12.00
Riverworld Adventure	Gm	O.K.	B C	OK	£10.00
Road Racer	Gm	Superior Software	B C	SE	£7.95
Road Runner	Gm	Superior Software	B C	CH	£7.95
Road Safety	Ed	Bryants	A,B C	HW	£4.85
Robotic Sums	Ed	GED Software	B C	GD	£4.50
Robot	Gm	Miking S/W	B C	KC	£4.95
Rocket Raid	Gm	Acornsoft	B C	AL	£9.95
Rocky	Gm	Superior	B C	SE	£7.95
ROM Read	Ut	A.J.	B C,D	AJ	£8.95, £11.95
Roman Empire	Gm	Lothlorien	B C	LO	£6.95
Roulette	Gm	Micro Power	A,B C	GK	£5.95
Row of Four	Gm	Software For All	B C	KN	£6.95
Royalty Quiz	Do	Acornsoft	B C	AL	£12.65
Rubble Trouble	Gm	Micro Power	B C	GK	£7.95
Russian Irregular Verbs	Ed	Carsondale	B C	CD	£21.00
Russian Text Fill	Ed	Carsondale	B C	CD	£11.96
Savage Pond	Gm	Starcade	B C,D	SC	£8.95
Scales and Decimal Estimation	Ed	RJE Software	B C	RJ	£3.95
Scanning/Word Finder	Ed	Heinemann	B C	HE	£9.25 + VAT
Science 1	Ed	Shards	B,E C,D	SH	£6.95, £9.95
Science Pack	Ed	Dial	B C,D	DL	£4.95, £6.50
Science Fiction Quiz	Do	Acornsoft	B,E C	AL	£12.65
Sets and Operators	Ed	Shiva	B C	SV	£14.95
737 Simulator Flight	Gm	Salamander	B,E C	SA	£9.95
Scramble	Gm	Bug-Byte	A,B C	BB	£6.95
Scred	Bs	Stable	B C	CS	£18
Scribe	Bs	Merlin	B C	MN	£29.95
Scribe II	Do	Alligata	B,E C,D	SY	£9.95, £14.95
Sea Cliff Erosion	Ed	Cambridge Micro	B C,D	CM	£15.00 + VAT
Sea Lord	Gm	Bug-Byte	B C	BB	£7.50
Sea Wolf	Gm	Optima	B C	OP	£8.95
Search for the Jewels	Gm	SJG Jft	B C	SJ	£8.95
Searchbas	Ut	Micr. Aid	A,B C	IZ	£1.95
Seed Germination	Ed	Garland Comp.	B C	JX	£18.82
Seige	Gm	Postern	B C	PT	£6.95
Sentence Maker	Ed	Arnold-Wheaton	B C	AW	£9.95 + VAT
Sequences	Ed	Chalksoft	B C	CH	£5.95
737 Flight Simulator	Gm	Salamander	B,E C	SA	£9.95
Shirley Conran's Magic Garden	Do	Acornsoft	B C	AL	£9.95
Sheepdog	Ed	Longman	B C	LM	£9.95, £12.95
Sheepdog Trials	Ed	Bryants S/W	B C	HW	£4.80
Share Analyser	BS	Synergy	B,E C,D	SY	£14.95, £19.95
Shoot/Top Shot	Ed	Soft Centre	B C	SN	£6.00
Shootout	Gm	MP S/W	B C	JZ	£5.00
Seek	Gm	Micro Power	A,B C	GK	£6.95
Sentence Sequencing	Ed	Acornsoft	A,B C	AL	£11.90
Sentence Shaker	Ed	GED Software	B C	GD	£4.50
747	Gm	Doctor Soft	B C	DO	£7.95
747	Gm	D.A.C.C.	B C	DC	£9.95
Shadowfax	Gm	Postern	B C	PT	£6.95
Shape Generator	Ut	Software for All	B C	KN	£11.50
Shapes Package	Ed	GED Software	B C	GD	£8.00
Shape Snap	Ed	Ega Beva	B C	EB	£11.95
Shop Keeper	Ed	Heinemann	B C	HE	£9.25 + VAT
Shopping	Ed	GED Software	B C	GD	£4.50
Shrinking Professor	Gm	A&F	B C	GE	£8.00
Shuttle	Gm	Molimerx	B C	MX	£14.95
Shuttle Pilot	Gm	Oakleaf	B C	OA	£9.95
Signals & Magic	Ed	HRH	B C,D	HH	£4.80, £6.10
Signs	Ed	Acornsoft	A,B C	AL	£11.90
Silversoft Index	Do/	Silversoft	B D	SV	£24.99
Simonsoft Sprites 2	Ut	Simonsoft	B,E C,D	SI	£12.95
Simple Word Processor	Do	A.J.	B C,D	AJ	£9.95, £14.95
Simple Queues	BS	Micropax	B C	MP	£7.95
Simulation Surgery	BS	Micropax	B C	MP	£12.95
Simulation-Carlton Trucks	Bs	Micropax	B C	UP	£12.95
6502 Development System	Ut	Acornsoft	B D	AL	£49.85
Sixers	Gm	O.I.C.	B,E C	OI	£6.95
Skwosh	Gm	Miking S/W	B C	KC	£3.95
Sliding Block Puzzles	Gm	Acornsoft	B C	AL	£9.95
Sliding Block Puzzle	Ed	Ega Beva	B C	RB	£9.95
Ski Slalom	Gm	R.H. Electronics	B C	RH	£8.95
Slicker Puzzle	Gm	G.K. Tronics	B C	DK	£6.95
Snail Trail	Gm	R.H. Electronics	B C	RH	£4.95
Snake	Gm	Kansas	B C	KA	£8.50
Snake	Gm	Computer Concepts	B C	GJ	£6.67
Snake Pit	Gm	Postern	B C	PT	£6.95
Snapper	Gm	Acornsoft	B,E C,R	AL	£9.95, £9.20
Snig	Gm	Computercat	B C	CC	£6.75
Snooker	Gm	Visions	B C	VI	£8.95
Snooker	Gm	Acornsoft	B C	AL	£9.95
Snorter	Gm	Beebug	B C	BE	£7.50
Snowball	Gm	Level 9	B C	CU	£9.90
Sort Animator	Ed	OIC	B C	OI	£6.50
Sort M/C	Ut	Micro-Aid	A,B C	IZ	£1.00
Sortbas	Ut	Micro-Aid	A,B C	IZ	£1.00
Sortout	Ed	Highlight	B C,D	HI	£6.00, £7.00
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Space Adventure	Gm	Virgin Games	B C	VG	£7.95
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Space Invaders	Gm	Bug-Byte	B C	BB	£5.50
Space Pirates	Gm	Bug-Byte	A,B C	BB	£5.50
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Spelling	Ed	Soft Centre	B	C	SN	£6.00							£11.00
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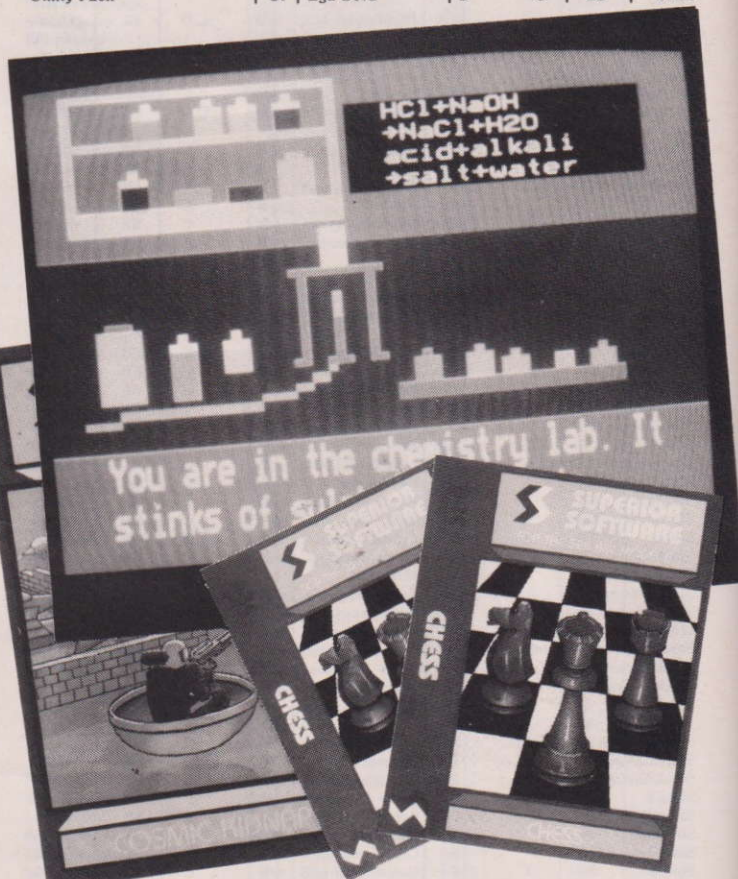
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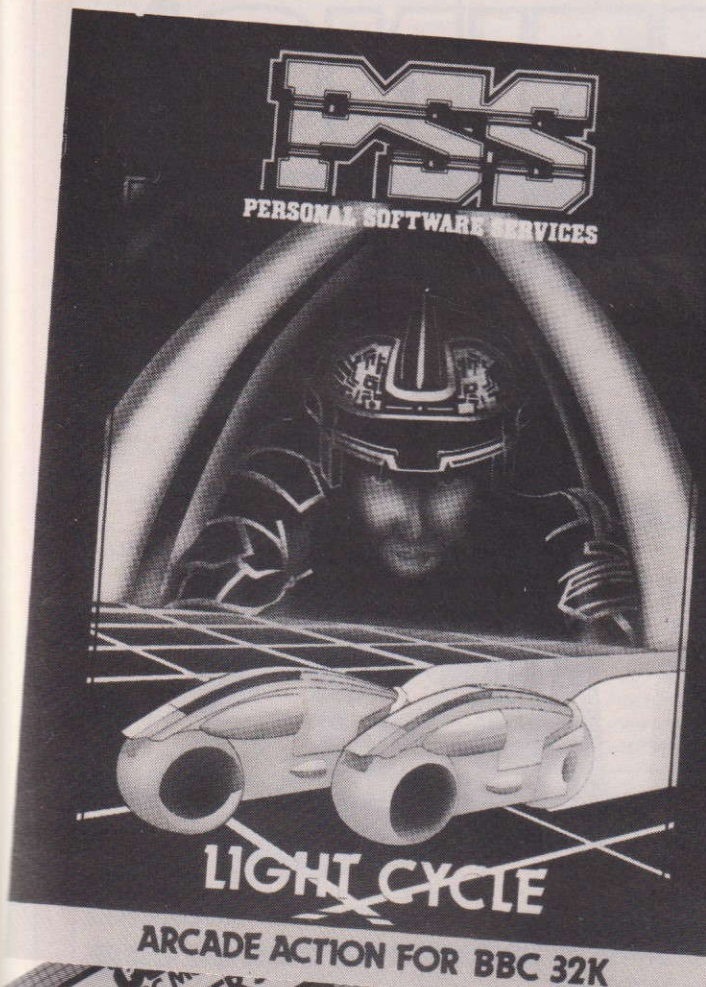
# SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
The Graphics Lesson	Ed	Ega Beva	B C	EB	£11.95
The Generators	Gm	Quicksilver	B C	QS	£6.95
The Halls of Time	Gm	OK	B C	OK	£10.00
The Lemming Syndrome	Gm	Dynabyte	B,E C	DB	£7.95
The Frog	Gm	Software For All	B C	KN	£7.95
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There	Ed	Golem	B C	OB	£8.05
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Titrations	Ed	System	B C	SY	£14.95
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Touch Type Tutor	Ed	Technical Education	A,B C	TE	£4.95
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Towns of Britain	Ed	Aztec S/W	A,B C	IB	£6.50
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2002	Gm	Superior Software	B C	SE	£7.95
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Word Master	Ut	R.H. Electronics	B	C	RH	£9.95
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Wordsmith	Do	A.J.	B	C,D	AJ	£19.95, £24.95
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Wordy	Ut	Odyssey	B	C	AS	£5.75
Word Sequencing	Ed	Acornsoft	A,B	C	AL	£11.90
Word-Square	Gm	Dial	B	C,D	DL	£4.95, £6.50
Wordsworth	Ut	Ian Copestake	B	C	IC	£17.25
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Worded	Ed	Processor Applications	B	C	AP	£5.95
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Xanagrams	Gm	Postern	B	C	PT	£6.95
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Zombie Island	Gm	Software For All	B	C	KN	£6.95
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# A&B

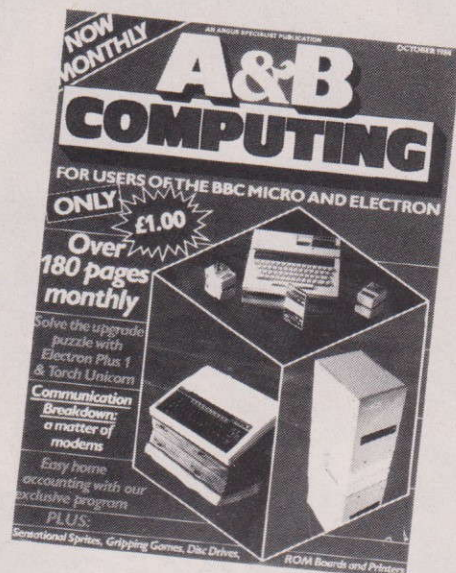
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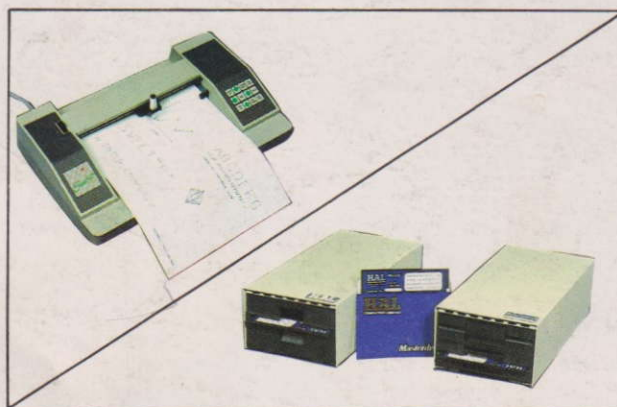
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